



**National Aeronautics and  
Space Administration  
Langley Research Center**

**Scientific and Technical  
Information Program Office**

# **Scientific and Technical Aerospace Reports**

# STAIR

## **WHAT'S INSIDE**

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- **NASA STI Program Overview**
- **Introduction**
- **NASA STI Availability Information**
- **Table of Contents**
- **Subject Term Index**
- **Personal Author Index**

## NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA scientific and technical information (STI) program plays a key part in helping NASA maintain this important role.

The NASA STI program operates under the auspices of the Agency Chief Information Officer. It collects, organizes, provides for archiving, and disseminates NASA's STI. The NASA STI program provides access to the NASA Aeronautics and Space Database and its public interface, the NASA Technical Report Server, thus providing one of the largest collections of aeronautical and space science STI in the world. Results are published in both non-NASA channels and by NASA in the NASA STI Report Series, which includes the following report types:

- **TECHNICAL PUBLICATION.** Reports of completed research or a major significant phase of research that present the results of NASA Programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.
- **TECHNICAL MEMORANDUM.** Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- **CONTRACTOR REPORT.** Scientific and technical findings by NASA-sponsored contractors and grantees.

- **CONFERENCE PUBLICATION.** Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.
- **SPECIAL PUBLICATION.** Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.
- **TECHNICAL TRANSLATION.** English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services also include creating custom thesauri, building customized databases, and organizing and publishing research results.

For more information about the NASA STI program, see the following:

- Access the NASA STI program home page at <http://www.sti.nasa.gov>
- E-mail your question via the Internet to [help@sti.nasa.gov](mailto:help@sti.nasa.gov)
- Fax your question to the NASA STI Help Desk at (301) 621-0134
- Phone the NASA STI Help Desk at (301) 621-0390
- Write to:  
NASA STI Help Desk  
NASA Center for AeroSpace Information  
7115 Standard Drive  
Hanover, MD 21076-1320

# Introduction

*Scientific and Technical Aerospace Reports (STAR)* is an online information resource listing citations and abstracts of NASA and worldwide aerospace-related scientific and technical information (STI). Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related research and development (R&D) results.

*STAR* subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

*STAR* includes citations to R&D results reported in:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

## The NASA STI Program

The NASA STI Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

Through the NASA Center for AeroSpace Information (CASI), the NASA STI Program acquires, processes, archives, announces, and disseminates both NASA's internal STI and world-wide STI. The results of 20th and 21st century aeronautics and aerospace research and development, a worldwide investment totaling billions of dollars, have been captured, organized, and stored in the NASA Aeronautics and Space Database. New information is continually announced and made available as it is acquired, making this a dynamic and historical collection of value to business, industry, academia, federal institutions, and the general public.

The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

For more information on the most up-to-date NASA STI, visit the STI Program's Web site at <http://www.sti.nasa.gov>.

# NASA STI Availability Information

## NASA Center for AeroSpace Information (CASI)

Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at [help@sti.nasa.gov](mailto:help@sti.nasa.gov). Others should visit the program at [www.sti.nasa.gov](http://www.sti.nasa.gov). The 'search selected databases' button provides access to the NASA Technical Reports Server (NTRS) – the publicly available contents of the NASA Aeronautics and Space Database.

Each citation in *STAR* indicates a 'Source of Availability.' When CASI is indicated, the user can order this information directly from CASI using the [STI Online Order Form](#), e-mail to [help@sti.nasa.gov](mailto:help@sti.nasa.gov), or telephone the STI Help Desk at 301-621-0390. Before ordering you may access [price code tables](#) for STI documents and videos. When information is not available from CASI, the source of the information is indicated when known.

NASA STI is also available to the public through Federal information organizations. NASA CASI disseminates publicly available NASA STI to the National Technical Information Service (NTIS) and to the Federal Depository Library Program (FDLP) through the Government Printing Office (GPO). In addition, NASA patents are available online from the U.S. Patent and Trademark Office.

## National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at <http://www.ntis.gov>.

## The Federal Depository Library Program (FDLP)

The U.S. Congress established the **Federal Depository Library Program** to ensure access for the American public to U.S. Government information. The program acquires and disseminates information products from all three branches of the U.S. Government to nearly 1,300 Federal depository libraries nationwide. The libraries maintain these information products as part of their existing collections and are responsible for assuring that the public has free access to the information. Locate the Federal depository libraries at <http://www.gpoaccess.gov/index.html>.

## The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

# Table of Contents

## Subject Divisions/Categories

Document citations are grouped by division and then by category, according to the *NASA Scope and Subject Category Guide*.

### Aeronautics

01	Aeronautics (General)	1
02	Aerodynamics	2
03	Air Transportation and Safety	5
04	Aircraft Communications and Navigation	16
05	Aircraft Design, Testing and Performance	16
07	Aircraft Propulsion and Power	39
08	Aircraft Stability and Control	42
09	Research and Support Facilities (Air)	44

### Astronautics

12	Astronautics (General)	46
13	Astrodynamics	47
15	Launch Vehicles and Launch Operations	48
16	Space Transportation and Safety	56
17	Space Communications, Spacecraft Communications, Command and Tracking	57
18	Spacecraft Design, Testing and Performance	58
20	Spacecraft Propulsion and Power	59

### Chemistry and Materials

23	Chemistry and Materials (General)	59
24	Composite Materials	79
25	Inorganic, Organic and Physical Chemistry	86
26	Metals and Metallic Materials	115
27	Nonmetallic Materials	121
28	Propellants and Fuels	128

### Engineering

31	Engineering (General)	132
32	Communications and Radar	142
33	Electronics and Electrical Engineering	184
34	Fluid Mechanics and Thermodynamics	214
35	Instrumentation and Photography	222
36	Lasers and Masers	231
37	Mechanical Engineering	235
38	Quality Assurance and Reliability	238
39	Structural Mechanics	239

## Geosciences

42	Geosciences (General)	240
43	Earth Resources and Remote Sensing	241
44	Energy Production and Conversion	242
45	Environment Pollution	250
46	Geophysics	260
47	Meteorology and Climatology	266
48	Oceanography	279

## Life Sciences

51	Life Sciences (General)	280
52	Aerospace Medicine	408
54	Man/System Technology and Life Support	421

## Mathematical and Computer Sciences

59	Mathematical and Computer Sciences (General)	428
60	Computer Operations and Hardware	440
61	Computer Programming and Software	443
62	Computer Systems	482
63	Cybernetics, Artificial Intelligence and Robotics	498
64	Numerical Analysis	508
65	Statistics and Probability	520
66	Systems Analysis and Operations Research	529
67	Theoretical Mathematics	547

## Physics

70	Physics (General)	550
71	Acoustics	587
72	Atomic and Molecular Physics	591
73	Nuclear Physics	593
74	Optics	596
75	Plasma Physics	603
76	Solid-State Physics	604
77	Physics of Elementary Particles and Fields	607

## Social and Information Sciences

80	Social and Information Sciences (General)	608
81	Administration and Management	608
82	Documentation and Information Science	608
84	Law, Political Science and Space Policy	664

## Space Sciences

88	Space Sciences (General)	664
89	Astronomy	665

90	<a href="#">Astrophysics</a>	668
91	<a href="#">Lunar and Planetary Science and Exploration</a>	675
93	<a href="#">Space Radiation</a>	676

## Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for linking to the corresponding document citation from *NASA Thesaurus* terms and personal author names.

[Subject Term Index](#)

[Personal Author Index](#)

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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

*A Biweekly Publication of the National Aeronautics and Space Administration*

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VOLUME 45, NUMBER 19

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## 01 AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

**20070028738** Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

### **Characteristics of Runback Ice Accretions and Their Aerodynamic Effects**

Whalen, E. A.; Broeren, A. P.; Bragg, M. B.; Apr. 2007; 92 pp.; In English  
Report No.(s): PB2007-109830; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The results of a research program to investigate runback ice accretions due to hot-air ice protection systems, scaling of external flow parameters for testing thermal systems, and the resulting aerodynamic effects are presented. Ice accretion testing was conducted at the National Aeronautics and Space Administration Glenn Icing Research Tunnel to evaluate thermal scaling methods and produce representative runback ice accretions using a business jet wing section equipped with a hot-air, anti-icing system. Test conditions simulated an airplane holding in both at ambient static air temperatures near freezing (warm hold) and well below freezing (cold hold), as well as descending through (descent) Title 14 Code of Federal Regulations Part 25 Appendix C icing conditions. Warm-hold ice accretions were characterized on the suction surface by dense frozen rivulets that formed a ridge while the pressure surface accretion was composed of nodules and chunks that formed a ridge. In all cases, a clean airfoil region of varying chordwise extent was located upstream of the runback ice accretions. The runback ridge formations were shown to be very sensitive to total air temperature in both height and chordwise location. Increased hot-air temperature and mass flow rate were found, in general, to correspond to shorter ridges located farther aft on the model. The cold-hold accretions had the character of rime ice and exhibited more spanwise variation due to the proximity of the ridge to the hot-air jet impingement zones. Descent accretions also exhibited spanwise variation in chordwise position, but were more uniform in height than the cold-hold accretion. Results of the scaling analysis showed that a useful and qualitatively accurate scaling method was developed for scaling thermal anti-icing systems for ground testing, but further development and investigation of the methods and governing equations are required.

NTIS

*Aerodynamics; Ice; Flow Characteristics*

**20070028872** NASA Langley Research Center, Hampton, VA, USA

### **Boundary Layer Transition Experiments in Support of the Hypersonics Program**

Berry, Scott A.; Chen, Fang-Jenq; Wilder, Michael C.; Reda, Daniel C.; June 25, 2007; 14 pp.; In English; 39th AIAA Thermophysics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.07.05

Report No.(s): AIAA Paper 2007-4266; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028872>

Two experimental boundary layer transition studies in support of fundamental hypersonics research are reviewed. The two studies are the HyBoLT flight experiment and a new ballistic range effort. Details are provided of the objectives and approach associated with each experimental program. The establishment of experimental databases from ground and flight are to provide better understanding of high-speed flows and data to validate and guide the development of simulation tools.

Author

*Boundary Layer Transition; Computerized Simulation; Hypersonics; Ballistic Ranges*



**20070029371** Army Soldier Systems Command, Natick, MA, USA

**Low Cost Parachute**

Bonaceto, B., Inventor; 12 Feb 04; 7 pp.; In English

Patent Info.: Filed 12 Feb 04; US-Patent-Appl-SN-10-779 484

Report No.(s): PB2007-104648; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A parachute includes first strips of fabric configurable to define a pattern wherein the first strips are separated from each other and extend parallel to each other, and second strips of fabric configurable to further define the pattern wherein the second strips are separated from each other and extend parallel to each other and normal to the first strips, the number of first strips being equal to the number of second strips. The first and second strips cross each other to define vent holes. The ends of the strips are connected to suspension lines which are extendible to a confluence area for support of an article of cargo.

NTIS

*Airdrops; Cargo; Low Cost; Parachutes*

**02  
AERODYNAMICS**

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also 34 Fluid Mechanics and Thermodynamics.

**20070026475** Naval Research Lab., Washington, DC USA

**Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems**

Hieatt, J L; Sep 30, 1958; 35 pp.; In English

Report No.(s): AD-A466220; 34; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466220>

The application of phase plane analysis to a missile jet relay control system is reviewed, explained, and illustrated. Only a single lead network is considered under conditions in which aerodynamic damping is negligible. The assumption that all forces occur as step inputs is used to simplify analysis techniques and does not constitute a significant limitation on the application of this method for design purposes. To aid in system design, an analytic method for the solution of phase plane plots is developed. The analytic technique reduces the time necessary to evaluate a system design by minimizing the necessity for construction of phase plane diagrams. In conclusion a summary of general principles which may be used to optimize a missile jet relay control system is presented.

DTIC

*Aerodynamic Forces; Aerodynamics; Control; Jet Control; Missile Control; Trajectories; Vanguard Project*

**20070026516** Monash Univ., Clayton, Australia

**Dynamic-Active Flow Control - Phase I**

Soria, Julio; Oct 18, 2006; 61 pp.; In English

Contract(s)/Grant(s): FA5209-05-T-0435

Report No.(s): AD-A466362; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466362>

This is the report of an investigation of active flow control using a wall-normal, zero-net-mass-flux (ZNMF) jet located at the leading edge of an airfoil.

DTIC

*Active Control; Dynamic Control; Flow Distribution; Flow Visualization*

**20070027723** Defence Science and Technology Organisation, Victoria, Australia

**A Review of Australian and New Zealand Investigations on Aeronautical Fatigue During the Period April 2005 to March 2007**

Clark, Graham; Apr 2007; 91 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468387; DSTO-TN-0747; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document has been prepared for presentation to the 30th Conference of the International Committee on Aeronautical Fatigue scheduled to be held in Naples, Italy, 14th and 15th May 2007. Brief summaries and references are provided on the aircraft fatigue research and associated activities of research laboratories, universities, and aerospace companies in Australia

and New Zealand during the period April 2005 to March 2007. The review covers fatigue-related research programs as well as fatigue investigations on specific military and civil aircraft.

DTIC

*Aeronautics; Australia; New Zealand*

**20070028518** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Finite Element Solution: Nonlinear Flapping Beams for Use with Micro Air Vehicle Design**

Walker, Robert L; Mar 2007; 122 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468442; AFIT/GAE/ENY/07-M26; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The development and use of Micro Air Vehicles is becoming more and more important to the military. Size, weight, maneuverability, stealth, and fuel consumption are just some of the constraints on a future Micro Air Vehicle. Perfect blueprints for a small scale flying machine are both insects and humming birds. Medium sized hummingbirds are found to have wings-beats at a frequency of 18-28 Hz. There is a vast amount of complexity to just how these creatures can create lift; however, this study looks at different beams made of common materials with 1st natural bending frequencies in this range. This study documents and evaluates the use of analytical tools to solve for nonlinear characteristics of a system. A function called the backbone curve is incorporated into a MATLAB program. The Hilbert transform characterized by the nonlinear decrement approach captures all of the necessary coefficients for this function. ABAQUS/CAE is relied upon. The numerical finite element results are compared to experiments. This work gives a better understanding of how materials and geometry perform when used in Micro Air Vehicle design considering large displacements.

DTIC

*Drone Aircraft; Finite Element Method; Flapping; Micromechanics; Nonlinearity*

**20070028565** Government Accountability Office, Washington, DC, USA

**Aviation Security: Efforts to Strengthen International Passenger Prescreening are Under Way, but Planning and Implementation Issues Remain**

May 2007; 54 pp.; In English

Report No.(s): PB2007-108779; GAO-07-346; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Passenger prescreening--a process that includes matching passengers' identifying information against records extracted from the U.S. government terrorist watch list--is one of several security measures in place to help ensure the safety of commercial flights traveling to or from the USA. DHS has several efforts underway to strengthen international aviation passenger prescreening. This report focuses on certain elements of the passenger prescreening process as well as some of the actions that DHS is taking or has planned to strengthen prescreening procedures. This report is a limited version of the original November 2006 report as various agencies that we reviewed deemed some of the information in the original report to be security sensitive. GAO's work included interviewing officials and assessing relevant documentation from federal agencies, U.S. and foreign air carriers, industry groups, and several foreign countries.

NTIS

*Passengers; Civil Aviation; Air Transportation; Airport Security*

**20070028870** NASA Langley Research Center, Hampton, VA, USA

**Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data**

Silva, Walter A.; Vartio, Eric; Shimko, Anthony; Kvaternik, Raymond G.; Eure, Kenneth W.; Scott, Robert C.; June 18, 2007; 17 pp.; In English; IFASD 2007: International Forum on Aeroelasticity and Structural Dynamics, 18-20 Jun. 2007, Stockholm, Sweden; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07; Copyright; Avail.: CASI: [A03](#), Hardcopy

Aeroservoelastic (ASE) analytical models of a SensorCraft wind-tunnel model are generated using measured data. The data was acquired during the ASE wind-tunnel test of the HiLDA (High Lift-to-Drag Active) Wing model, tested in the NASA Langley Transonic Dynamics Tunnel (TDT) in late 2004. Two time-domain system identification techniques are applied to the development of the ASE analytical models: impulse response (IR) method and the Generalized Predictive Control (GPC) method. Using measured control surface inputs (frequency sweeps) and associated sensor responses, the IR method is used to extract corresponding input/output impulse response pairs. These impulse responses are then transformed into state-space models for use in ASE analyses. Similarly, the GPC method transforms measured random control surface inputs and associated

sensor responses into an AutoRegressive with eXogenous input (ARX) model. The ARX model is then used to develop the gust load alleviation (GLA) control law. For the IR method, comparison of measured with simulated responses are presented to investigate the accuracy of the ASE analytical models developed. For the GPC method, comparison of simulated open-loop and closed-loop (GLA) time histories are presented.

Author

*Aeroservoelasticity; Wind Tunnel Models; Aerodynamic Drag; Impulses; Wind Tunnel Tests; Control Surfaces*

**20070028873** NASA Langley Research Center, Hampton, VA, USA

**Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone**

Kara, K.; Balakumar, P.; Kandil, O. A.; June 27, 2007; 20 pp.; In English; 37th AIAA Fluid Dynamics Conference and Exhibit, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754; Copyright; Avail.: CASI: [A03](#), Hardcopy

Receptivity and stability of hypersonic boundary layers are numerically investigated for boundary layer flows over a 5-degree straight cone at a free-stream Mach number of 6.0. To compute the shock and the interaction of shock with the instability waves, we solve the Navier-Stokes equations in axisymmetric coordinates. The governing equations are solved using the 5th-order accurate weighted essentially non-oscillatory (WENO) scheme for space discretization and using third-order total-variation-diminishing (TVD) Runge-Kutta scheme for time integration. After the mean flow field is computed, disturbances are introduced at the upstream end of the computational domain. Generation of instability waves from leading edge region and receptivity of boundary layer to slow acoustic waves are investigated. Computations are performed for a cone with nose radii of 0.001, 0.05 and 0.10 inches that give Reynolds numbers based on the nose radii ranging from 650 to 130,000. The linear stability results showed that the bluntness has a strong stabilizing effect on the stability of axisymmetric boundary layers. The transition Reynolds number for a cone with the nose Reynolds number of 65,000 is increased by a factor of 1.82 compared to that for a sharp cone. The receptivity coefficient for a sharp cone is about 4.23 and it is very small, approx.  $10(\exp -3)$ , for large bluntness.

Author

*Boundary Layer Flow; Stability; Essentially Non-Oscillatory Schemes; Hypersonic Boundary Layer; Flow Distribution; Leading Edges; Slender Cones*

**20070029422** NASA Langley Research Center, Hampton, VA, USA

**Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number**

Khodadoust, Abdollah; Washburn, Anthony; June 25, 2007; 25 pp.; In English; 25th AIAA Applied Aerodynamics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.07.03

Report No.(s): AIAA Paper 2007-4424; Copyright; Avail.: CASI: [A03](#), Hardcopy

The NASA Energy Efficient Transport (EET) airfoil was tested at NASA Langley's Low-Turbulence Pressure Tunnel (LTPT) to assess the effectiveness of distributed Active Flow Control (AFC) concepts on a high-lift system at flight scale Reynolds numbers for a medium-sized transport. The test results indicate presence of strong Reynolds number effects on the high-lift system with the AFC operational, implying the importance of flight-scale testing for implementation of such systems during design of future flight vehicles with AFC. This paper describes the wind tunnel test results obtained at the LTPT for the EET high-lift system for various AFC concepts examined on this airfoil.

Author

*Active Control; Boundary Layer Separation; Separated Flow; Wind Tunnel Tests; High Reynolds Number; Flapping; Airfoils*

**20070029508** Naval Air Systems Command, Patuxent River, MD USA

**Use of Statistical Tools to Improve Modeling and Simulation of Store Separation**

Lenko, A.; Piranian, A.; Rupert, J.; Jun 1, 2004; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): RTO-MP-AVT-108

Report No.(s): AD-A468593; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468593>

No abstract available

*Flight Tests; Simulation; Statistical Analysis*

**20070029702** Naval Air Systems Command, Patuxent River, MD USA

**Advances in Modeling and Simulation Capabilities for Predicting Store Trajectories - Past Success and Future Challenges**

Cenko, A; Piranian, A; Jun 2004; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468902; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468902>

No abstract available

*External Store Separation; Mathematical Models; Predictions; Simulation; Trajectories*

**20070029778** Army Research Lab., Aberdeen Proving Ground, MD USA

**Shot-Peening Sensitivity of Aerospace Materials**

Grendahl, Scott; Snoha, Daniel; Hardisky, Benjamin; May 2007; 154 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469082; ARL-TR-4095; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469082>

The U.S. Army Aviation and Missile Research Development and Engineering Command (AMRDEC), Aviation Engineering Division in Huntsville, AL requested that the U.S. Army Research Laboratory, Weapons and Materials Research Directorate at Aberdeen Proving Ground, MD develop and execute a program aimed at evaluating the shot-peening sensitivity of several aerospace materials. The materials represent the four most common metals utilized on U.S. Army aviation shot-peened components. The study had three main thrusts: to assess the variation in shot-peening intensity expected from variation shot-peening parameters, to assess the fatigue strength yielded at prescribed shot-peening intensities, and to correlate surface roughness and x-ray diffraction residual stress analysis data to those prescribed stress intensities. Once the shot-peening parameters' effect on shot-peening intensity was characterized, specific intensities and parameters were selected over an intensity range (dictated by AMRDEC) for each material to assess the sensitivity on fatigue strength.

DTIC

*Aircraft Construction Materials; Sensitivity; Shot Peening; Spacecraft Construction Materials*

**20070029956** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Relaxed Fidelity CFD Methods Applied to Store Separation Problems**

Johnson, Rudy; Davis, M B; Finley, Dennis; Jun 1, 2004; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468706; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468706>

No abstract available

*Aerodynamics; Computational Fluid Dynamics*

### 03

#### AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety and 85 Technology Utilization and Surface Transportation.

**20070026437** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint)**

Behbahani, Alireza R; Nov 2006; 49 pp.; In English

Contract(s)/Grant(s): Proj-3066

Report No.(s): AD-A466151; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466151>

The USA Air Force (USAF) has over 24,000 aircraft which include over 47,000 turbine engines. The aircraft systems are expensive and must be routinely modernized or upgraded to keep pace with threats, missions, and advancing technology. Each modern turbine engine includes controls and accessories which cost about 1/5 of the total cost of an engine. The main component of controls and accessories are the Full Authority Digital Engine Controls (FADECs). Currently, legacy FADEC systems are both unique and dedicated to their specific weapon system. Engine FADECs are built for three primary

applications, military aviation, commercial aviation, and ground based power turbines. Today, each FADEC design is unique within its application class. Future goals are to establish a universal or common standard for engine controls and accessories which includes FADECs. This will significantly reduce the costs of both development and support across DOD platforms, costs which are currently extremely high.

DTIC

*Commercial Off-the-Shelf Products; Digital Systems; Electronic Control; Engine Control; Engines; Manufacturing; Military Technology; Standardization*

**20070026476** Air Force Research Lab., Wright-Patterson AFB, OH USA

**An Integrated Approach to Conversion, Verification, Validation and Integrity of AFRL Generic Engine Model and Simulation (Postprint)**

Dalton, Jeffrey S; Behbahani, Al; Feb 2007; 38 pp.; In English

Contract(s)/Grant(s): Proj-3066

Report No.(s): AD-A466221; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466221>

Modern airborne weapons systems face increasingly stringent demands for improved performance and lower cost of ownership. The key to attaining the first of these demands is increased sub-systems integration, which leverages improved component performance to make even greater improvements in overall weapons system capability. Research is essential to gaining a fundamental understanding of the behavior and control of these highly integrated systems. Progress towards meeting the affordability demands for these systems is also being closely scrutinized. Recognition and control of ownership costs has become increasingly difficult in the face of increasing systems complexity. It may be possible to reduce the amount of physical engine test required in a typical gas turbine engine development program through the use of simulation and modeling techniques in a virtual engine test cell. However, in order to establish the credibility of a simulation and modeling approach to virtual engine test, carefully documented verification and validation (V & V) activities must be undertaken during model development.

DTIC

*Engine Parts; Models; Simulation; Simulators; Turbine Engines*

**20070026616** Air Force Research Lab., Mesa, AZ USA

**Helmet-Mounted Displays for Use in Air Force Training and Simulation**

Winterbottom, Marc D; Patterson, Robert; Pierce, Byron J; Nov 2005; 62 pp.; In English

Contract(s)/Grant(s): F41624-97-D-5000; Proj-1123

Report No.(s): AD-A466568; AFRL-HE-AZ-TR-2005-0186; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466568>

This report provides a review and analysis of the published literature on head-mounted displays (HMDs). In particular, we discuss several key perceptual issues that are relevant to the use of HMDs. The issues discussed are: (1) brightness and contrast; (2) accommodationvergence synergy; (3) field of view; (4) binocular input; and (5) head movements. This review of the literature is intended to anticipate and solve perceptual issues associated with two particular HMD applications: (1) simulation of off-bore sight (OBS) targeting and (2) full fieldof- view out-the-window (OTW) simulation for deployable flight training. Additionally, several technology issues important to the continued development of HMDs are discussed. This report concludes with a set of recommendations for the design and use of HMDs for OBS and OTW flight training applications.

DTIC

*Education; Flight Simulation; Flight Training; Helmet Mounted Displays; Simulation*

**20070026779** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps**

Albery, William B; Jul 2006; 22 pp.; In English

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A467411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467411>

The Air Force regards Spatial Disorientation (SD) and loss of situational awareness (SA) as contributing factors in operational Class A (\$1 M in aircraft loss and/or pilot fatality) aircraft mishaps. Multisensory systems have been developed

to enhance the aircraft altitude information to the pilot. The systems incorporate multisensory aids including helmet-mounted symbology and tactile and audio cues. Two systems have been prototyped and demonstrated in the Air Force Research Laboratory. The technology could have application in the rotary-wing brownout program. This paper discusses the development of two systems and a potential application including an augmented cognition application. Unlike automatic ground collision avoidance systems, these systems do not take over the aircraft if a pre-set altitude is breached by the pilot; rather, these multisensory systems provide complementary attitude cues to the pilot via the tactile, audio, and visual systems that allow the pilot to continue flying through disorienting conditions.

DTIC

*Aircraft Accidents; Attitude (Inclination); Augmentation; Brain; Disorientation; Physiology; Situational Awareness*

**20070026856** Air Force Research Lab., Brooks AFB, TX USA

**Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study**

Chaiken, Scott; Elliott, Linda R; Dalrymple, Mathieu; Covert, Michael D; Riddle, Dawn; Gordon, Thomas R; Hoffman, Kimberly A; Miles, Donald E; King, Thomas V; Schifflett, Samuel G; Jun 2001; 16 pp.; In English  
Report No.(s): AD-A468181; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468181>

The Airborne Warning and Control System (AWACS) is a core command and control (C2) function in which sensors, shooters, and refuelers are managed by 'Weapons Directors' (WDs) in an airborne radar and communications command post. Improving the quality of WD training can have profound effects on mission outcome. A basic technology capable of doing this is 'intelligent-agent' technology, which allows more frequent practice, via simulated players, and embedded decision aids that display reasonable task options online. We report initial empirical work with an embedded-agent simulation based on the AWACS, namely the 21st Century Systems, Inc. Weapon's Director Intelligent-Agent Assist platform. Using this platform, we observed how 38 WDs performed during two high-workload missions. One mission was played with a decision aid that recommended target pairings and refuelings, while the other was not. Our sample benefited from the decision aid, but the more experienced WDs benefited the most (counter to our expectations). We discuss the results in terms of interface challenges decision aids will face in high workload environments. This report extends the initial report for this system (Elliott, Chaiken, Dalrymple, Petrov, Stoyen, 2000).

DTIC

*AWACS Aircraft; Computerized Simulation; Education; Personnel Development*

**20070027248** Air Force Research Lab., Mesa, AZ USA

**Visual Simulation S&T: Summary of Accomplishments**

Pierce, Byron J; Geri, George A; Dec 2006; 37 pp.; In English

Contract(s)/Grant(s): F41624-97-D-5000-0024; Proj-24

Report No.(s): AD-A466844; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research performed under Task Order 24 of Air Force Contract F41624-97-D-5000 for the period 1 June 2002 through 30 November 2005 is summarized in this technical report. The summaries includes citations and associated abstracts of published research, as well as a more complete description of seven of the major research projects conducted as part of this Task Order.

DTIC

*Display Devices; Flight Simulators; Helmet Mounted Displays; Simulation*

**20070027309** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Proportional Navigation With Adaptive Terminal Guidance For Aircraft Rendezvous (Preprint)**

Smith, Austin L; Feb 2007; 21 pp.; In English

Report No.(s): AD-A467109; No Copyright; Avail.: Defense Technical Information Center (DTIC)

1. PN with adaptive terminal guidance is shown to be a viable guidance method for aircraft rendezvous in 6DOF simulation. 2. Adaptive PN and Velocity controller combination is shown to effect successful rendezvous. 3. Adaptation accounts for errors caused by assumptions (stationary RZ location), wind, and tanker maneuvers.

DTIC

*Proportional Navigation; Refueling; Rendezvous Guidance; Terminal Guidance*

**20070027384** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis**

Bryant, Michael T; Mar 2007; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467354; AFIT/GCA/ENV/07-M2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis developed models to forecast the KC-135R monthly Consumables (CONS) and Depot Level Repairable (DLR) Cost per Flying Hour (CPFH) for each U.S. Air Force service component. Using data for each operating location from FY1998 to FY2004, the models were constructed using panel data analysis, a form of regression that adds a cross-sectional and time-series dimension. In addition to including factors previously identified as prime contributors to CPFH, the models added new elements that may influence maintenance costs and be of interest to policymakers. These elements included mission capable rates, airframe operating hours, and climatology factors. An interaction variable for utilization rate and combat flying hours is also included. The results reveal that utilization rate can be a major factor to determine if the CPFH increases or decreases when a wing is flying combat hours. Furthermore, mission capable rates have an inverse relationship on the KC-135R CPFH while average airframe hours have a positive relationship. Average airframe hours is an alternative measure to aircraft age, although this measure is better suited for quarterly or yearly models. Overall, this research extends knowledge of the KC-135R CPFH program and provides a tool for planners, programmers, and decision makers at all levels.

DTIC

*Airframes; C-135 Aircraft; Cost Analysis; Costs; Data Processing; Flight Crews; Flight Simulation; Forecasting*

**20070027408** Lockheed Martin Aeronautical Systems, Marietta, GA USA

**Multi-Sensor Information Fusion Technology Applied to the Development of Smart Aircraft**

Jeun, Buddy H; Whittaker, Allan; Sep 2002; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467469; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper explores the possibility of applying multi-sensor information fusion technology to the development of smart aircraft. This technology integrates information from multiple sensors and extracts tactical information to detect, track and identify time critical targets at any time, in any place and under all weather conditions. Such target information will help the war fighter avoid fratricide and deploy weapon systems for surgical strike. Finally, the smart aircraft helps the war fighter establish air superiority in the air, on the land and at sea. The architecture of a smart aircraft includes the pilot and flight crew, vehicle interface unit, multi-sensor correlation processor, multi-sensor image fusion model, multi-sensor track fusion model, multiple target identification fusion model and multiple sensors such as: Radar, CNI, EW, IFF Visual, Electro Optic and IR. The multi-sensor track fusion model computes a fused track from the sensor trackers. A Multiple Target Identification Fusion model creates integrated target identifications from identification of multiple targets. Similarly, a Multi-Sensor Image Fusion model creates an integrated target image from multiple sensor images. In traditional aircraft, the pilot and crew extract tactical information from a huge amount of multi-sensor information. This processing is time consuming and subject to human error. A future smart aircraft with Multi-Sensor Information Fusion technology will have access to accurately correlated fused information. Fused information assists the pilot and crew to detect, track and identify targets more rapidly and accurately. Such platforms are truly smart aircraft.

DTIC

*Information Systems; Multisensor Fusion*

**20070027482** Air Force Research Lab., Mesa, AZ USA

**The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device**

Nullmeyer, Robert T; Spiker, V A; Golas, Katharine C; Logan, Ryan C; Clemons, Larry; Dec 2006; 19 pp.; In English

Contract(s)/Grant(s): Proj-1123

Report No.(s): AD-A467700; AFRL-HE-AZ-TP-2007-0002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Inadequate crew resource management (CRM) behaviors are still cited as causal factors in most military and commercial aircraft mishaps despite mandatory CRM training in virtually all aviator training programs, suggesting a need to explore alternative approaches. A low-cost, PC-based simulator was designed to elicit the communication and crew coordination behaviors associated with instrument and visual airdrop missions. These targeted behaviors were frequently addressed in instructor comments from earlier C-130 student training records, especially for navigators and copilots. The effectiveness of instruction using this device was evaluated. Treatment group students received a four hour training profile before their first airdrop flight while control group students did not. Multiple measures of effectiveness were tracked. Instructors and students rated training effectiveness using 5-point Likert scales. Ratings from both groups were significantly greater than '3' (neutral)

for task management, communication, and crew coordination. In addition, instructors reported that the experience was a good use of instructor and student time. Detailed CRM proficiency data were collected during the first subsequent airdrop flight. Positive transfer of training was substantiated by a multivariate analysis of variance. CRM performance ratings during this flight were significantly higher for treatment group students than for their control group peers. Higher performance grades in training records were also observed for treatment group students in all CRM skill areas through subsequent flights, with fewer sorties to criterion for communication, crew coordination, task management, and decision making for both navigators and copilots.

DTIC

*Flight Crews; Flight Training; Resources Management; Simulators; Training Devices*

**20070027496** Library of Congress, Washington, DC USA

**Navy-Marine Corps Tactical Air Integration Plan: Background and Issues for Congress**

Bolkcom, Christopher; O'Rourke, Ronald; Apr 10, 2003; 7 pp.; In English

Report No.(s): AD-A467733; CRS-RS21488; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As part of its FY2004 budget submission, the Department of the Navy (DoN) has proposed implementing a Navy-Marine Corps Tactical Air Integration (TAI) plan that would manage the Navy's strike fighters and the Marine Corps' strike fighters more like a common pool of strike fighters. DoN officials say the TAI plan would permit DoN to perform its stated missions with a smaller total number of operational strike fighters, and thereby permit DoN to reduce its planned buy of F/A-18E/F and F-35 strike fighters by 497 aircraft. Not procuring these 497 aircraft, DoN officials say, would save DoN about \$35 billion in aircraft procurement costs and significantly reduce DoN's projected approaching procurement 'bow wave.' The TAI plan poses potential issues for Congress regarding its effect on total DoN strike fighter capability, its cost effectiveness, and its possible significance in terms of further integration of U.S. military aviation assets in the future.

DTIC

*Budgeting; Military Aircraft; Navy*

**20070027537** Air Force Logistics Management Center, Gunter AFS, AL USA

**Capability Based Resourcing for DPEM**

Flory, John; Cushion, Jennifer; Blazer, Doug; Apr 19, 2007; 10 pp.; In English

Contract(s)/Grant(s): Proj-AFLMA-LY-2006-33300

Report No.(s): AD-A467819; AFLMA-LY-2006-33300; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Historically, the AF Depot Purchased Equipment Maintenance (DPEM) requirements development and validation process projects the impacts of funding and shortfalls/deferrals for the DPEM budget. The funding impacts are stated in terms of deferrals with emphasis on the number of Programmed Depot Maintenance (PDM) and whole-engine deferrals. This detracts from the potential impacts of other DPEM commodities as well as aircraft that do not undergo PDMs and engines overhauled in modules. This study investigates why projected deferrals in budget years differ from actuals in execution years using both quantitative and anecdotal data.

DTIC

*Maintenance; Resources Management*

**20070027567** Gulhane Military Medical Academy, Eskishehir, Turkey

**First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005**

Sen, Ahmet; Akin, Ahmet; Craft, Krisit J; Canfield, Dennis V; Chaturvedi, Arvind K; May 2007; 17 pp.; In English

Report No.(s): AD-A467870; DOT/FAA/AM-07/12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

First-generation H1-receptor antagonists are popularly used for alleviating allergy and cold symptoms, but these antihistaminics cause drowsiness and sedation. Such side effects could impair performance and, thus, could be the cause or a factor in accidents. Therefore, the prevalence of these antagonists was evaluated in aviation accident pilot fatalities. During civil aircraft accident investigations, postmortem samples from pilots involved in fatal aviation accidents are submitted to the Civil Aerospace Medical Institute (CAMI) for toxicological analyses. These analytical findings are stored in a database. This CAMI Toxicology Database was examined for the presence of the first-generation antihistamines in pilot fatalities of civil aircraft accidents that occurred during a 16-year (1990-2005) period. Of 5383 fatal aviation accidents from which CAMI received specimens, there were 338 accidents wherein pilot fatalities (cases) were found to contain the antihistaminics brompheniramine, chlorpheniramine, diphenhydramine, doxylamine, pheniramine, phenyltoloxamine, promethazine, and



triprolidine. Of the 338 accidents, 304 were general aviation accidents; 175 of the 338 pilots held private pilot airman certificates. Antihistamines were detected alone in 103 fatalities (1 antihistamine in 94 fatalities and 2 antihistamines in 9), while other drug(s) and/or ethanol were also present in an additional 235 fatalities. Thirty-five of the 338 fatalities had more than 1 antihistamine. The antihistamines were found in approximately 4 and 11% of the fatalities/accidents in 1990 and in 2004, respectively.

DTIC

*Aircraft Accidents; Antihistaminics; Civil Aviation*

**20070027636** Federal Aviation Administration, Oklahoma City, OK USA

**Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy**

DeWeese, Richard; Moorcroft, David; Green, Tom; Philippens, M M; May 2007; 30 pp.; In English

Report No.(s): AD-A468006; DOT-FAA-AM-07-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A project was conducted to assess the injury potential of current side facing aircraft seat configurations using the ES-2 Anthropomorphic Test Dummy proposed for use in Federal Motor Vehicle Safety Standards. The ability of inflatable restraint systems to mitigate injuries in these configurations was also assessed. Impact sled tests were conducted at the Federal Aviation Administration's Civil Aerospace Medical Institute using a side-facing sofa fixture with cushion construction representative of current business jets. The tests simulated three typical seating configurations: occupant in the middle seat, occupant seated next to a rigid wall, and occupant seated next to an armrest end closure. Two types of restraints were evaluated: a three-point body centered conventional restraint with inertia reel and a similar restraint incorporating a new inflatable shoulder restraint (airbag). The test conditions were the 16g, 44 ft/s, horizontal impact specified in 14 CFR 25.562 but without yaw. Test setup techniques were developed to ensure consistent occupant positioning. Test repeatability was assessed for some test conditions. The suitability of the ES-2 for use in aircraft seat testing was evaluated. Injury criteria were calculated from the data gathered during the tests, including criteria currently published in the Federal Aviation Regulations and Federal Motor Vehicle Safety Standards such as the Head Injury Criteria, upper torso restraint loads, Thoracic Trauma Index, and peak lateral pelvis acceleration. Other research criteria and those identified in proposed Federal Motor Vehicle Safety Standards were also calculated. These criteria included neck forces and moments, Preliminary Lateral Nij, Viscous Criteria, rib deflection, abdominal forces, pubic force, upper spine acceleration, and femur torsion. Results were analyzed to identify criteria relevant for avia

DTIC

*Anthropometry; Crashworthiness; Human Body; Impact Tests; Injuries; Seats*

**20070027668** Applied Research Associates, Inc., Tyndall AFB, FL USA

**Firefighting Agent Research, Phase I**

Dierdorf, Douglas S; Enlow, Mark A; Stern, Seymour; Carr, Virgil J; Apr 2007; 73 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F08637-03-C-6006; Proj-4915

Report No.(s): AD-A468067; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project's objective is to replace current firefighting aqueous film forming foams, AFFF, with an agent that is twice as effective as fire extinguishment. By reducing the required foam/water solution, the deployed firefighting footprint will thereby be reduced. In order to do this, the mechanism of firefighting foams and surfactants must be determined. Such physical characteristics as equilibrium surface tension, dynamic interfacial tension, and surface pressure have been examined in order to determine agent/surfactant behavior during the extinguishment process. This data will be correlated with computer models that will then be used to predict new, more efficient firefighting agents.

DTIC

*Computer Programming; Computerized Simulation; Fire Extinguishers; Fire Fighting; Molecular Dynamics; Software Engineering*

**20070027678** Library of Congress, Washington, DC USA

**Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues**

Shea, Dana A; Morgan, Daniel; Apr 26, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468087; CRS-RS21920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The National Commission on Terrorist Attacks Upon the USA, known as the 9/11 Commission, recommended that Congress and the Transportation Security Administration give priority attention to screening airline passengers for explosives.

The key issue for Congress is balancing the costs of mandating passenger explosives detection against other aviation security needs. Passenger explosives screening technologies have been under development for several years and are now being deployed in selected airports. Their technical capabilities are not fully established, and operational and policy issues have not yet been resolved. Critical factors for implementation in airports include reliability, passenger throughput, and passenger privacy concerns. Presuming the successful development and deployment of this technology, certification standards, operational policy, and screening procedures for federal use will need to be established. This topic continues to be of congressional interest, particularly as the 110th Congress reexamines implementation of the 9/11 Commission's recommendations via H.R. 1 and S. 4.

DTIC

*Airline Operations; Chemical Analysis; Commercial Aircraft; Detection; Explosives; Explosives Detection; Law (Jurisprudence); Passengers; Policies*

**20070027702** Air Force Research Lab., Eglin AFB, FL USA

**A Comparison of Trajectory Determination Approaches for Small UAVs**

Anderson, Murray B; Lopez, Juan L; Evers, Johnny H; Sep 2006; 14 pp.; In English

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A468280; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In considering the problem of small unmanned aerial vehicle (SUAV) surveillance mission in a target rich environment, it is desirable to follow a trajectory path that maximizes targets coverage and observation time, while minimizing airframe maneuvering. Motivated by this requirement, this paper investigates the merits of multiple vehicle trajectory path schemes. Genetic Algorithms (GAs) and local optimum techniques are compared to a more conventional defined-path approach. The authors also introduce a polygon boundary reflection algorithm (PBRA) and investigate its merits.

DTIC

*Algorithms; Drone Vehicles; Flight Paths; Genetic Algorithms; Optimization; Pilotless Aircraft; Surveillance; Trajectories*

**20070027720** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Autonomous Unmanned Aerial Vehicle Rendezvous for Automated Aerial Refueling**

Burns, Brian S; Mar 2007; 94 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468380; AFIT/GAE/ENY/07-M05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As unmanned aerial vehicles (UAVs) increase in capability, the ability to refuel them in the air is becoming more critical. Aerial refueling will extend the range, shorten the response times, and extend loiter time of UAVs. Executing aerial refueling autonomously will reduce the command and control, logistics, and training efforts associated with fielding UAV systems. Currently, the Air Force Research Lab is researching the various technologies required to conduct automated aerial refueling (AAR). One of the required technologies is the ability to autonomously rendezvous with the tanker. The goal of this research is to determine the control required to fly an optimum rendezvous using numerical optimization and to design a controller that will approximate that control. Two problems were examined. The first problem is for the receiver to rendezvous in minimum time, with a known tanker path. The second problem is for the receiver to rendezvous at a specified time with a known tanker path. For the first problem, the simulated controller results will be compared to the calculated optimal control.

DTIC

*Air to Air Refueling; Autonomy; Drone Vehicles; Pilotless Aircraft; Refueling*

**20070027724** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Simulation of the Dynamically Coupled KC-135 Tanker and Refueling Boom**

Smith, Jeremy J; Mar 2007; 126 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468388; AFIT/GAE/ENY/07-M21; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Future Air Force requirements for the use of unmanned aircraft will require Automated Aerial Refueling (AAR). Current AAR research requires a precision model to simulate the refueling process of a KC-135 tanker and a UAV. There are existing high fidelity models of the tanker aircraft, refueling boom and proposed receiver aircraft. However, none of the models are coupled. Since boom orientation and motion is known to change the trim of the tanker aircraft, which in turn influences all other aspects of the refueling process, a new model is needed. The new model was created by integrating an existing KC-135 tanker and refueling boom model. The tanker boom equations of motion were coupled using joint coordinates and the velocity

transformation. Assessment of the new model investigated boom and tanker motion in comparison with other established models. Ultimately, behavior of the new model was validated by a comparison of simulation results to flight test data.

DTIC

*C-135 Aircraft; Refueling; Simulation; Tanker Aircraft*

**20070027804** Oak Ridge National Lab., TN USA

**Evaluation of airborne Electromagnetic Systems for Detection and Characterization of unexploded ordnance (uXo)**

Doll, William; Millhouse, Scott; Gamey, T J; Beard, Les P; Jan 2007; 67 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-MM-0101

Report No.(s): AD-A468552; MM-0101; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As a result of past military training and weapons-testing activities, an estimated 6 million hectares (approximately 15 million acres) of U.S. land is potentially contaminated with unexploded ordnance (UXO) and/or weapons testing- and training-related artifacts. Using current technologies, the costs associated with detection, identification, and mapping of this contamination has been estimated to be in the tens of billions of dollars. Current surface-based technologies are generally labor-intensive, slow, and expensive. The Oak Ridge Airborne Geophysical System time-domain electromagnetic (ORAGS-TEM) system is a boom-mounted EM induction system designed for mounting on rigid Kevlar and carbon fiber booms attached to the underside of a Bell 206L Long Ranger helicopter. Rigid booms allow the helicopter to fly closer to the ground, increasing system resolution and permitting precise control of receiver positions, thus allowing more accurate determination of UXO locations. The airborne system is based on a single transmitter coil and two receiver coils mounted on a rigid 12m x 3m rectangular boom structure. Ancillary equipment includes a laser altimeter and a real-time differentially corrected global positioning system (GPS) for navigation and data positioning. This configuration enables operation at a nominal flight altitude of 1 to 3 meters above ground level (AGL). The survey methodology used for this report consisted of parallel lines traversing the areas of interest so that data were collected for each flight line at nominal data spacing. The survey process concludes with data processing, analysis, interpretation, and mapping using commercial software to generate digital images depicting locations and magnitudes of anomalies that may represent UXO.

DTIC

*Ammunition; Explosives Detection; Ordnance*

**20070028550** Civil Aerospace Medical Inst., Oklahoma City, OK, USA

**Prediction and Classification of Operational Errors and Routine Operations Using Sector Characteristics Variables**

Pfeiderer, Elaine M.; Manning, Carol A.; July 2007; 17 pp.; In English

Contract(s)/Grant(s): AM-B07-HRR-522

Report No.(s): DOT/FAA/AM-07/18; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This study examined prediction and classification of operational errors (OEs) and routine operations (ROs) using sector characteristics variables. Average Control Duration, Aircraft Mix Index, Average Lateral Distance, Average Vertical Distance, Number of Handoffs, Number of Point Outs, Number of Transitioning Aircraft, and Number of Heading Changes were used as predictors in two stepwise logistic regression analyses conducted for the high-altitude and low-altitude sectors. In the high-altitude sample, variables included in the final model (Number of Heading Changes, Number of Transitioning Aircraft, and Average Control Duration) accurately classified OE and RO samples for 80% of the cases. In the low-altitude sample, variables included in the final model (Number of Point Outs, the Number of Handoffs, and the Number of Heading Changes) accurately classified OE and RO samples for 79% of the cases. Although logistic regression cannot be used to determine causation, it effectively identified variables that predicted the occurrence of OEs.

Author

*Error Analysis; Air Traffic Control; Air Traffic Controllers (Personnel)*

**20070028572** Government Accountability Office, Washington, DC, USA

**Aviation Security: Foreign Airport Assessments and Air Carrier Inspections Help Enhance Security, but Oversight of These Efforts Can Be Strengthened**

May 2007; 124 pp.; In English

Report No.(s): PB2007-108418; GAO-07-729; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The Transportation Security Administration's (TSA) efforts to evaluate the security of foreign airports and air carriers that service the USA are of great importance, particularly considering that flights bound for the USA from foreign countries continue to be targets of coordinated terrorist activity, as demonstrated by the alleged August 2006 liquid explosives terrorist

plot. For this review, GAO evaluated the results of foreign airport and air carrier evaluations; actions taken and assistance provided by TSA when security deficiencies were identified; TSA's oversight of its foreign airport and air carrier evaluation programs; and TSA's efforts to address challenges in conducting foreign airport and air carrier evaluations. To conduct this work, GAO reviewed foreign airport and air carrier evaluation results and interviewed TSA officials, foreign aviation security officials, and air carrier representatives.

NTIS

*Air Transportation; Airports; Inspection; Security*

**20070028731** William J. Hughes Technical Center, Atlantic City, NJ, USA

**Subgrade CBR Values for Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility**

Hayhoe, G. F.; Apr. 2007; 25 pp.; In English

Report No.(s): PB2007-109835; No Copyright; Avail.: National Technical Information Service (NTIS)

Full-scale traffic test results from tests run at the Federal Aviation Administration National Airport Pavement Test Facility (NAPTF) in 2000, 2001, and 2002 with four-wheel and six-wheel landing gears have previously been combined with results from tests run by the U.S. Army Corps of Engineers in the early 1970s. The combined results were analyzed in a recent report, and updated alpha factor values were determined for four- and six-wheel gears at 10,000 coverages. The strength of the subgrades in the NAPTF test pavements was characterized by averages of CBR (California Bearing Ratio) measurements made at the surface of the subgrade before and after testing and CBR measurements made after testing at depths of one foot and two feet (30.48 cm and 60.96 cm) below the surface of the subgrade. A number of minor transcription and rounding errors were made in the original calculations of the average CBR values and, since publication of the previous report, results have become available from an additional trench opened in one of the test items. The average CBR values for the NAPTF tests are updated in this report, resulting in an increase in the computed four-wheel alpha factor of approximately 0.6 percent and a decrease in the computed six-wheel alpha factor of approximately 1.3 percent.

NTIS

*Airports; Data Acquisition; Pavements; Test Facilities*

**20070028736** William J. Hughes Technical Center, Atlantic City, NJ, USA

**Enhanced Aircraft Conspicuity to Reduce Runway Incursions**

Gallagher, D. W.; Apr. 2007; 29 pp.; In English

Report No.(s): PB2007-109831; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A study, which was conducted for the Runway Safety and Operational Services Office concerning controller and pilot error in surface operations, recommended increasing aircraft conspicuity when the aircraft is on the runway through the use of existing aircraft lights, thus making the aircraft more conspicuous to controllers and pilots both on the ground and on approach. The objectives of this research effort using standard aircraft lighting were to (1) determine the best aircraft lighting configuration for making an aircraft on the active runway more conspicuous to an aircraft on final approach and (2) determine from an air traffic control (ATC) tower which aircraft lighting configuration is better for making an aircraft on a runway more conspicuous to air traffic controllers. This research examined aircraft conspicuity from the two perspectives mentioned above, using a representative selection of aircraft types to the extent available as a target aircraft. Two aircraft were used for the approaches, one of which was equipped with an eye-tracker device that the subjects wore during the approaches. Results of the flight test showed that, of the external aircraft lighting configurations studied (steady and pulsing landing lights), none provided enough of a visual cue for the needed conspicuity for an approaching aircraft. From the ATC tower, steady and pulsing landing lights were both effective in providing the needed conspicuity.

NTIS

*Runway Incursions; Visibility; Air Traffic Controllers (Personnel)*

**20070028768** Library of Congress, Washington, DC USA

**Strategic Airlift Modernization: Background, Issues and Options**

Bolkcom, Christopher; Mar 25, 2005; 7 pp.; In English

Report No.(s): AD-A467729; CRS-RS20915; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There is a growing consensus that the U.S. strategic airlift fleet provides an increasingly important military capability, and is increasingly stressed. The Department of Defense's (DOD) latest mobility study points to a shortfall in current and projected airlift capability. Several options have been suggested to address this reported shortfall.

DTIC

*Military Operations; Transport Aircraft; Strategy*

**20070028771** Air Univ. Press, Maxwell AFB, AL USA

**Military Airpower: A Revised Digest of Airpower Opinions and Thoughts**

Westenhoff, Charles M; Mar 2007; 277 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467598; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This book is about what Airmen have in common - our heritage, capacity, and future potential. It also illustrates that while we're on the leading edge, we're also part of the sweep of military history. Understanding the way that our predecessors handled their challenges can equip us to better serve our nation. The number one aim of this book is to supply Airmen with useful thoughts that might help them meet their known responsibilities and the unknown challenges their service will bring. We can learn from both the failures and the successes of soldiers, sailors, marines, and Airmen; the ancient past; and yesterday's headlines. This book is a revision of one published in 1990. Just as in the 1990 edition, the quotations are arranged by subject matter to present multiple views of each topic.

DTIC

*Histories; Military Personnel*

**20070029510** National Defense Univ., Norfolk, VA USA

**Flexible Precision: Air Force's Answer to Army Transformation and Intratheater Airlift on the 21st Century Battlefield**

Hering, Mark A; Jun 1, 2007; 73 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468595; JFSC-25789; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468595>

The changing operational environment has motivated the Army to undergo its largest transformation since WW II. The Army decision to procure the Joint Cargo Aircraft (JCA) has rekindled the 'roles and missions' debate that first surfaced soon after the Air Force stood up as a separate service. Both the Army and Air Force have a legitimate requirement to recapitalize the average age of Army cargo aircraft is over twenty years old and the average age of active duty Air Force C-130s are almost thirty-five years old. The significant increase in capability of the JCA, however, compared to current Army cargo aircraft (twice the range and three and a half times the payload capacity) is the source of the current 'roles and mission' debate. The purpose of this paper is to offer a solution to meeting intratheater airlift requirements that supports the Army's recent transformation. History is full of examples where the intratheater airlift community has embraced new technologies or modified operational procedures in order to overcome evolving threats and resupply troops in the field. The situation today is no different. Two examples of how the Air Force can adapt to support this Army transformation will be proposed. The first example involves using Joint Precision Air Drop System (JPADS) technology to resupply ground forces. The second involves On-Call Airdrop, a time-sensitive employment capability for airlift that adopts procedures currently used by the Close Air Support (CAS) community. Both JPADS and on-call airdrop represent a new distinctive capability-Flexible Precision-that the airlift community offers a joint force commander (JFC). The thesis of this paper is to add the concept of Flexible Precision as a USAF fixed-wing distinctive capability to enhance the JFC's ability to meet war-fighter logistical needs and allow the Air Force to continue as the intratheater airlift provider for the Army.

DTIC

*Military Operations; Transport Aircraft*

**20070029557** Naval Surface Warfare Center, Dahlgren, VA USA

**Interim Heavy Airlift: Sea Base Logistics Glider Concept**

Thoms, Keith H; Jan 2007; 110 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468743; NSWCDD/TR-06/52; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468743>

This technical report proposes an interim heavy airlift (iHL) concept to connect the littoral Sea base to warfighters ashore.

Ships capable of selective offload use the iHL system to provide materiel over the horizon by distributed air means to Ship-to-Objective Maneuver (STOM) forces moving rapidly to operational objectives without stopping to seize, defend, and build up beachheads or landing zones. iHL purposely does not alter planned Navy Sea base constructions. iHL scales to sustain any force ashore from small units and Distributed Operations up to Marine Expeditionary Brigade (MEB) operations. iHL can reduce the number of rotorcraft or tilt-rotorcraft it would otherwise take to daily resupply by air, and uses ship cargo space for storage.

DTIC

*Gliders; Logistics; Seas*

**20070029729** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Automated Aerial Refueling Presentation to 2007 ARSAG Conference (Preprint)**

Hinchman, Jacob; Schreiter, Daniel; Apr 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-A00T

Report No.(s): AD-A468985; AFRL-VA-WP-TP-2007-314; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468985>

This presentation was prepared for the 2007 Aerial Refueling Systems Advisory Group (ARSAG) conference to update the status of the Automated Aerial Refueling (AAR) program at the Air Force Research Laboratory. The AAR technology suite has application to both manned and unmanned vehicles. For unmanned vehicles, AAR allows eliminates the tyranny of fuel, allowing unmanned vehicles to be based, deployed, and employed like manned systems. Furthermore as manned mission durations increase, aerial refueling becomes more and more strenuous on the pilot. AAR seeks to reduce the workload in cockpit and provide a in-weather refueling capability. Also, this technology allows manned or unmanned platforms to fly formation in IFR conditions.

DTIC

*Air to Air Refueling; Conferences; Refueling*

**20070029816** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel**

McNiel, Charles M; Mar 2007; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469163; AFIT/GAE/ENY/07-M19; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469163>

The purpose of this research was to determine whether solid carbon dioxide (CO<sub>2</sub>) particles might provide a satisfactory, and cleaner, alternative to traditional seed material for Particle Image Velocimetry (PIV) for use in a closed circuit supersonic wind tunnel. The Air Force Institute of Technology (AFIT) closed circuit pressure-vacuum supersonic wind tunnel was utilized, which achieves a nominal Mach number of Mach 2.9 in a 2.5 inch by 2.5 inch square test section. CO<sub>2</sub> was dispensed into the flow as a liquid from a standard compressed gas liquid tank through two different injector styles at two injection sites using various injector attitudes. Upon exiting the injector in either the stagnation chamber or converging-diverging nozzle, the liquid CO<sub>2</sub> rapidly formed solid particles which became entrained in the wind tunnel flow and began the sublimation process from a solid to a gaseous state. The particles traveled through the test section, in which they were illuminated by a laser, and the light scattered by the particles was imaged with a camera. The resulting images were processed using the Dantec Dynamics FlowManager PIV processing software to generate vector maps representing the flow field in the test section. The particles fully sublimated after traveling through the test section, making the injection process self cleaning and hazard free. Vector maps that matched the nominal 606 m/s velocity in the empty test section were generated utilizing both multi-port tube and shroud tube style injectors. Realistic vector maps were also generated for the flow with a 10° half-angle cone model placed inside the test section. Overall this research successfully demonstrated the use of CO<sub>2</sub> as a seed material for PIV processing.

DTIC

*Carbon Dioxide; Circuits; Cleaning; Computational Fluid Dynamics; Particle Image Velocimetry; Seeds; Supersonic Wind Tunnels*

## 04

### AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications, Spacecraft Communications, Command and Tracking; and 32 Communications and Radar.

**20070027486** Civil Aeromedical Inst., Oklahoma City, OK USA

#### **Developing the Federal Aviation Administration's Requirements for Color Use in Air Traffic Control Displays**

Xing, Jing; May 2007; 19 pp.; In English

Report No.(s): AD-A467708; DOT/FAA/AM-07/10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the materials we developed for the Federal Aviation Administration's requirements for color use in Air Traffic Control (ATC) displays. While many color use guidelines and the Federal Aviation Administration's Human Factors Design Standard (HF-STD-001) provide general information about how to choose color schemes in visual displays, the purpose of this document is for developers of ATC technologies and human factors practitioners to evaluate the use of color from the perspective of ATC operations. This document provides two checklists. The first is a 'To-do' checklist to assess whether the use of a color is effective for its intended purpose of assisting ATC task performance. The second is a 'Do-not do' checklist to assess whether the use of color introduces potential negative effects on performance. While the two checklists may not cover all color use issues, they are pertinent to performance and can serve as a baseline to qualify/disqualify color schemes in ATC displays. Developers and human factors practitioners are encouraged to reference these checklists for interface design and acquisition evaluation of ATC technologies.

DTIC

*Air Traffic Control; Color; Display Devices; Management*

## 05

### AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance and evaluation, and aircraft and flight simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Technology Utilization and Surface Transportation.

**20070026383** Notre Dame Univ., IN USA

#### **Tip Clearance Control Using Plasma Actuators**

Morris, Scott C; Corke, Thomas C; Mar 2007; 73 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0198

Report No.(s): AD-A466059; UND-SM07-0328; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466059>

This report documents experimental results from a series of experiments using active flow control to improve the performance and efficiency of turbine tip clearance flows. The flow control was based on plasma actuators. Two experimental facilities were used as part of this research project. The first was a low-speed, large-scale turbine cascade using Pak-B turbine blades. The second was a smaller scale, high-speed cascade with low aspect ratio. The active flow control was designed to act as a plasma squealer. Specifically, the plasma force was oriented perpendicular to the camber line in order to resist the leakage flow through the tip gap. Both steady and unsteady forcing was used as a method for manipulating natural jet-like instabilities that existed as the leakage flow separated in the tip gap. The results have indicated that the unsteady plasma forcing was as effective as the passive squealer geometry in reducing the losses that occurred in the wake of the blade tip.

DTIC

*Actuators; Clearances; Fluid Dynamics; Plasmas (Physics); Turbine Blades; Turbomachinery*

**20070026404** Air Force Research Lab., Wright-Patterson AFB, OH USA

#### **Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint)**

Baur, Jeff; Silverman, Edward; Nov 2006; 18 pp.; In English

Report No.(s): AD-A466106; AFRL-ML-WP-TP-2007-408; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466106>

Incorporation of nanoparticles into engineered composites represents one of the largest volume applications for

nanocomposites currently envisioned. Of the wide variety of structural applications, fiber-reinforced composites for aerospace structures have some of the most demanding applications with extreme requirements in physical, chemical, electrical, thermal, and mechanical properties. Nanocomposites offer tremendous potential to improve these properties for advanced engineered composites with modest additional weight and easy integration into current processing schemes. Significant progress has been made in fulfilling this vision. Within this paper, we review the relative status of nanocomposites incorporation into aerospace composite structures and the need for continued development. In particular, nanocomposites have been applied at specific and multiple locations within the hierarchical composites to improve specific properties and to offer yet another method and level to optimize multiple properties of the overall structural composite.

DTIC

*Aerospace Vehicles; Composite Structures; Fiber Composites; Nanocomposites; Nanostructures (Devices); Nanotechnology; Polymer Matrix Composites*

**20070026406** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Aircraft Battery Design Concept for Improved Ultra Low Temperature Performance (Postprint)**

Erbacher, John K; Loeber, Gary J; Owens, Sarah M; Riepenhoff, Cameron A; Nov 2006; 6 pp.; In English

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A466109; AFRL-PR-WP-TP-2007-215; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466109>

The AFRL, Electrochemistry and Thermal Sciences Branch has evaluated numerous aircraft battery designs and chemistries since the 1960s. Recent experiments on advanced battery chemistries have shown poor performance at ultra low temperatures below -20 deg C. Aircraft battery designs stress low weight and volume and maximum capacity. One design concept uses lower capacity cells in a series parallel configuration to reduce overall battery resistance and should also improve ultra low temperature performance. Our organization has begun experiments with series-parallel cell designs to evaluate the concept and to solve low temperature performance issues. Progress, observations on the effect of different chemistries, and the impact on aircraft battery characteristics are discussed.

DTIC

*Aircraft Equipment; Electric Batteries; Low Temperature*

**20070026501** Library of Congress, Washington, DC USA

**V-22 Osprey Tilt-Rotor Aircraft**

Bolkcom, Christopher; Mar 13, 2007; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466335; CRS-RL31384; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466335>

The V-22 Osprey is a tilt-rotor aircraft, capable of vertical or short take off and landing, with forward flight like a conventional fixed-wing aircraft. The MV-22 is the Marine Corps top aviation priority. Marine Corps leaders believe that the Osprey will provide them an unprecedented capability to quickly and decisively project power from well over the horizon. The Air Force's CV-22 version will be used for special operations. Army officials have testified that the service has no requirement for the V-22, but the Navy has expressed interest in purchasing MV-22s for a variety of missions. The V-22 program has been under development for over 25 years. Safety and maintenance concerns have arisen during this period (due in large part to three fatal accidents). The commander of the V-22 maintenance squadron admitted to falsifying maintenance records to make the aircraft appear more maintainable than it was, and three Marines were found guilty of misconduct. The program has maintained support from many in Congress despite these deficiencies. The program has undergone restructuring to accommodate congressional direction, budget constraints, and recommendations from outside experts, and DOD managers. After a 17 month hiatus, the Osprey embarked on its second set of flight tests in May of 2002. Tests were completed in June 2005 to the satisfaction of Navy testers, who believe that the V-22 has resolved all technical and engineering problems identified in internal and external reviews. On September 28, 2005 the V-22 program passed a major milestone when the Defense Acquisition Board approved it for military use and full rate production. Supporters tout the V-22's potential operational capabilities relative to the helicopters it will replace. It will fly faster, farther and with more payload than the CH-46 Sea Knight the Marine Corps currently operate.

DTIC

*Aircraft Configurations; Fixed Wings; Flight Tests; Tilt Rotor Aircraft; V-22 Aircraft*



**20070026514** Orbital Research, Inc., Cleveland, OH USA

**Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint)**

Patel, Mehul P; Kolacinski, Richard M; Patil, S K; Ng, T T; Oct 2006; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-M-3540; Proj-A08W

Report No.(s): AD-A466359; AIAA-2006-3158; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466359>

This report was developed under a SBIR contract. Active flow control experiments were conducted on a two-dimensional, single-element NACA 4312 airfoil to assess the performance of vortex generators and gurney flaps as lift-enhancing devices for the control of longitudinal dynamics of an air vehicle. The vortex-generators are shown to delay boundary layer separation and provide an increase in the lift coefficient for angles of attack above 12 deg, and the gurney flaps yield a constant shift in the lift curve for all angles of attack up to stall angle. The vortex-generators are most effective when used between 2 to 5% chord, and the gurney flap is most effective when used at the trailing-edge. Experiments from actuators distributed spanwise along the wing reveal that there is minimal interaction between individual gurney flaps at low-to-moderate angles of attack, while, the interactions between the individual vortex-generators are slightly more pronounced at high angles of attack. The effects of these individual actuators can be combined linearly to produce a desired net effect.

DTIC

*Actuators; Airfoils; Feedback Control; Mechanical Engineering; Mechanical Properties*

**20070026597** Defence Science and Technology Organisation, Edinburgh, Australia

**North West Shelf Unmanned Aerial System Trial**

Craig, Duncan; Feb 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466536; DSTO-TR-1958; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466536>

In response to a government policy announcement issued during the lead-up to the 2004 federal election, Defence undertook two demonstrations of the application of Unmanned Aerial Systems (UAS) technology to the protection of the North West Shelf region. A real world trial took place in August-September 2006, involving the General Atomics Aeronautical Systems Incorporated Mariner Demonstrator UAS. A modelling and simulation based trial involving Northrop Grumman's Cyber Warfare Integration Network (CWIN) facility took place in October 2006, with a Global Hawk-based UAS being represented within the simulation environment. This report provides a public releasable summary of these two activities.

DTIC

*Drone Vehicles; Oceans; Surveillance*

**20070026600** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Thermal Applications for Advanced Metallic Materials (Preprint)**

Spowart, Jonathan E; Jan 2007; 13 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A466545; AFRL-ML-WP-TP-2007-410; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466545>

Various applications for advanced metallic materials in the area of thermal management of potential interest to the USA Air Force are discussed. Particular emphasis is given to the following technologies; passive thermal systems utilizing high thermal conductivity metallic composites; lightweight metallic phase-change materials for managing thermal transients; high-efficiency thermoelectric materials for energy harvesting applications. In this paper, a brief background of the current SOA in each technology is presented, along with potential new areas for growing new research directions. Strategies for short-, medium-, and long-term materials and systems development are proposed.

DTIC

*Aircraft Engines; Maintenance; Metals; Textiles; Thermal Conductivity; Thermodynamic Properties; Thermoelectricity*

**20070026615** Air Force Research Lab., Wright-Patterson AFB, OH USA

**The Joy of Computing with Volume-Integrals**

Sabbagh, Harold A; Murphy, R K; Sabbagh, Elias H; Aldrin, John C; Knopp, Jeremy S; Lindgren, Eric A; Jan 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4349

Report No.(s): AD-A466566; AFRL-ML-WP-TP-2007-411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466566>

As an alternative to the finite-difference time-domain (FDTD), the finite-element method (FEM), and the Method of Moments (MoM) based on the surface integral equation (SIE), a volume-integral equation (VIE) approach using MoM and conjugate-gradient methods is presented to address a wide variety of complex problems in computational electromagnetics. A formulation of the volume integral method is presented to efficiently address inhomogeneous regions in multilayered media. Since volume element discretization is limited to local inhomogeneous regions, numerical solutions for many complex problems can be achieved more efficiently than FDTD, FEM, and MoM/SIE. A challenge-problem in the field of nondestructive evaluation is the inspection of fastener sites for fatigue cracks in multilayer structures, ferromagnetic fastener sites, gaps between materials interfaces, and the presence of fatigue cracks are accurately modeled. Simulated studies are presented with VIC-3D, a proprietary volume-integral code, and comparisons are made with FEM highlighting performance advantages of the VIE approach.

DTIC

*Computer Programs; Electromagnetic Properties; Integral Equations; Integrals; Method of Moments*

**20070026618** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint)**

McNeely, Rachelle L; Iyer, Ram V; Chandler, Phillip R; Feb 2007; 36 pp.; In English

Contract(s)/Grant(s): Proj-A03D

Report No.(s): AD-A466570; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466570>

A very important sub-problem in the task assignment problem for unmanned air vehicles (UAVs) is the evaluation of costs for the state transitions of a directed graph. Usually a Dubins vehicle flying in the absence of wind is considered in the computation of costs. However, when a prevailing wind vector field is considered, the costs take on very different values and the task assignment problem can have very different solutions. In this paper, we consider the problem of constructing minimum time trajectories for a Dubins vehicle in the presence of a time varying wind vector field. We present results on the existence and uniqueness of minimum-time solutions for a Dubins vehicle flying in a general time-varying wind vector field under some technical conditions. These results extend the conclusions of the well-known Dubins theorem. We also propose an algorithm for obtaining the minimum-time solution for an UAV and prove its convergence. We also present the results of numerical experiments that show that the importance of considering wind vector fields while planning the tour for an UAV.

DTIC

*Drone Vehicles; Planning; Vector Analysis; Wind (Meteorology); Wind Direction; Wind Velocity*

**20070026621** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Value-Focused Thinking Model for the Selection of the Best Rigid Pavement, Partial-Depth Spall Repair Material**

Speer, Benjamin G; Mar 2007; 106 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466573; AFIT/GEM/ENS/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466573>

Concrete spalls on airfield pavements generate foreign object debris (FOD) that is damaging to aircraft engines, and may damage landing gear by roughening of the pavement surface. Repairing spalled concrete on aging and deteriorating airfields is essential for its safe operational use. Picking the best repair material from many products on the commercial market is difficult. There is wide variation on material properties, and good performance on certain criteria is critical to constructing long lasting repairs. Since there is currently no procedure for Air Force decision-makers to select the best rigid-pavement repair material, a model was created using Value-Focused Thinking (VFT) to evaluate repair material alternatives. Fourteen products

were compared against each other. Each was scored using fourteen evaluation measures that were identified as important to the repair material selection process. Pavemend EX-H was found to be the best choice for repairs conducted during conventional, steady-state operations. VFT was shown to be an effective methodology for objectively ranking repair products, while providing a systematic process that can be tailored for future circumstances.

DTIC

*Aircraft Engines; Concretes; Debris; Depth; Landing Sites; Pavements*

**20070026624** Defence Science and Technology Organisation, Victoria, Australia

**A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division**

Hu, W; Tong, Y C; Walker, K F; Mongru, D; Amaratunga, R; Jackson, P; Dec 2006; 165 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466578; DSTO-RR-0321; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466578>

The Air Vehicles Division of Defence Science and Technology Organisation (DSTO) owns and/or uses a large number of software tools for crack-initiation and crack-growth analyses of aircraft structures. These tools represent a substantial body of knowledge of fatigue and fracture of engineering materials and structures that has been created and accumulated over the years. This report presents a review and assessment of the methods underpinning the more commonly-used software tools and approaches in Air Vehicles Division. The key points of the principle of each method are discussed, and different implementation considerations are highlighted, to demonstrate the similarity and difference between the models. A start is made on the compilation of a compendium of benchmark problems and challenging problems in order to assist the evaluation and consistent validation of existing and newly-developed tools. The objectives of the review are to help to increase the responsiveness and robustness of the advice DSTO provides to its clients by identifying the strengths and limitations of the commonly-used methods and tools; identifying and recommending software platforms for future improvement, and horizon-scanning the field of fatigue and fracture for new and emerging methodologies for aircraft structural life prediction. It is expected that the recommendations presented in this review will be addressed in follow-on work.

DTIC

*Airframes; Fatigue Life; Software Development Tools*

**20070026639** Air Force Research Lab., Wright-Patterson AFB, OH USA

**UAV Scheduling via the Vehicle Routing Problem with Time Windows (Preprint)**

Weinstein, Amanda L; Schumacher, Corey; Jan 2007; 17 pp.; In English

Contract(s)/Grant(s): Proj-A03D

Report No.(s): AD-A466627; AFRL-VA-WP-TP-2007-306; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466627>

In an urban environment, multiple small unmanned aerial vehicles (UAVs) may be utilized to locate, surveil, or attack various targets. Whatever the task, the air vehicles must cooperate by efficiently communicating with each other and optimally assigning each UAV to the appropriate task at the appropriate target and at the appropriate time. In this paper, a vehicle assignment algorithm is developed using a mixed integer linear program (MILP) to find the global optimal scheduling solution. The MILP can accommodate both binary and continuous decision variables as well as a variety of constraints and objective functions; however, the NP-hard nature of the problem implies a dramatic increase in the computing complexity as the number of variables and constraints increase. This formulation accounts for an assortment of scenarios focused on the military necessity for precise intelligence, surveillance, and reconnaissance (ISR) by modifying the vehicle routing problem with time windows (VRPTW) formulation. The VRPTW is a type of capacitated vehicle routing problem which optimally assigns a designated number of delivery vehicles originating at a single depot to a known number of customers. Specifically, the VRPTW and network flow techniques account for various scenarios as well as operator imposed timing constraints such as precedence constraints. For example, certain targets may take precedence or require simultaneous arrival times where the targets are first hierarchically clustered according to their proximity to each other. Thus, this paper also focuses on methods of clustering targets and implements this information into the MILP to optimally assign UAVs to targets. Clustering targets that are near enough to alert each other of an attack will allow UAVs to recognize this potential and hence surveil these targets simultaneously to avoid early detection. This techn

DTIC

*Aircraft; Algorithms; Linear Programming; Scheduling*

**20070026641** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Sizing Mobility Readiness Spares Packages for Today's Warfighting Units**

Beckley, Christopher M; Mar 2007; 126 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466629; AFIT/GLM/ENS/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466629>

As the Air Force transforms from a garrisoned force into a light expeditionary force, one area for restructuring is the manner in which mobility readiness spares packages (MRSPs) are managed and stocked. For a war tasking, thirty days supply is typically deployed in a MRSP as it is assumed that there will be no re-supply for thirty days. Studies of combat operations from the past decade suggest that thirty days without re-supply is an outdated assumption. The objective of this thesis is to economically build a robust MRSP that is flexible enough to provide adequate support for a variety of squadron sizes at least through day 20 of a war. Faster establishment of a reliable re-supply pipeline is the key to successfully implementing such a MRSP. This research focused on three different weapon-systems; the A-10, F-15E, and F-16C. Through use of the Aircraft Sustainability Model, smaller MRSPs are constructed which have the ability to adequately support squadron sizes of 12, 18, and 24 aircraft based on their ability to maintain aircraft availability goals without generating excessive amounts of expected backorders.

DTIC

*Fighter Aircraft; Logistics; Mobility; Spare Parts*

**20070026642** Ohio State Univ., Columbus, OH USA

**Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint)**

Fiorentini, Lisa; Serrani, Andrea; Bolender, Michael A; Doman, David B; Dec 2006; 19 pp.; In English

Contract(s)/Grant(s): F33615-01-2-3154; Proj-A02D

Report No.(s): AD-A466631; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466631>

This paper describes the design of a nonlinear controller for an air-breathing hypersonic vehicle. To overcome the analytical intractability of this model, a nominal control-oriented model is used to derive the control law. The nominal model has unstable zero dynamics with respect to the output to be controlled, namely flight path angle and velocity, and presents intricate couplings between the engine dynamics and flight dynamics. The flexible effects have not been included in the analysis yet. Adaptive control techniques and robust control techniques are applied to achieve tracking of velocity and altitude trajectories. Simulation results are provided to show that the derived control law allows to achieves excellent tracking performance on the nominal model.

DTIC

*Adaptive Control; Control Systems Design; Control Theory; Hypersonic Vehicles; Nonlinearity; Trajectories*

**20070026714** National Defense Univ., Washington, DC USA

**Enhancing Army S&T Lessons from 'Project Hindsight Revisited'**

Chait, Richard; Lyons, John W; Long, Duncan; Sciarretta, Albert A; Jan 2007; 161 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466795; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466795>

This book draws on a series of studies known as Project Hindsight Revisited conducted by the authors at the National Defense University from 2004-2006. The Hindsight Revisited studies examined, in three reports, the development of four current U.S. Army weapons systems: the Abrams main battle tank, the Apache attack helicopter, the Stinger anti-aircraft missile, and the Javelin anti-tank missile. In exploring how these weapons systems were taken from conceptual design to full-scale production, the studies brought to light crucial factors in their successful development. This book pursues significant implications of the studies' findings, with the intention that this analysis and commentary will help the Army's science and technology (S&T) leadership manage the Army S&T portfolio today and tomorrow. The Hindsight Revisited studies addressed the development of the weapons systems in question in terms of Critical Technology Events (CTEs). CTEs, as further explained in Chapters I and II, were those actions and advances that were vital to the capabilities with which a system was ultimately endowed. As such, they provided a way to focus on those factors that were crucial to success, including who performed the development work, who financed it, and what management practices were employed. These CTEs were established after many hours of discussion and extensive correspondence with scientists, engineers, technicians, and managers who were directly involved with the systems' developments. All told, the Hindsight Revisited studies found 135 CTEs for the four systems. Despite the obvious differences in the development stories of such disparate systems as a tank, a helicopter, and

two missiles, the research showed some common ingredients of success. Success depended both on having the S&T resources available to conduct the work and on the ability of the parties, principally the Army laboratories and industry, to team and work together.

DTIC

*Antiaircraft Missiles; Antitank Missiles; Attack Aircraft; Military Helicopters; Research and Development; Technologies; Weapon Systems*

**20070026728** Naval Air Warfare Center, China Lake, CA USA

**High-Speed-/Hypersonic-Weapon-Development-Tool Integration**

Duchow, Erin M; Munson, Michael J; Alonge, Jr, Frank A; Nov 14, 2006; 9 pp.; In English

Report No.(s): AD-A466848; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466848>

Multiple tools exist to aid in the design and evaluation of high-speed weapons. This paper documents efforts to integrate several existing tools, including the Integrated Hypersonic Aeromechanics Tool (IHAT)1-7. Two major integration efforts are covered. The first is the combination of IHAT optimized vehicle output with a generic 6-degree-of-freedom (6-DOF) simulation capable of being run in a virtual environment. The second effort involves the addition of realistic campaign level target sets into the IHAT lethality module. M II. IHAT System Background The IHAT system is a multidisciplinary analysis system for the design, analysis, and systems level optimization of high-speed air vehicles. Traditional approaches use separate efforts for each of the major design disciplines (e.g. aerodynamics, propulsion, thermal, structures). The design of high-speed or hypersonic air vehicles involves a limited design space that poses problems for designing with separated discipline teams. For hypersonic vehicles, an integrated design approach lends itself to an efficient exploration of the design space. The IHAT system was developed in an effort to integrate the preliminary design and analysis procedure. It is intended to be run by a small team of engineers, with representatives from the involved disciplines.

DTIC

*Aerodynamics; High Speed; Hypersonic Vehicles; Hypersonics*

**20070026775** Department of Defense, Reston, VA USA

**Human Engineering Design Data Digest**

Apr 2000; 159 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467401; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467401>

This booklet is a digest of material appearing in MIL-STD-1472, and is complemented with material from MIL-HDBK-759 and the Federal Aviation Administration (FAA) Human Factors Design Guide. The user is therefore referred to those documents and its references for required supplementary information. This digest provides basic, quantitative human engineering design data in pictorial, tabular, and graphical formats for use during system, equipment, or facility design and assessment. Its purpose is to furnish a convenient portable reference of human engineering design criteria and guidelines. The principles, explanations, limitations, and application techniques associated with the data have been intentionally omitted. This abbreviated presentation presupposes that the user is familiar with the bases and limitations of the given data or will consult applicable references to ensure appropriate application of the data. This digest was prepared by the Human Factors Standardization SubTAG of the Department of Defense Human Factors Engineering Technical Advisory Group (DoD HFE TAG).

DTIC

*Aircraft Design; Human Factors Engineering*

**20070026787** Ministry of Defence, London, UK

**The Effects of Wind Turbine Farms on Air Defence Radars**

Jan 6, 2005; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467441; AWC/WAD/72/652/TRIALS; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467441>

The UK Government supports the introduction of wind turbine farms as part of its alternative energy strategy but existing Ministry of Defense (MoD) Guidelines restrict planning consent for wind turbine farms within 60% of maximum instrumented range (interpreted as 74 km) and line of sight from primary surveillance radars. However, wind farm developers are

increasingly questioning the validity of current Guidelines. Consequently, a Trial was conducted by the Air Command and Control Operational Evaluation Unit (Air C2 OEU) in response to a tasking from the Directorate of Counter Terrorism and UK Operations (D CT&UK Ops) to determine the effects of wind turbine farms on Air Defense (AD) radars. The aim of the Trial was to determine the effects of wind turbine farms on AD radars by considering the effects of wind turbine farms on radar performance with regard to probability of detection, tracking and displayed effects, the effects on low-level coverage due to the wind turbine farms and system set-up and observed displayed effects. It was confirmed that on the T101 radar, primary radar returns from aircraft having a low Radar Cross Section (Hawk T Mk 1a and Tucano T Mk 1) are lost when flying over wind turbines, regardless of the aircraft's height. The cause of this effect is believed to be as a result of excessive returns from the wind turbines being received in the elevation sidelobes of the radar. As a result of this Trial, the MoD has provisionally ceased automatic approval of wind turbine developments beyond 74 km but within Line of Sight from an AD radar.

DTIC

*Air Defense; Aircraft; Radar; Turbines; Wind (Meteorology); Wind Effects; Wind Turbines*

**20070026824** QinetiQ Ltd., Malvern, UK

**Flexible UAV Mission Management Using Emerging Technologies**

Desimone, Roberto; Lee, Richard; Jun 2002; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467613; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467613>

This paper discusses recent results and proposed work in the application of emerging artificial intelligence technologies for flexible mission management, especially for unmanned (combat) airborne vehicles. Military user needs are discussed for planning, monitoring and control tasks, along with relevant emerging technologies. A story board is described that depicts these military needs in the context of a scenario for countering mobile target threats. The paper concludes with a brief discussion of technical and non-technical barriers to integrating these emerging technologies within fielded systems, and an outline for the next steps.

DTIC

*Aircraft; Artificial Intelligence; Military Operations; Planning*

**20070027297** Naval Postgraduate School, Monterey, CA USA

**Investigation of the Effect of Fuselage Dents on Compressive Failure Load**

Lang, Nann C; Mar 2007; 73 pp.; In English

Report No.(s): AD-A467083; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The main motivation for this thesis study is that significant workload for aging transport aircrafts is related to dent removal from fuselages. This thesis is a preliminary investigation of aircraft fuselage dents using the Finite Element Method (FEM) via FEA ABAQUS software. We investigated single impact dent on fuselage panel at various locations and impact speeds. The material used for our finite element models is Aluminum Alloy 2024-T3, a typical material used for fuselages of older transport aircrafts. Our finite element model consisted of impact analysis, buckling prediction analysis, and post buckling analysis successively. These analyses were performed on both stiffened and unstiffened aluminum panels. We found that, depending on dent status in aluminum panel, the dent may increase or decrease buckling load of the panel compared to that of the virgin panel (undented). The buckling load of panel with low velocity impact is generally lower than that of the virgin plate. As the impact velocity is increased, buckling load of dented panel increases exceeding buckling load of virgin plate. In addition, we also noticed an existence of critical impact velocity at which the buckling load of the dented panel reached maximum and after which will start to decrease.

DTIC

*Compression Loads; Failure; Fuselages; Transport Aircraft*

**20070027303** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint)**

Behbahani, Alireza R; Sep 2006; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3066

Report No.(s): AD-A467099; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sensor reliability is critical to turbine engine control. Today's aircraft engines demand more sophisticated sensors in the control systems, requiring advanced engine testing for component performance demonstration. Expertise in the gas turbine

instrumentation community is located across the gas turbine industry itself, within several specialized university departments serving to supplement the more general research programs in gas turbine research. Sensor technology has advanced in many fields; however, implementation has been slower in aerospace's push for engine health management through adaptive control systems demands more robust instrumentation with inherently fail safe sensors. The future needs of the USAF require innovative reliable control architectures. These needs require new ideas for turbine engine controls, employing the next generation computing, communication hardware and advanced sensors. Turbine engine control research includes: implementation, control theory, algorithms, sensors and transducers.

DTIC

*Aircraft Engines; Control Theory; Detectors; Engine Control; Fail-Safe Systems; Failure; Gas Turbine Engines; Health; Life (Durability); Transducers*

**20070027305** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Optimal UAV Task Assignment and Scheduling (Preprint)**

Weinstein, Amanda; Schumacher, Corey; Jan 2007; 23 pp.; In English

Contract(s)/Grant(s): Proj-A03D

Report No.(s): AD-A467104; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper addresses the issue of task assignment and scheduling for teams of cooperative Unmanned Aerial Vehicles (UAVs) operating in a semi-autonomous manner with a single operator controlling the multiple-vehicle team. Mixed-Integer Linear Programming (MILP) is a highly effective technique for expressing this type of complex optimization problem because it allows for binary decision variables, continuous timing variables, and an extensive, flexible constraint set. A general MILP formulation is proposed, allowing a wide variety of vehicle capabilities and mission requirements to be incorporated. Possible task coupling constraints include precedence constraints, time windows, simultaneous tasks, joint tasks, and more. A variety of scenarios, with heterogeneous vehicles, and a wide range of mission constraints can be addressed.

DTIC

*Autonomy; Drone Vehicles; Linear Programming; Scheduling*

**20070027352** Army War Coll., Carlisle Barracks, PA USA

**A Bold 21st Century Strategy for U.S. Airborne ISR**

Kimberly, Jack L; Mar 13, 2007; 23 pp.; In English

Report No.(s): AD-A467241; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The airborne Intelligence, Surveillance, and Reconnaissance (ISR) capabilities of the U.S. Army could provide the Joint Commands their essential tools to support battlefield interdiction in the 21st Century. Various sensor packages are available today to provide the intelligence and/or information needed to project multiple modes of firepower on target. The U.S. Army has been adding to its existing ISR fleet by fielding unique sensor-integrated Quick Reaction Capabilities (QRC) to answer the short term ISR needs of the Global War on Terrorism (GWOT). These ISR QRC assets have helped increase the density of ISR capabilities across the battlefield, but they have been operationally integrated without meeting the persistent unblinking eye requirement. These assets were procured using un-forecasted supplemental funding, and more importantly, they were acquired without a guiding strategy to help identify the requirements and develop an integrated master plan to sustain the U.S. Army's ISR capabilities into the future. The purpose of this paper is to review and discuss the past and present issues that have impacted development of today's combat ISR capabilities within the U.S. Army, and to recommend an affordable ISR strategy to support the long term ISR needs of the GWOT.

DTIC

*Aerial Reconnaissance; Drone Vehicles; Intelligence; Surveillance*

**20070027365** Naval Postgraduate School, Monterey, CA USA

**Effects of Using NATEC Services within E-2C and FA-18 Operational Squadrons**

Sanford, Allen E; Mar 2007; 149 pp.; In English

Report No.(s): AD-A467284; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The thesis identifies Navy E-2C and FA-18 squadron metrics that are affected by Technical Representative (Tech Rep) Usage from Naval Air Technical and Engineering Service Command (NATEC). Six different databases are identified that contain the following types of metrics: Readiness, Standards and Policy (RS&P), Maintenance and Supply Chain Management (M&SCM); Fleet Readiness Training Plan (FRTTP); Financial; Manpower; and Tech Rep Usage. From the databases, twenty-four months of data is collected for 11 E-2C Squadrons and 37 FA-18 Squadrons. Exploratory Data Analysis is

conducted to visually identify trends within the metrics as well as relationships amongst Tech Rep usage and the other metrics. At the completion of the Exploratory Analysis an overdispersed Poisson Regression Model is then developed, with a subset of metrics, to predict the number of Tech Rep assists per month. Relationships between the predicted Tech Rep Usage and the predictors in the model are then explored.

DTIC

*E-2 Aircraft; Fighter Aircraft; Maintainability*

**20070027379** Library of Congress, Washington, DC USA

**Homeland Security: Protecting Airspace in the National Capital Region**

Elias, Bart; Sep 1, 2005; 7 pp.; In English

Report No.(s): AD-A467333; CRS-RS22234; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since September 11 2001, several actions have been taken to monitor and protect the airspace around Washington, DC. However, many general aviation (GA) interests have protested that extensive airspace restrictions and complex procedures exceed what is necessary to protect critical assets from possible terrorist attacks using aircraft. Policymakers have struggled to address airspace protection needs without unduly impeding air commerce or compromising safety. While the administration is currently seeking to make the airspace restrictions in the National Capital Region permanent, Congress has pushed for an easing of restrictions on GA aircraft at Ronald Reagan Washington National Airport (DCA) and nearby GA airports through legislation and oversight. However, a few high profile airspace breaches have prompted some in Congress to seek stiffer penalties for violators and mandatory training for pilots (see H.R. 3465). Better pilot training and technologies to improve pilot situational awareness may help curtail inadvertent airspace violations that complicate surveillance and protection efforts. Further assessment of airspace design and special flight procedures around Washington, DC, may be undertaken to determine whether an appropriate balance exists between homeland security and defense requirements and air commerce and safety. This report will be updated as needed.

DTIC

*Airports; Airspace; General Aviation Aircraft; Law (Jurisprudence); Protection; Security; Terrorism*

**20070027381** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Price vs. Performance: The Value of Next Generation Fighter Aircraft**

Stelly, John M; Mar 2007; 48 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467340; AFIT/GCA/ENV/07-M10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Department of Defense (DoD) is currently recapitalizing its aging fighter aircraft inventory with the F-22A and F-35. While the DoD may consider cost and performance issues, it does not use a quantitative model that effectively measures the tradeoffs between the two. This thesis constructs a hedonic model of the fighter aircraft market to measure the implicit price on fighter performance characteristics and specifically applies it to next-generation aircraft. Data from 50 aircraft from 1949-present were used to construct two models ? one based on procurement costs and one based on research, design, test, and evaluation (RDT&E) costs. The models, based on a linear Box-Cox transformation, demonstrated that the unique F-22 trait, the ability to super-cruise, has the highest per-unit implicit price (\$68.5M), followed by the stealth technology (\$58.7M) and large-scale integrated circuitry (\$55.3M). The high marginal value for the super-cruise trait implies that, depending on how super-cruise is used operationally, the F-35A may be a more effective purchase in terms of resource allocation than the F-22A.

DTIC

*Cost Analysis; Econometrics; Fighter Aircraft; Jet Aircraft*

**20070027398** Library of Congress, Washington, DC USA

**Civil Reserve Air Fleet (CRAF)**

Bolkcom, Christopher; Oct 18, 2006; 14 pp.; In English

Report No.(s): AD-A467423; CRS-RL33692; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Civil Reserve Air Fleet (CRAF) supports Department of Defense (DoD) airlift requirements in emergencies when the need for airlift exceeds the capability of the military aircraft fleet. All CRAF participants must be U.S. carriers fully certified by the Federal Aviation Administration, and they must meet the stringent standards of Federal Aviation Regulations pertaining to commercial airlines (Part 121). The CRAF has three main segments: international, national, and aeromedical evacuation. The international segment is further divided into the long-range and short-range sections and the national segment is divided into the domestic and Alaskan sections. Assignment of aircraft to a segment depends on the nature of the requirement and the



performance characteristics needed. The commercial airlines contractually pledge aircraft to the various segments of CRAF, ready for activation when needed. To provide incentives for civil carriers to commit aircraft to the CRAF program and to assure the USA of adequate airlift reserves, the government makes peacetime airlift business available to civilian airlines that obligate aircraft to the CRAF. DoD offers business through the International Airlift Services. CRAF presents benefits and opportunities for both DoD and U.S. airlines. By all accounts it appears to be a symbiotic relationship. Yet, as circumstances change, pressures and diverging interests may emerge that could bring changes to CRAF. A number of factors may be considered when examining the future size, character, and role of CRAF. These factors include cost, other potential government/commercial arrangements, potential change in DoD requirement for CRAF, and industrial base or financial assistance to U.S. air carriers. This report will be updated as events warrant.

DTIC

*Air Transportation; Airline Operations; Civil Aviation; Commercial Aircraft; Emergencies; Transport Aircraft*

**20070027411** Naval Postgraduate School, Monterey, CA USA

**Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information**

Papadopoulos, Themistoklis; Mar 2007; 98 pp.; In English

Report No.(s): AD-A467498; No Copyright; Avail.: Defense Technical Information Center (DTIC)

UCAVs are advanced weapon systems that can loiter autonomously in a pack over a target area, detect and acquire the targets, and then attack them. Modeling these capabilities in a specific hostile operational setting is necessary for addressing weapons design and operational issues. While much attention has been given to the engineering and technological aspects of UCAV developments, there are very few studies on operational concepts for these weapon systems and their effectiveness and efficiency. This thesis builds probability models (Markov Chains) that describe UCAV operations, defines Measures of Effectiveness (MOEs) for the engagement performance, maps the functional relations between the parameters and the MOEs, and obtains insights regarding the design of the UCAVs and their tactical employment. The models are used to conduct extensive numerical analysis, based on experimental design concepts and traditional sensitivity analysis. The main focus of the analysis is to investigate optimal and robust mixes of UCAVs of different types, with respect to the MOEs. While in most cases, extreme-point solutions are optimal, there are cases where a balanced UCAV mix is better.

DTIC

*Autonomous Navigation; Autonomy; Combat; Information Theory; Pilotless Aircraft; Probability Theory; Remotely Piloted Vehicles; Targets*

**20070027412** California Univ., Santa Barbara, CA USA

**A Review of Recent Algorithms and a New and Improved Cooperative Control Design for Generating a Phantom Track (Preprint)**

Purvis, Keith B; Chandler, Phillip R; Feb 2007; 11 pp.; In English

Contract(s)/Grant(s): Proj-A03D

Report No.(s): AD-A467506; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For a team of unmanned aerial vehicles (UAVs) to deceive a radar network by generating a phantom track requires a high degree of cooperation due to: 1) dynamic constraints imposed mainly by the UAVs and 2) strong coupling caused by the phantom. We first review three works that have addressed this problem, namely two one-step look-ahead algorithms and an optimal solution with full time horizon; original simulations of each are included. Second, since the one-step algorithms do not satisfy the UAV and/or phantom constraints in many cases, we design a new algorithm that does, as shown by simulation. Finally, we add a multi-step look-ahead for the UAV constraints and modify the algorithm so that an operator can dynamically add objective waypoints for the phantom.

DTIC

*Algorithms; Combat; Drone Vehicles; Networks; Radar*

**20070027416** RAND Corp., Santa Monica, CA USA

**Sustaining Air Force Space Systems: A Model for the Global Positioning System**

Snyder, Don; Mills, Patrick; Comanor, Katherine; Roll, Jr, Charles R; Jan 2007; 63 pp.; In English

Contract(s)/Grant(s): F49642-01-C-0003; FA7014-06-C-0001

Report No.(s): AD-A467528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Aging systems and systems operating longer than their anticipated life span, sometimes because of program slips in

follow-on systems, have intensified the need for understanding how maintenance and sustainment affect the performance of space systems. In this monograph, we develop a pilot framework for analyzing these and related questions in the ground segment of the Global Positioning System and recommend steps for implementing this framework. In doing so, we address the issue of modeling approach and how to define appropriate metrics of performance. We develop the guidelines for metrics and analytic methods as generally as possible so that they will be useful for other space systems. Much of the spirit of the current metrics used to monitor the maintenance of the ground segments of space systems follows that of metrics used for aircraft. But, space systems have some attributes that differ significantly from those of aircraft systems, and these attributes suggest that the metrics for maintenance and sustainment for space systems be reconsidered. From a modeling perspective, the central difference is that space systems are highly integrated systems in near constant operation, not fleets of aircraft, any one of which can perform the specified mission. This difference leads to three challenges for the analyst. First, the logical metric used in the aircraft realm the fraction of the fleet that can perform the stated mission is not applicable in the space realm. Space command systems function as an integrated whole, and the whole must meet operational mission goals at all times. What is needed for space systems is either a measure or measures that reflect the overall system performance, even when the system is operating nominally. The metric should also be sensitive to sustainment perturbations.

DTIC

*Aerospace Systems; Global Positioning System; Military Operations; Systems Engineering*

**20070027417** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources**

Collup, Justin W; Mar 2007; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467529; AFIT/GCA/ENV/07-M4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research was to create a model that could potentially predict demand for military trained pilots in the airline industry. Specifically, this thesis sought to answer the research question addressing whether or not military trained pilots are currently more in demand or less in demand. The research questions were answered through a comprehensive literature review, collection of data relevant to airline industry growth, and regression analysis. The Aviation Continuation Pay Bonus, offered to all eligible Air Force aviators, has risen from \$12,000/year to its current value of \$25,000/year. With shrinking budgets, and ever increasing costs of war, it remains important to implement cost savings measures wherever possible. Airline hiring is one of the most significant factors in an Air Force pilot's decision to leave the service. By monitoring airline industry, pilot growth and military pilot retention rates, it is possible to determine the amount of military trained pilots needed in civilian industry. Armed with this information, Air Force official could potentially revise bonus offerings and pilot production rates, ultimately saving the service money. Results of this research show that variables such as the unemployment rate and September 11, 2001 terrorist attacks are significant in predicting airline industry growth. Also, despite current high pilot retention rates in the Air Force, the research model shows a slight increase in demand for military trained pilots from the years 2005 to 2006.

DTIC

*Airline Operations; Armed Forces (United States); Commercial Aircraft; Cost Reduction; Costs; Forecasting; Military Personnel; Pilots*

**20070027453** Naval Research Lab., Washington, DC USA

**RF Design for Tactical Ultra-Light Unmanned Aerial Vehicle Radar System**

Alatishe, Jimmy O; Mokole, Eric L; Talapatra, Sukomal; Leibowitz, Lawrence M; Mar 29, 2007; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467595; NRL/FR/5340--07-10147; XB-NRL/MR/5340; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Radar Division of the Naval Research Laboratory (NRL) has developed the radio frequency (RF) section of an unmanned aerial vehicle (UAV) radar system in support of the Navy's Tactical Ultra-Light (TUL) UAV program. This RF section consists of a local oscillator (LO) and timing-circuitry module, transmit and receive modules, and a calibration network. The objective of the UAV Radar project was to develop and demonstrate the feasibility of a target detection concept for the TUL UAV system. This concept includes hardware and digital signal processing (DSP) algorithms for target detection in high clutter and foilage with low false-track rates. The hardware effort described represents a significant contribution to the Navy's ability to field a TUL UAV system with an effective radar capability.

DTIC

*Pilotless Aircraft; Radar Equipment; Radio Frequencies*

**20070027477** Library of Congress, Washington, DC USA

**Military Helicopter Modernization: Background and Issues for Congress**

Liles, Christian F; Bolkcom, Christopher; Jun 24, 2004; 55 pp.; In English

Report No.(s): AD-A467680; CRS-RL32447; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent military operations, particularly those in Afghanistan and Iraq, have brought to the fore a number of outstanding questions concerning helicopters in the U.S. armed forces, including deployability, safety, survivability, affordability, and operational effectiveness. These concerns are especially relevant, and made more complicated, in an age of military transformation, the global war on terrorism, and increasing pressure to rein in funding for the military, all of which provide contradictory pressures with regard to DOD's large, and often complicated, military helicopter modernization efforts. Despite these questions, the military use of helicopters is likely to hold even, if not grow. This report includes a discussion of the evolving role of helicopters in military transformation. The Department of Defense (DOD) fields 10 different types of helicopters, which are largely of 1960s and 1970s design. This inventory numbers approximately 5,500 rotary-wing aircraft, not including an additional 144 belonging to the Coast Guard, and ranges from simple utility platforms such as the ubiquitous UH-1 Huey to highly-advanced, multi-mission platforms such as the Air Force's MH-53J Pave Low special operations helicopter and the still-developmental MV-22B Osprey tilt-rotor aircraft. Three general approaches can be taken to modernize DOD's helicopter forces: upgrading current platforms, rebuilding current helicopter models (often called recapitalization), or procuring new models. These approaches can be pursued alone, or concurrently, and the attractiveness or feasibility of any approach or combination of approaches depends largely on budgetary constraints and operational needs. In some cases, observers argue that upgrades to helicopter sub-systems, especially radar, communications, and targeting systems, are the most cost effective way to satisfy current helicopter requirements.

DTIC

*Helicopters; Military Helicopters; Military Operations; System Effectiveness*

**20070027478** Library of Congress, Washington, DC USA

**Potential Military Use of Airships and Aerostats**

Bolkcom, Christopher; May 9, 2005; 7 pp.; In English

Report No.(s): AD-A467685; CRS-RS21886; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense (DOD) has a history of using lighter-than-air (LTA) platforms. Aerostats have recently been fielded to protect U.S. troops in the field. Contemporary interest is growing in using airships for numerous missions. This report examines the various concepts being considered and describes the issues for Congress.

DTIC

*Aerostatics; Airships*

**20070027485** Naval Postgraduate School, Monterey, CA USA

**Pictorial Display Design to Enhance Spatial Awareness of Operators in Unmanned Aviation**

Zirkelbach, Thomas; Mar 2007; 140 pp.; In English

Report No.(s): AD-A467707; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In aviation, spatial awareness and spatial orientation are essential for performing the task of recovering from an unusual attitude. Degraded spatial awareness, particularly in extreme flight situations, may lead to lower operational effectiveness and to loss of equipment and, in manned aviation, loss of life. Therefore, improvements in spatial awareness are important in complex 3D environments, including both manned and unmanned aviation. The main goal of this thesis was to determine whether a new prototype display design, called WEBER-Box, is a useful alternative or supplement to traditional flight instruments for unmanned aviation. In addition we combined the traditional flight instrument as well as the WEBER-Box with a colored-coded indication when the aircraft entered an unusual attitude. In this experiment, the participants executed typical tasks of a UAV-operator. We investigated the influence of the WEBER-Box on UAV operator's orientation performance. The important results can be summarized as follows: 1. significant improvement in correctly solving the orientation tasks 2. significant reduction in time to solve orientation tasks 3. color coded indication of unusual attitude significantly decreased the response time and reduced the error 4. the proposed display design was accepted, interpreted, and used to solve 3D-orientation tasks efficiently

DTIC

*Graphic Arts; Remotely Piloted Vehicles; Situational Awareness*

**20070027487** Naval Postgraduate School, Monterey, CA USA

**Platform Camera Aircraft Detection for Approach Evaluation and Training**

Yusko, Ryan S; Mar 2007; 82 pp.; In English

Report No.(s): AD-A467710; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Approach training currently relies solely on manual observation and verbal feedback to the pilot. This project aims to provide pilots and landing signal officers (LSOs) with valuable information about individual approaches in the carrier landing environment. The author investigated fully automatic flight path acquisition by means of computer vision-based analysis of platform camera video. The obtained data supports enhanced LSO training, real-time approach analysis, and pilot self-improvement through advanced review capabilities.

DTIC

*Aircraft Detection; Cameras; Detection; Education; Personnel; Pilots; Video Signals*

**20070027490** NDE Computational Consultants, Dublin, OH USA

**FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures**

Martin, Steve A; Jata, Kumar V; Apr 2007; 12 pp.; In English

Contract(s)/Grant(s): F33615-03-C-5220; Proj-4349

Report No.(s): AD-A467720; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Structural health monitoring (SHM) technologies, which use integrated sensing for damage detection, are expected to improve system reliability, availability, and operational cost. Guided waves can propagate great distances while experiencing low attenuation. They have been successfully used for damage detection in structures of relatively low geometric complexity such as plates and cylindrical pipes. The use of guided waves for this purpose becomes increasingly difficult as the geometric complexity of the structure increases. Aerospace structural components such as fuel tanks, wings, etc. often are comprised of substructures that consist of plates with integral stiffeners. This work reports on finite element simulations of guided waves in integrally stiffened plate structures. In these studies, the guided waves are generated by PZT wafer-type transducers mounted on the structure. Transient dynamic finite element simulations using PZFlex, in 2D and in 3D, were used to model both the structure and transducers. The interaction of the guided waves with cracks, simulated by notches of varying dimensions, is also modeled. This allows appraisal of the sensitivity of various modes for crack detection by providing insight into mode conversion and scattering resulting from the guided wave and crack interaction.

DTIC

*Finite Element Method; Health; Maintenance; Rigid Structures; Stiffening; Waveguides*

**20070027493** Library of Congress, Washington, DC USA

**VXX Presidential Helicopter: Background and Issues for Congress**

Bolkcom, Christopher; Apr 1, 2005; 7 pp.; In English

Report No.(s): AD-A467728; CRS-RS22103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On January 28, 2005, Navy officials announced the award of the VXX helicopter contract to Lockheed Martin Corp. Critics of the award have raised concerns about the effect on the U.S. defense industrial base, U.S. trade, and whether Buy American statutes apply. Some question whether the competition was fair. Legislation has been introduced regarding some of these issues. This report will be updated as warranted.

DTIC

*Government Procurement; Helicopters; Presidential Reports*

**20070027494** Library of Congress, Washington, DC USA

**V-22 Osprey Tilt-Rotor Aircraft**

Bolkcom, Christopher; Jan 7, 2005; 22 pp.; In English

Report No.(s): AD-A467730; CRS-RL31384; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies like a plane by tilting its wing-mounted rotors to function as propellers. Begun in FY1982 by the Army and now funded in part by the Air Force, the V-22 has been primarily a Marine Corps program funded by the Navy Department. The aircraft is produced by Bell Helicopter Textron and Boeing Helicopters, with engines produced by Rolls-Royce/Allison. Flight testing and operational evaluation of pre-production V-22s began in early 1997, with procurement of production aircraft approved in April 1997. Congress has supported the V-22 as a new technology with multi-service military applications as well as various civilian uses (if derivatives of this tilt-rotor aircraft are developed for civil aviation) with potential commercial and foreign sales

implications. Critics of the V-22 have questioned its affordability and argued that its performance would not justify the cost of procuring this new aircraft in the quantity projected. Also, in light of several accidents, and a reported cover-up, critics argue that the tilt-rotor technology is too risky, while supporters contend that risks are being adequately addressed under a revamped program. This report will be updated.

DTIC

*Tilt Rotor Aircraft; V-22 Aircraft*

**20070027510** Army Aeromedical Research Lab., Fort Rucker, AL USA

**Preliminary Assessment of Stroboscopic Shutter Glasses on Motion Sickness in Helicopter Passengers**

Estrada, Arthur; May 2007; 28 pp.; In English

Report No.(s): AD-A467760; USAARL-2007-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the results of preliminary tests conducted by the USAARL of two sets of stroboscopic shutter glasses (at 4Hz and 8 Hz) proposed as a countermeasure for motion sickness. The purpose was to examine the mission applicability and product potential of the glasses and to gain support for their inclusion in future USAARL motion sickness studies. Six participants experienced two flights in the cabin of a Black Hawk helicopter: the first flight with shutter glasses and the second without them. Following each flight, each participant filled out a motion sickness questionnaire and provided subjective feedback. This preliminary testing of the shutter glasses was conducted to determine their worthiness of further study. The testing was deliberately limited with no intentions of drawing firm conclusions as to the shutter glasses' efficacy. Although the effectiveness of the shutter glasses as a countermeasure for motion sickness is not implied by this test, the results did indicate that shutter glasses, particularly the 8 Hz device demonstrated promise and should be explored as a non-pharmacological motion sickness prevention strategy.

DTIC

*Glass; Helicopters; Motion Sickness; Passengers*

**20070027525** Army War Coll., Carlisle Barracks, PA USA

**Comanche Helicopter Program - A Strategic Failure**

Werthman, Robert W; Mar 1, 2007; 21 pp.; In English

Report No.(s): AD-A467794; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Army initiated the RAH-66 Comanche Helicopter as the Light Helicopter Family (LHX) in 1983 with early cost estimates of five million dollars per helicopter. In March 2004, after 22 years, 6 program restructurings, and 6.9 billion dollars, the Army Chief of Staff terminated the Comanche with the intent to reallocate 14.6 billion dollars programmed through 2011 to restructure Army Aviation. This paper explores the possibility that shortsighted threat analysis coupled with flawed group consensus within the Army allowed the Comanche Helicopter Program to continue through two decades despite intense Congressional scrutiny. Army senior level leadership safeguarded a helicopter program that did not adequately explore alternatives to transformation even when the threat environment called for a change in strategy. The Army's failure to adequately foster critical thinking about aviation threats resulted in a current helicopter force that was not adequately postured for the Global War on Terror.

DTIC

*Failure; Helicopters; Military Helicopters*

**20070027532** Library of Congress, Washington, DC USA

**Unmanned Aerial Vehicles: Background and Issues for Congress**

Bone, Elizabeth; Bolkcom, Christopher; Apr 25, 2003; 53 pp.; In English

Report No.(s): AD-A467807; CRS-RL31872; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Unmanned Aerial Vehicles (UAVs) have been referred to in many ways: RPV (remotely piloted vehicle), drone, robot plane, and pilotless aircraft. Most often called UAVs, they are defined by the Department of Defense (DoD) as powered, aerial vehicles that do not carry a human operator, use aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. UAVs range from the size of an insect to that of a commercial airliner. DoD currently possesses five major UAVs: the Air Force's Predator and Global Hawk, the Navy and Marine Corps's Pioneer, and the Army's Hunter and Shadow. Other key UAV developmental efforts include the Air Force and Navy's unmanned combat air vehicle (UCAV), Navy's vertical takeoff and landing UAV (VTUAV) and the Broad Area Maritime Surveillance UAV (BAMS), and the Marine Corps's Dragon Eye and Dragon Warrior. The services continue to be innovative in their use of UAVs. Recent examples include arming UAVs (Predator, Hunter), using UAVs to extend the

eyes of submarines, and teaming UAVs with strike aircraft and armed helicopters to improve targeting. In the past, tension has existed between the services' efforts to acquire UAVs and congressional initiatives to encourage a consolidated DoD approach. Some observers argue that the result has been a less than stellar track record for the UAV. However, reflecting the growing awareness and support in Congress and the DoD for UAVs, investments in unmanned aerial vehicles have been increasing every year. Congressional considerations include the proper pace, scope, and management of DoD UAV procurement; appropriate investment priorities for UAVs vs manned aircraft; future roles and applications; and aerospace industrial base considerations. Summaries of UAVs now in operation include system characteristics, mission, payload, program status, inventory, cost, recent uses, losses, and recent actions.

DTIC

*Costs; Drone Vehicles; Payloads; Pilotless Aircraft; Procurement*

**20070027552** Analytical Processes/Engineered Solutions, Inc., Saint Louis, MO USA

**Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries**

Brooks, Craig; Honeycutt, Kyle; Domasky, Scott P; Mar 2006; 65 pp.; In English

Contract(s)/Grant(s): FA8650-04-D-3446-0004; Proj-A02P

Report No.(s): AD-A467841; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The challenges of designing modern aircraft continue to drive the development of more advanced analytical tools; often these more advanced analytical tools themselves require development of other enabling technologies such as powerful computers and associated software. The primary historical objective of this project was to develop the infrastructure and to demonstrate that key enabling technologies such as faster and bigger personal computers, as well as database and programming software, have evolved to the point that more advanced analytical tools for analyzing the damage tolerance of aircraft structures are now possible.

DTIC

*Airframes; Crack Propagation; Damage; Libraries; Prediction Analysis Techniques; Stress Intensity Factors; Tolerances (Mechanics)*

**20070027582** Florida Univ., Shalimar, FL USA

**Research Institute for Autonomous Precision Guided Systems**

Rogacki, John R; Mar 8, 2007; 81 pp.; In English

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A467899; F49620-03-1-0170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During this three year time period significant advancements were made modeling behavior of shape memory alloys for wing warping applications, shape optimization of piezoceramic composite micro actuators, development of a visualization lab for modeling vision based guidance algorithms, concept development of a rapid prototyping and aero characterization lab, vision based control of autonomous vehicles, cooperative flight of autonomous aerial vehicles using GPS and vision information, cooperative and sharing of information in search missions involving multiple autonomous agents, multi-scale modeling of hexagonal closed pack metals, characterization and modeling of cement like materials involved in munitions penetration, modeling and simulation of ceramic matrix composites, and mechanical response of composites in the presence of electromagnetic fields.

DTIC

*Autonomy; Composite Materials; Computerized Simulation; Control; Drone Vehicles; Simulation*

**20070027697** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

**Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment**

Brickhouse, Mark D; Turetsky, Abe; MacIver, Brian K; Pfarr, Jerry W; Lalain /Iain /McVey, Theresa A; Alter, Wendlyn; Lloyd, John P; Fonti, Jr, Mark A; Mar 2007; 63 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911SR-04-C-0074

Report No.(s): AD-A468145; ECBC-TR-510; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The chemical and biological weapons decontamination of a C-141B aircraft carried out during Oct-Nov 2004 is part of a Congressionally funded joint venture between U.S. Army Edgewood Chemical Biological Center and Strategic Technology Enterprises (STE)/STERIS Corporation, Inc., (Mentor, OH) to develop and demonstrate the suitability of vaporous hydrogen

peroxide/modified vaporous hydrogen peroxide (VHP/mVHP) technology. The purpose of this exercise was to ensure that the vapor could be evenly distributed within the aircraft's cargo hold and its concentration sustained during four runs of 5-24 hr. For the biological decontamination tests, commercial *Geobacillus stearothermophilus* biological indicator (BI) strips and coupons of three aircraft related surface materials contaminated with the same type of spores were strategically placed within the aircraft prior to exposure to the VHP/mVHP fumigant. Coupons of two surface materials contaminated with distilled mustard were used in the chemical warfare (CW) decontamination tests. Over 99.5% kill (3 of 600), of all commercial BIs was achieved for the four decontamination runs. The three positive BIs are exclusively associated with the 5-hr VHP run. In the 5- and 10.5-hr fumigant exposures, residual chemical and biological warfare (CBW) agent simulant levels were below the worker's threshold limits set by the Joint Portable Interior Decontamination System's Operational Requirements Document draft for the corresponding agents. The resulting data has clearly established the suitability of the VHP/mVHP technology for the decontamination of aircraft interiors contaminated with CBW threat materials.

DTIC

*C-141 Aircraft; Decontamination; Fumigation; Hydrogen Peroxide; Vapors*

**20070027708** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Experimental Methods to Characterize Nonlinear Vibration of Flapping Wing Micro Air Vehicles**

Tobias, Adam P; Mar 2007; 170 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468317; AFIT/GAE/ENY/07-M23; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For urban combat reconnaissance, the flapping wing micro air vehicle concept is ideal because of its low speed and miniature size, which are both conducive to indoor operations. The focus of this research is the development of experimental methods best suited for the vibration testing of the wing structure of a flapping wing micro air vehicle. This study utilizes the similarity of a beam resonating at its first bending mode to actual wing flapping motion. While computational finite element analysis based on linear vibration theory is employed for preliminary beam sizing, an emphasis is placed on experimental measurement of the nonlinear vibration characteristics introduced as a result of large movement. Beam specimens fabricated from 2024-T3 aluminum alloy and IM7/5250-4 carbon-epoxy were examined using a high speed optical system and a scanning laser vibrometer configured in both three and one dimensions, respectively.

DTIC

*Aircraft; Flapping; Nonlinear Systems; Nonlinearity; Vibration; Wings*

**20070027719** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Wide Area Search and Engagement Simulation Validation**

Marlin, Michael J; Mar 2007; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468378; AFIT/GAE/ENY/07-M17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The use of computer simulation in the development of autonomously controlled unmanned combat aerial vehicles (UCAV) for wide area search and engagement applications is addressed. Computer simulation is an essential tool to analyze control algorithms designed to optimally employ multiple UCAVs in wide area search and engagement. To be representative of real world mission conditions a simulation must be able to accurately duplicate the performance of the automatic target recognition (ATR) methods that will be used to discriminate between targets and non-targets in actual combat. The objective of this research is to demonstrate a method to validate a simulation's ATR model for use in research of wide area search and engagement control schemes. This objective is accomplished by comparing results of multiple simulations of academically contrived wide area search and engagement scenarios to closed form analytic solutions derived for the same scenarios.

DTIC

*Autonomous Navigation; Computerized Simulation; Drone Vehicles; Scanners; Scanning; Simulation; Target Recognition*

**20070027743** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling**

Newlon, Thomas M; Mar 2007; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468450; AFIT/GOR/ENS/07-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Air Force fighter training squadrons build weekly schedules using a long and tedious process. Very little of this process is automated and optimality of any kind is nearly impossible. Schedules are built to a feasible condition only to be changed with consideration of Wing level requirements. Weekly flying schedules are restricted by requirements for crew rest,

days since a pilot's last sortie, sorties in the last 30 days, and sorties in the last 90 days. By providing a scheduling model to the pilot charged with creating the schedule, valuable pilot hours could be spent in the cockpit, simulator, or other required duty. This research effort presents a mathematical programming (MP) approach to the fighter squadron pilot training scheduling problem. The methodology presented is based on binary variables that will provide integer solutions to every feasible set of inputs. A simulator heuristic developed specifically for this problem assigns pilots to simulator sorties based on the feasible solutions obtained from two different formulation and solving approaches. One approach assigns training mission sorties and duties for the entire week, while the other approach breaks the week into ten successive sub-problems. The model constructs two feasible schedules in approximately 2.5 minutes.

DTIC

*Education; Fighter Aircraft; Flight Training; Heuristic Methods; Mathematical Programming; Pilots; Preprocessing; Scheduling*

**20070027784** RAND Corp., Santa Monica, CA USA

**Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability**

Loredo, Elvira N; Pyles, Raymond A; Snyder, Don; Jan 2007; 120 pp.; In English

Contract(s)/Grant(s): F49642-01-C-0003; FA7014-06-C-0001

Report No.(s): AD-A468524; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This monograph describes a model for evaluating the combined capacity of organic (U.S. Air Force owned and operated) and contractor maintenance assets to meet aircraft programmed depot maintenance (PDM) workloads. The PDM Capacity Assessment Tool (PDMCAT) forecasts the average number of aircraft that will be in PDM status each year over several decades, based on the initial number of aircraft in PDM status, the physical capacity of the facility or facilities (number of docks available for conducting PDM work), the PDM induction policy (the period allowed between the completion of one PDM and the start of the next), and the minimum hands-on flow time (the minimum time it would take a facility to complete a PDM if only one aircraft were in PDM status). While not directly part of the model, the derived induction data can be used to estimate both near- and long-term obligation authority requirements for different induction policies, labor rates, and workload forecasts. To illustrate the model's operations and capabilities, we applied the model to evaluate the U.S. Air Force's current capacity for supporting KC-135 PDM and examined several options for improving both near- and long-term availability. In the process, we discovered that, while future annual fleet costs increase and availability decreases with age and workload, they do so rather less rapidly because the aircraft induction rates (the number of aircraft inducted each year) decrease as the PDM flow time increases. This leads to a less-drastring cost and availability forecast than usual.

DTIC

*C-135 Aircraft; Maintenance; Models; Tanker Aircraft; Workloads (Psychophysiology)*

**20070028531** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Solutions Analysis for Helicopter Brownout**

Anderson, Lee; Doty, Pete; Griego, Manuel; Timko, Ken; Hermann, Brian; Colombi, John; Oct 2006; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468063; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This briefing applies systems engineering to the question of how to safely perform a vertical landing when you can't see outside due to recirculating dust/snow.

DTIC

*Helicopters; Systems Engineering; Vertical Landing*

**20070028542** Naval Air Systems Command, Lakehurst, NJ USA

**A Review of the History of Fire Suppression on U.S. DoD Aircraft**

Bein, Donald P; Jul 13, 2006; 38 pp.; In English

Report No.(s): AD-A467847; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As the Department of Defense's (DoD) Next Generation Fire Suppression Technology Program (NGP) culminates its research efforts, it is prudent to capture the history of fire suppression on DoD aircraft. This paper provides a synopsis of the history of fire suppression on DoD aircraft to provide a context against which the findings of the NGP can be assessed. The following aircraft fire suppression applications are reviewed: (1) power plant compartments, which include engine nacelles and auxiliary power unit (APU) compartments; (2) dry bay compartments; and (3) fuel tank ullage (wet bays). The following topics are discussed: the evolution of engine nacelle fire suppression system designs, from 'conventional' systems design to



current high-rate discharge systems; nacelle/APU fire occurrence and suppression discharge relative to altitude and outside air temperature; pilot response and system effectiveness; the evolution of active dry bay fire suppression; and technologies and methods for fuel tank ullage fire suppression.

DTIC

*Auxiliary Power Sources; Compartments; Drying; Fires; Fuel Tanks; Nacelles; Ullage*

**20070028545** Science Applications International Corp., Alexandria, VA USA

**Aircraft Downwind Hazard Distance After a Chemical Attack**

McNally, Richard E; SPita, Claudia; May 8, 2007; 104 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA7014-06-A-2003

Report No.(s): AD-A468458; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the development of a rule for the standoff distance from a chemical warfare contaminated aircraft for the Air Force counter-chemical warfare concept of operations (C-CW CONOPS). The 10-foot rule that was originally developed in the C-CW CONOPS described the precautionary procedures used to safely approach a painted, chemically-contaminated vehicle surface at varied times after the chemical warfare agent (CWA) attack. In order to make the 10-foot rule applicable to areas larger than a vehicle surface area, the 10-foot rule needed to be revised. The revision of the 10-foot rule focused on the impact of approaching chemically contaminated painted metal surfaces that were larger than the original vehicle surface area covered in the 10-foot rule, to include rules for safely approaching the contaminated item at different times after the attack. As part of the 10-foot rule revision process, a range of aircraft in the Air Force inventory were examined to generate the spatial extent and geometry to be used in modeling the downwind hazard areas around the aircraft. Further, a parametric study was conducted that used representative contamination densities and patterns, as well as representative aircraft paint combined with wind speed, relative wind direction, and the Pasquill Stability Category (PSC) over the range of anticipated conditions. The results of the parametric study identified the relative risk associated with operations for one-hour at various times (after the attack) and distances from the simulated contaminated aircraft. This report provides time-phased rules of thumb for operations in proximity to contaminated aircraft (and other large contaminated painted metal surfaces larger than 10m<sup>2</sup>).

DTIC

*Aircraft; Chemical Attack; Chemical Warfare; Contamination; Hazards; Wind Direction*

**20070028612** Black Lowe and Graham, PLLC, Seattle, WA, USA

**Pneumatically Actuated Flexible Coupling end Effectors for Lapping/Polishing**

Wood, J. H., Inventor; 12 Feb 04; 11 pp.; In English

Contract(s)/Grant(s): AF-F33615-97-2-3400

Patent Info.: Filed 12 Feb 04; US-Patent-Appl-SN-10-777-388

Report No.(s): PB2007-104296; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Methods and apparatus for end effectors for performing surface lapping using a robotic system are provided. In one embodiment, a lapping system includes a robotic arm and a pneumatic end effector unit. The pneumatic end effector unit includes a first base attached to the robotic arm, a second base, a lapping pad attachable to the second base, and a pneumatic piston system coupled between the first and second bases. An abrasive pad is attached to the lapping pad with a layer of pitch. The pneumatic piston system includes a piston chamber, a piston being slideably received within the piston chamber, and a component for controlling air pressure within the piston chamber. A slurry system introduces a slurry compound into one of the second base or the lapping pad.

NTIS

*Actuators; End Effectors; Patent Applications; Pneumatics; Polishing*

**20070028660** Los Alamos National Lab., NM USA

**Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers**

January 2006; 242 pp.; In English

Report No.(s): DE2007-899976; LA-14319-T; No Copyright; Avail.: National Technical Information Service (NTIS)

To monitor in-flight damage and reduce life-cycle costs associated with CFRP composite aircraft, an autonomous built-in structural health monitoring (SHM) system is preferred over conventional maintenance routines and schedules. This thesis investigates the use of ultrasonic guided waves and piezoelectric transducers for the identification and localization of

damage/defects occurring within critical components of CFRP composite aircraft wings, mainly the wing skin-to-spar joints.  
NTIS

*Aircraft Structures; Carbon Fiber Reinforced Plastics; Composite Materials; Composite Structures; Diagnosis; Nondestructive Tests; Piezoelectric Transducers; Ultrasonic Tests*

**20070028775** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Prognostic Fusion for Uncertainty Reduction**

Goebel, Kai; Eklund, Neil; Bonanni, Pierino; Feb 2007; 12 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A467544; AFRL-ML-WP-TP-2007-430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes how the fusion of two different prognostic approaches produces a result that is more accurate and has more narrow uncertainty bounds than either approach alone. The fused prognostic estimate can be calculated by using both a physics-based as well as a data-driven approach. The individual approaches can have a plurality of input sources such as component properties (e.g., material properties and usage properties), history of the component (current damage state and history of accumulated usage), future anticipated usage, damage propagation rates established during experiments, etc. Damage estimates are arrived at using sensor information such as oil debris monitoring data as well as vibration data. The method detects the onset of damage and triggers the prognostic estimator that projects the remaining life. Uncertainty, stemming from the variability observed during experiments, as well as modeling inaccuracies, are propagated to provide a distribution around the projected remaining life. It is desirable to keep the uncertainty interval as narrow as possible while truthfully considering their spread. In this paper, we introduce an approach to fuse competing prediction algorithms for prognostics. Results presented are derived from rig test data wherein multiple bearings were first seeded with small defects, then exposed to a variety of speed and load conditions similar to those encountered in aircraft engines, and run until the ensuing material liberation accumulated to a predetermined damage threshold or cage failure, whichever occurred first.

DTIC

*Multisensor Fusion; Algorithms; Tolerances (Mechanics)*

**20070028822** Coburn (Thompson) LLP, Saint Louis, MO, USA

**High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction**

Drago, Raymond J., Inventor; Lenski, Joseph W., Inventor; Robuck, Mark J., Inventor; 16 Jun. 2005; 20 pp.; In English

Contract(s)/Grant(s): NCC2-9019

Patent Info.: Filed 10 Nov. 2003; US-Patent-Appl-SN-10-706497; US 2005/0130792

Report No.(s): PB2007-102598; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028822>

A high ratio, double helical epicyclic gear transmission that is primarily intended for use in rotary wing aircraft employs double helical planet gears to obtain a reduction in size of the transmission, to improve the safety of the transmission, and to reduce the noise created by operation of the transmission.

Author

*Gears; Noise Reduction; Rotary Wing Aircraft; Transmissions (Machine Elements); Safety*

**20070028827** NASA Dryden Flight Research Center, Edwards, CA, USA

**F-15B QuietSpike(TradeMark) Aeroservoelastic Flight Test Data Analysis**

Kukreja, Sunil L.; June 18, 2007; 14 pp.; In English; International Forum on Aeroelasticity and Structural Dynamics (IFASD) 2007, 18-20 Jun. 2007, Stockholm, Sweden; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#),

Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028827>

System identification or mathematical modelling is utilised in the aerospace community for the development of simulation models for robust control law design. These models are often described as linear, time-invariant processes and assumed to be uniform throughout the flight envelope. Nevertheless, it is well known that the underlying process is inherently nonlinear. The reason for utilising a linear approach has been due to the lack of a proper set of tools for the identification of nonlinear systems. Over the past several decades the controls and biomedical communities have made great advances in developing tools for the identification of nonlinear systems. These approaches are robust and readily applicable to aerospace systems. In this paper, we

show the application of one such nonlinear system identification technique, structure detection, for the analysis of F-15B QuietSpike(TradeMark) aeroservoelastic flight test data. Structure detection is concerned with the selection of a subset of candidate terms that best describe the observed output. This is a necessary procedure to compute an efficient system description which may afford greater insight into the functionality of the system or a simpler controller design. Structure computation as a tool for black-box modelling may be of critical importance for the development of robust, parsimonious models for the flight-test community. Moreover, this approach may lead to efficient strategies for rapid envelope expansion which may save significant development time and costs. The objectives of this study are to demonstrate via analysis of F-15B QuietSpike(TradeMark) aeroservoelastic flight test data for several flight conditions (Mach number) that (i) linear models are inefficient for modelling aeroservoelastic data, (ii) nonlinear identification provides a parsimonious model description whilst providing a high percent fit for cross-validated data and (iii) the model structure and parameters vary as the flight condition is altered.

Author

*Aerospace Systems; Mathematical Models; Control Theory; Nonlinear Systems; System Identification; Aeroservoelasticity; Flight Tests; Detection; Simulation*

**20070028871** NASA Langley Research Center, Hampton, VA, USA

**Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing**

Spearman, M. Leroy; June 25, 2007; 3 pp.; In English; 25th AIAA Applied Aerodynamics Conference, 25-28 Jun. 2007, Miami, FL, USA

Contract(s)/Grant(s): WBS 584772

Report No.(s): AIAA Paper 2007-4439; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028871>

Heavy-load aircraft of conventional wing-body-tail design have become very large. Excessive size of such aircraft may present problems in the manufacturing process. In addition, large wing spans may cause some difficulties in ground handling. Increasing lift loads on large span cantilever wings will also increase the strength of the wing tip vortex. The concept presented herein proposes a means for substantially increasing the lift load capability of an aircraft without increasing the overall length and span of the configuration. The concept has a rectangular wing with a relatively low span and a large chord to provide the area required for high lift. Large fuselages are attached at each wing tip to provide the volume required for heavy loading. The fuselages serve as endplates for the wing and should preclude tip flow so that two-dimensional flow might be established on the wing. Elimination of the wing tip flow should prevent the formation of a tip vortex and eliminate the tip vortex hazard to trailing aircraft. Exploratory wind tunnel tests of such an aircraft concept have been conducted. Lessons learned from these tests are discussed herein in an effort to determine the validity of the concept.

Author

*Two Dimensional Flow; Body-Wing and Tail Configurations; Loads (Forces); Wind Tunnel Tests; Ground Handling; Wing Loading; Fuselages*

**20070028877** Lawrence Livermore National Lab., Livermore, CA USA

**Persistent Monitoring Platforms**

Bennett, C. L.; Feb. 26, 2007; 49 pp.; In English

Report No.(s): DE2007-902249; UCRL-TR-228327; No Copyright; Avail.: National Technical Information Service (NTIS)

This project was inspired and motivated by the need to provide better platforms for persistent surveillance. In the years since the inception of this work, the need for persistence of surveillance platforms has become even more widely appreciated, both within the defense community and the intelligence community. One of the most demanding technical requirements for such a platform involves the power plant and energy storage system, and this project concentrated almost exclusively on the technology associated with this system for a solar powered, high altitude, unmanned aircraft. An important realization for the feasibility of such solar powered aircraft, made at the outset of this project, was that thermal energy may be stored with higher specific energy density than for any other known practical form of rechargeable energy storage. This approach has proved to be extraordinarily fruitful, and a large number of spin-off applications of this technology were developed in the course of this project.

NTIS

*Energy Storage; Solar Powered Aircraft; Surveillance; Pilotless Aircraft*

**20070029580** Air Force Research Lab., Wright-Patterson AFB, OH USA

**A Model of the Effects of Acceleration on a Pursuit Tracking Task**

McKinley, Richard A; Fullerton, Kathy L; Tripp, Jr , Lloyd D; Esken, Robert L; Goodyear, Chuck; Sep 2004; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F41624-97-D-6004; Proj-7184

Report No.(s): AD-A468809; AFRL-HE-WP-TR-2005-0008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468809>

Flight in fast fighter aircraft often results in physiological decrements caused by high accelerations due to gravity (Gz). Of principal importance during combat is the pilot's ability to track a moving target during high Gz maneuvers. A mathematical model of this task could become useful when planning air combat missions. Eight subjects performed a 2-D manual pursuit tracking task during four different Gz conditions in a human centrifuge simulator. The conditions included a 3-Gz, 5-Gz, and 7-Gz profile with one 15-sec peak. The final profile was a 7Gz peak simulated aerial combat maneuver (SACM). Time, Gz, and root mean square error (RMSE) were recorded. A modeling program was then created that accepted the time history of a Gz profile as input and used the values to calculate changes in the tracking RMSE values. The Gz profiles were then examined for agreement. The correlation coefficient, linear best-fit slope, and mean percent error were calculated for each Gz condition. Results: Correlation coefficients, linear best fit slope, and mean % error were as follows: 3Gz (0.91, 1.04, 6%), 5Gz (0.96, 0.99, 7%), and 7Gz SACM (0.82, 0.78, 8%). The 3 Gz predicted and measured output was a relatively constant RMSE value of 72. Conclusions: The model is a reasonable predictor of average RMSE values during a pursuit tracking task for Gz levels between 3 and 7 in a human centrifuge.

DTIC

*Acceleration (Physics); Fighter Aircraft; Mathematical Models; Pursuit Tracking; Tasks; Tracking (Position)*

**20070029583** Massachusetts Inst. of Tech., Lexington, MA USA

**Guidance Material for Mode S-Specific Protocol Application Avionics**

Grappel, R D; Wiken, R T; Jun 4, 2007; 98 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0002; Proj-1564

Report No.(s): AD-A468813; ATC-334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468813>

This ATC report presents guidance material for the use of the 'Ground-Initiated Comm. B' (GICB) register set contained in a Mode S transponder. The guidance material is intended to provide assistance for implementers of Mode S avionics installations. A common summary of the requirements and specifications for Mode S GICB transponder register data link applications is developed. While this ATC report focuses primarily on the 'Elementary Surveillance' (ELS), 'Enhanced Surveillance' (EHS), and 'Automatic Dependent Surveillance-Broadcast' (ADS-B) applications, guidance information is also provided for general transponder configuration and architecture of other Mode S functions employing the GICB register set. Although the information contained in this ATC report is drawn from a number of approved national and international standards, it is not intended to replace or supersede those standards documents. In the event of a conflict or contradiction between this ATC report and any approved standards, the approved standard takes precedence and the reader is encouraged to contact the authors of this document.

DTIC

*Aircraft; Avionics; Protocol (Computers); Surveillance*

**20070029704** California Univ., Los Angeles, CA USA

**Experimental and Detailed Numerical Studies of Fundamental Flame Properties of Gaseous and Liquid Fuels**

Egolfopoulos, Fokion N; Dec 2006; 120 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0006; FA9550-04-1-0003; Proj-2308

Report No.(s): AD-A468904; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468904>

The dynamic behavior of laminar flames was studied for a wide range of conditions. The parameters considered included the fuel type, reactant composition, flame temperature, and combustion mode. Both gaseous and liquid fuels, including jet fuels and their surrogates, were considered. Flame ignition and extinction limits were determined experimentally and numerically for fuels and reaction conditions that have not been considered previously. For both low and high molecular weight fuels, it was determined that diffusion and kinetics can have similar effects on flames. Furthermore, it was found that kinetic mechanisms that predict laminar flame speeds, do not necessarily predict extinction limits, even though both

propagation and extinction are high temperature phenomena. Finally, it was determined that the chain mechanisms that control near-limit flames may change notably as the reactant temperature and pressure increase well above their standard values. These results enhance current understanding of the combustion behavior of fuels that are of relevance to air-breathing propulsion. Furthermore, the derived experimental data constitute a basis for partially validating combustion kinetics as well as proposed surrogates of jet fuels.

DTIC

*Air Breathing Engines; Flames; Gaseous Fuels; Jet Engine Fuels; Liquid Fuels*

**20070029814** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles**

Hyland, Matthew T; Mar 2007; 119 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469161; AFIT/GCS/ENG/07-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469161>

This thesis investigates the performance of three mobile ad hoc routing protocols in the context of a swarm of autonomous unmanned aerial vehicles (UAVs). It is proposed that a wireless network of nodes having an average of  $5.1774 \log n$  neighbors, where  $n$  is the total number of nodes in the network, has a high probability of having no partitions. By decreasing transmission range while ensuring network connectivity, and implementing multi-hop routing between nodes, spatial multiplexing is exploited whereby multiple pairs of nodes simultaneously transmit on the same channel. The proposal is evaluated using the Greedy Perimeter Stateless Routing (GPSR), Optimized Link State Routing (OLSR), and Ad hoc On-demand Distance Vector (AODV) routing protocols in the context of a swarm of UAVs using the OPNET network simulation tool. The first-known implementation of GPSR in OPNET is constructed, and routing performance is observed when routing protocol, number of nodes, transmission range, and traffic workload are varied. Performance is evaluated based on proportion of packets successfully delivered, average packet hop count, and average end-to-end delay of packets received. Results indicate that the routing protocol choice has a significant impact on routing performance. While GPSR successfully delivers 50% more packets than OLSR, and experiences a 53% smaller end-to-end delay than AODV when routing packets in a swarm of UAVs, increasing transmission range and using direct transmission to destination nodes with no routing results in a level of performance not achieved using any of the routing protocols evaluated.

DTIC

*Aircraft; Autonomy; Computer Networks; Evaluation; Performance Tests; Pilotless Aircraft; Protocol (Computers); Radiotelephones*

**20070029819** Army Tank-Automotive Research and Development Command, Warren, MI USA

**In the Midst of a Fuels Evolution - An Army Perspective**

Muzzell, Patsy; Oct 2, 2006; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469166>

(1) Army is already using alternative fuels in its non-tactical fleets; (2) Fuels used in tactical fleets must accommodate military's worldwide deployment; (3) Under the Office of the Secretary of Defense (OSD) Assured Fuels Initiative, DoD is pursuing qualification and use of unconventional fuels (not made from petroleum) in its aircraft, ships and tactical vehicle fleets.

DTIC

*Energy Policy; Fuels*

**20070029832** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Development of an Experimental Platform for Testing Autonomous UAV Guidance and Control Algorithms**

Rufa, Justin R; Mar 2007; 98 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469181; AFIT/GAE/ENY/07-M20; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469181>

With the USA's push towards using unmanned aerial vehicles (UAVs) for more military missions, wide area search theory is being researched to determine the viability of multiple vehicle autonomous searches over the battle area. Previous work includes theoretical development of detection and attack probabilities while taking into account known enemy presence within the search environment. Simulations have been able to transform these theories into code to predict the UAV performance

against known numbers of true and false targets. The next step to transitioning these autonomous search algorithms to an operational environment is the experimental testing of these theories through the use of surrogate vehicles, to determine if the guidance and control laws developed can guide the vehicles when operating in search areas with true and false targets. In addition to the challenge of experimental implementation, dynamic scaling must also be considered so that these smaller surrogate vehicles will scale to full size UAVs performing searches in real world scenarios. This research demonstrates the ability of a given sensor to use a basic ATR algorithm to identify targets in a search area based on its size and color. With this ability, the system's target thresholds can also be altered to mimic real world UAV sensor performance.

DTIC

*Algorithms; Automatic Control; Autonomy; Drone Vehicles*

## 07

### AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power; 28 Propellants and Fuels; and 44 Energy Production and Conversion.

**20070028823** Honeywell International, Inc., Morristown, NJ, USA

#### **Reduced Exhaust Emissions Gas Turbine Engine Combustor**

Zupanc, Frank J., Inventor; Yankowich, Paul R., Inventor; 23 Jun. 2005; 10 pp.; In English

Contract(s)/Grant(s): NAS3-01136

Patent Info.: Filed 23 Dec. 2003; US-Patent-Appl-SN-10/746654; US 2005/0132716

Report No.(s): PB2007-102623; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028823>

A gas turbine engine combustor includes a plurality of main fuel injector assemblies, and a plurality of pilot fuel injector assemblies, that are arranged and configured to reduce exhaust gas emissions during engine operation. The plurality of main fuel injector assemblies are arranged in a substantially circular pattern of a first radius, and each includes an outlet port having a first divergence angle. The plurality of pilot fuel injector assemblies are arranged in a substantially circular pattern of a second radius. Each pilot fuel injector assembly is disposed between at least two main fuel injector assemblies, and each includes an outlet port having a second divergence angle.

Author

*Combustion Chambers; Exhaust Emission; Gas Turbine Engines; Pollution Control; Aircraft Engines*

**20070028828** Army Research Lab., Cleveland, OH, USA

#### **Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion**

Litt, Jonathan S.; Simo, Donald L.; June 25, 2007; 22 pp.; In English; Forum 63, 1-3 May 2007, Virginia Beach, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): FY06-VTD-02; WBS 561581.02.07.03.05

Report No.(s): NASA/TM-2007-214843; ARL-TR-4087; E-16059; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents a preliminary demonstration of an automated health assessment tool, capable of real-time on-board operation using existing engine control hardware. The tool allows operators to discern how rapidly individual turboshaft engines are degrading. As the compressor erodes, performance is lost, and with it the ability to generate power. Thus, such a tool would provide an instant assessment of the engine's fitness to perform a mission, and would help to pinpoint any abnormal wear or performance anomalies before they became serious, thereby decreasing uncertainty and enabling improved maintenance scheduling. The research described in the paper utilized test stand data from a T700-GE-401 turboshaft engine that underwent sand-ingestion testing to scale a model-based compressor efficiency degradation estimation algorithm. This algorithm was then applied to real-time Health Usage and Monitoring System (HUMS) data from a T700-GE-701C to track compressor efficiency on-line. The approach uses an optimal estimator called a Kalman filter. The filter is designed to estimate the compressor efficiency using only data from the engine's sensors as input.

Author

*Helicopter Engines; Turboshafts; Degradation; Kalman Filters; Ingestion (Engines); Compressor Efficiency; Real Time Operation*

**20070028849** Research and Technology Organization, Neuilly-sur-Seine, France  
**Technologies for Propelled Hypersonic Flight**

January 2006; In English; See also 20070028850 - 20070028852

Report No.(s): RTO-TR-AVT-007; Copyright; Avail.: CASI: [C01](#), CD-ROM

The topics covered include: Technologies for Propelled Hypersonic Flight, Volume 1 - Subgroup 1: Plug Nozzles; Technologies for Propelled Hypersonic Flight, Volume 2 - Subgroup 2: Scram Propulsion; and Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight.

Derived from text

*Computational Fluid Dynamics; Hypersonic Flight; Propulsion; Plug Nozzles*

**20070028850** Research and Technology Organization, Neuilly-sur-Seine, France

**Technologies for Propelled Hypersonic Flight, Volume 1 - Subgroup 1: Plug Nozzles**

Technologies for Propelled Hypersonic Flight; January 2006; 44 pp.; In English; See also [20070028849](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper represents an overview of the activities carried out in the framework of RTO/AVT Working Group 10, Subgroup 1, dedicated to plug nozzle aerothermodynamics and performance. The subgroup worked out two main objectives: i) thorough understanding of the flow physics of plug nozzles through literature review and recent experiments conducted in Europe and USA; ii) definition of CFD test cases, conduction of CFD calculations and comparison with experimental data. This paper summarizes the findings of the flow physics based on literature review and recent experiments. It is the result of the many interesting discussions promoted by all members participating to the subgroup, whose contribution is acknowledged by the authors. In particular, the following key topics are discussed in depth in the paper: a) Survey on Past AGARD Activities. b) The Fundamental Aspects of Plug Nozzle Flowfields. c) The Wake Structure Transition from Open to Closed. d) The Influence of the External Flow. e) Plug Nozzle Base Pressure versus Flight Altitude. f) Altitude Adaptive Character of Plug Nozzles with Regard to Performance. g) Contour Design Methods. h) Aerospike: Thrust Vector Control.

Author

*Plug Nozzles; Aerothermodynamics; Computational Fluid Dynamics; Thrust Vector Control; Flow Distribution*

**20070028851** Research and Technology Organization, Neuilly-sur-Seine, France

**Technologies for Propelled Hypersonic Flight, Volume 2 - Subgroup 2: Scram Propulsion**

Technologies for Propelled Hypersonic Flight; January 2006; 212 pp.; In English; See also [20070028849](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A10](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

While problem areas still exist in Supersonic Combustion Ramjets (SCRJ), its technology is nevertheless progressing towards military application. This Final Report contains discussions and calculations relevant to the SCRJ problem areas identified at the beginning of the activities by this Subgroup. ITAR, sensitivity and proprietary issues have prevented a full analysis of certain topics: some were explored only at the qualitative level, while others should be carried out later. The military implications of SCRJ technology is such that this is to be considered unavoidable if not acceptable. Participants in this Subgroup agreed that SCRJ technology, filled as it is with challenges, is ready to be tested for certain applications. With the understanding that Chapters 1-9 of this report are representative of only what is already available and understood in the open literature, the Conclusions and Recommendations sections at the end of each chapter indicate that (with the usual caveat from scientists) critical areas such as mixing, supersonic combustion, scaling and ground testing are approaching the maturity level enabling stepping up to flight testing of SCRJ-powered vehicles. It is important also to realize that problem areas outlined in these chapters are amenable to technological solutions either being tested now or that can be tested in the short term. This conclusion is supported by recent information from US supersonic combustion tests and by the successful Australian flight test of a scramjet engine. The general consensus was that SCRJ engines are likely to be viable for tactical missiles, e.g., for future Air Guided Missiles and also, possibly, for reconnaissance vehicles and cruise missiles. In this context, ground testing may be very effective to reduce the uncertainties (and therefore the cost) of flight tests; this is made possible by appropriately accounting for the differences in chemistry (and thus for the effect of air vitiation) as detailed in Chapter 4. This report identifies many key areas in need of further work. However, recent supersonic combustor experiments in the US are very encouraging in that they indicate that kerosene-based fuels pose fewer problems than anticipated in the past, thus paving the way to tactical applications. Hydrogen may remain the fuel for long range (strategic) SCRJ-powered vehicles, and (likely) that for part of trajectory of accelerators. Experiments mentioned, and others planned or in progress in France, indicate

regenerative cooling and flame anchoring is not only possible, but also feasible within the range of materials and flight conditions to be expected either now or in the near future.

Derived from text

*Hypersonic Flight; Supersonic Combustion Ramjet Engines; Technology Utilization; Supersonic Combustion; Propellers*

**20070028852** Research and Technology Organization, Neuilly-sur-Seine, France

**Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight**

Technologies for Propelled Hypersonic Flight; January 2006; 452 pp.; In English; See also [20070028849](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A20](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The RTO AVT Working Group 10 was aimed to address selected critical issues related to propelled hypersonic flight, to review the associated state of the art for analysis and design, as well as to recommend activities for further developments. The three volumes cover mainly 3 parts corresponding to the output of three subgroups. Subgroup 1 dealt with reviewing fundamental aspects on plug nozzles such as altitude adaptation aspects, influence of external flow on thrust and addressing design methods. Subgroup 2 addressed the physical modelling aspects associated with scram combustion including fuels, turbulence mixing, ignition and flame holding prediction capabilities. Subgroup 3 screened and repeated a large number of test cases for CFD validation for areas where CFD validation was deemed essential, such as transition, real gas flows, laminar and turbulent shock-boundary layer interaction, as well as base flows with and without plumes. High standards for the selection and evaluation of test cases for CFD validation were applied, resulting in an unprecedented effort to improve technologies for hypersonic flight.

Author

*Computational Fluid Dynamics; Hypersonic Flight; Technology Utilization; Hypersonic Aircraft; Flight Tests; Test Facilities; Propellers*

**20070029473** Honeywell International, Inc., Morristown, NJ, USA

**Gas Turbine Engine Including a Low Pressure Sump Seal Buffer Source and Thermally Isolated Sump**

Morris, M. C., Inventor; Tiltman, A. G., Inventor; Poon, K., Inventor; Volkman, A., Inventor; 21 Apr 04; 10 pp.; In English  
Contract(s)/Grant(s): N00421-02-C-0004

Patent Info.: Filed 21 Apr. 04; US-Patent-Appl-SN-10-830 265

Report No.(s): PB2007-108625; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A gas turbine engine is configured to use relatively cool, low pressure air discharged from a low pressure compressor to supply buffer air to lubrication sump seals. The engine is further configured such that the lubrication sump is thermally layered by isolating relatively hot, high pressure compressor air from the sump by utilizing a warm vent mixing cavity, which is located radially between of the hot high pressure compressor air and the cool buffer air, which is located in a buffer cavity between the vent cavity and the sump.

NTIS

*Gas Turbine Engines; Low Pressure; Sumps*

**20070029491** Bachman and Lapointe, P.C., New Haven, CT, USA

**Double Near-Net Forging of Article**

Parisi, F. B., Inventor; Glinn, S. M., Inventor; Mercier, C. W., Inventor; 29 Apr 04; 7 pp.; In English

Contract(s)/Grant(s): F33657-98-C-2004

Patent Info.: Filed Filed 29 Apr 04; US-Patent-Appl-SN-10-835 035

Report No.(s): PB2007-104071; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method of forming a blade comprising the steps of forging a part comprising a suction side, a pressure side, and a dividing portion of material greater than a portion of material to be sacrificed between the suction side and the pressure side, splitting the part through the dividing portion of material to form a suction side inner surface and a pressure side inner surface, and joining the suction side inner surface and the pressure side inner surface to form the blade.

NTIS

*Fan Blades; Forging; Gas Turbine Engines; Titanium*



**20070029981** McCormick, Paulding and Huber, LLP, Hartford, CT, USA

**Cooled Turbine Airfoil**

Mongillo, D. J., Inventor; Gregg, S. J., Inventor; Mercadante, R., Inventor; 6 May 04; 7 pp.; In English

Patent Info.: Filed Filed 6 May 04; US-Patent-Appl-SN-10-840 546

Report No.(s): PB2007-108639; No Copyright; Avail.: CASI: [A02](#), Hardcopy

According to the present invention, a hollow airfoil is provided that comprises a leading edge wall portion, a plurality of cavities, one or more crossover ribs, a plurality of cooling apertures, and a plurality of impingement ribs. The cavities are disposed adjacent the leading edge wall portion, between the leading edge wall portion and a first rib. The crossover ribs extend between the leading edge wall portion and the first rib, and at least one crossover rib is disposed between a pair of the cavities. The cooling apertures are disposed in the leading edge wall portion, providing a passage through which cooling air can exit the cavities. The impingement apertures are disposed in the first rib, providing a passage through which cooling air can enter the cavities. At least one of the impingement apertures is contiguous with one of the crossover ribs.

NTIS

*Airfoils; Patent Applications; Turbine Engines; Turbines*

**20070030015** Semenov (N. N.) Inst. for Chemical Physics, Moscow, Russian Federation

**Confined Detonations and Pulse Detonation Engines**

Roy, Gabriel D; Frolov, Sergi M; Santoro, Robert J; Tsyganov, Sergei A; Jan 2003; 377 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469135; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469135>

The current focus on utilizing detonations for air-breathing propulsion has shifted from long-term studies of the possibility of fuel energy transformation in stabilized oblique detonation waves to investigations and practical development of propulsion engines operating on propagating detonations in a pulse mode. Contrary to the oblique-detonation concept that is applicable to hypersonic flight at velocities comparable or higher than the Chapman-Jouguet detonation velocity of the fuel-air mixture, the concept of a pulse detonation engine (PDE) is attractive for both subsonic and supersonic flight with the PDE as a main propulsion unit or as an afterburner in turbojet or turbofan propulsion system. In particular, PDE-based propulsion is attractive for flight Mach number up to about 4. Within this range of Mach number, solid rocket motors are known to be very efficient in terms of simplicity and high-speed capability, but they have a limited powered range. Turbojet and turbofan engines, due to their high specific impulse, provide longer range and heavier payloads, but at flight Mach number exceeding 2-3, they get too expensive. Ramjets and ducted rockets designed for flight Mach number up to 4 require solid rocket boosters to accelerate them to the ramjet take over speed, which increase the complexity and volume of a propulsion system. Combined-cycle engines, such as turbo-rockets or turboramjets, are also very complex and expensive for similar applications.

DTIC

*Detonation Waves; Pulse Detonation Engines; Energy Transfer; Propulsion System Configurations*

## 08

### AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also 05 Aircraft Design, Testing and Performance; and 06 Avionics and Aircraft Instrumentation.

**20070026493** Naval Air Warfare Center, Warminster, PA USA

**A Multiservice Switch for Advanced Avionics Data Networks**

Rosen, W A; Phipps, W A; George, A D; Turner, D D; Gershman, V; Birmingham, M P; Jan 1996; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466320; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466320>

With knowledge of persistent data communication traffic patterns offered to an avionics data network, modifications to the routing through the network can be made to improve total throughput and bound the latency of packets. The Multiservice Switch (MSS) is such a route-optimizing switch for streaming sensor data. The MSS has two switching fabrics: packet switching and circuit switching. The packet-switching fabric routes small control and data packets between switch ports. The circuit-switching fabric uses a crossbar to physically connect ringlets, which reduces the workload on the packet-switching fabric for long data streams between the ports. An implementation of the MSS is described which uses commercial-off-the-

shelf (COTS) components. A simulation model was developed to show the benefits of the MSS under standard avionics workloads. The results of the MSS indicate distinct advantages in terms of performance, price, and power consumption over other conventional switch and network topology designs.

DTIC

*Avionics; Network Analysis; Switches; Switching*

**20070026543** Virginia Univ., Charlottesville, VA USA

**QoS Negotiation in Real-Time Systems and its Application to Automated Flight Control**

Abdelzaher, Tarek F; Atkins, Ella M; Shin, Kang G; Nov 2000; 15 pp.; In English

Contract(s)/Grant(s): N00014-94-1-0229; IRI-9209031

Report No.(s): AD-A466414; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466414>

Real-time middleware services must guarantee predictable performance under specified load and failure conditions, and ensure graceful degradation when these conditions are violated. Guaranteed predictable performance typically entails reservation of resources and use of admission control. Graceful degradation, on the other hand, requires dynamic reallocation of resources to maximize the application-perceived system utility while coping with unanticipated overload and failures. We propose a model for quality-of-service (QoS) negotiation in building real-time services to meet both of the above requirements. QoS negotiation is shown to 1) outperform 'binary admission control schemes (either guaranteeing the required QoS or rejecting the service request), 2) achieve higher application-perceived system utility, and 3) deal with violations of the load and failure hypotheses. We incorporated the proposed QoS-negotiation model into an example real-time middleware service, called RTPOOL, which manages a distributed pool of shared computing resources (processors) to guarantee timeliness QoS for real-time applications. In order to guarantee timeliness QoS, the resource pool is encapsulated with its own schedulability analysis, admission control, and load-sharing support. This support differs from others in that it adheres to the proposed QoS-negotiation model. The efficacy and power of QoS negotiation are demonstrated for an automated flight control system implemented on a network of PCs running RTPOOL. This system is used to fly an F-16 fighter aircraft modeled using the Aerial Combat (ACM) F-16 Flight Simulator. Experimental results indicate that QoS negotiation, while maintaining real-time guarantees, enables graceful QoS degradation under conditions in which traditional schedulability analysis and admission control schemes fail.

DTIC

*Automatic Control; Distributed Processing; Flight Control; Real Time Operation*

**20070028834** NASA Langley Research Center, Hampton, VA, USA

**Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle**

Malik, Mujeeb R.; Li, Fei; Choudhan, Meelan; June 25, 2007; 34 pp.; In English; 37th AIAA Fluid Dynamics Conference and Exhibit, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 305311.43

Report No.(s): AIAA Paper-2007-4487; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Pegasus wing-glove flight experiment was designed to provide crossflow transition data at high Mach numbers, specifically to help validate stability based predictions for transition onset in a flight environment. This paper provides an analysis of the flight experiment, with emphasis on computational results for crossflow disturbances and the correlation of disturbance growth factors with in-flight transition locations via the  $e(\sup N)$  method. Implications of the flight data for attachment line stability are also examined. Analysis of the thermocouple data reveals that transition (from turbulent to laminar flow) was first detected during the ascending flight of the rocket when the free stream Mach number exceeded about 4. Therefore, computations have been performed for flight Mach numbers of 4.13, 4.35, 4.56 and 4.99. Due to continually decreasing unit Reynolds number at higher altitudes, the entire wing-glove boundary layer became laminar at the highest flight Mach number computed above. In contrast, the boundary layer flow over the inboard tile region remained transitional up to and somewhat beyond the time of laminarization over the instrumented glove region. Linear stability predictions confirmed that the tile boundary layer is indeed more unstable to crossflow disturbances than the much colder stainless steel glove boundary layer. The transition locations based on thermocouple data from both the glove and the tile regions are found to correlate with stationary-crossflow N-factors within the range of 7 to 12.4 and with traveling mode N-factors between 7.6 and 14.1. Data from the thermocouples and hot film sensors indicates that transition from turbulent to laminar flow (i.e., laminarization) at a fixed point over the glove is generally completed within a flight time interval of 3 seconds. However, the

times at which transition begins and ends as inferred from the hot film sensors are found to differ by about 2 seconds from the corresponding estimates based on the thermocouple data.

Author

*Boundary Layer Flow; Transition Flight; Mach Number; Cross Flow; Aerodynamic Stability; Turbulent Flow; Launch Vehicles*

**20070029742** Infoscitex Corp., Waltham, MA USA

**Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint)**

Choppy, K J; Kovar, R F; Cushman, B M; Mar 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-06-M-5033; Proj-3005

Report No.(s): AD-A469003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469003>

This report was developed under a SBIR contract, and has been released to the public by Infoscitex. Aluminum and titanium alloys are used as replacements for steel in gear boxes of aircraft and helicopters in both military and commercial air vehicles, due to their low density, mechanical strength and thermal conductivity. However, these alloys are susceptible to fretting wear when matched to harder steel surfaces under high loads at elevated temperatures. Anodized coatings are too thin and porous to protect these metals. Infoscitex applied a proprietary micro-arc oxidation process to produce hard, thick, and adherent oxide coatings on aluminum and titanium alloys that rendered the coated metal components resistant to fretting type wear. Selected aluminum and titanium alloy test specimens were micro-arc treated then measured for surface hardness, roughness, and adhesion to metal substrate. Block-on-Ring fretting wear tests on polished test specimens against M-50 steel were conducted in the presence of lubricant, under high loading, at ambient and 400 degrees F temperatures. Coefficient of friction and wear volume were measured versus number of test cycles. The results of efforts to improve the fretting wear resistance of aluminum and titanium alloy bearings for use in aircraft gear box applications will be discussed.

DTIC

*Aircraft Equipment; Aluminum Alloys; Fretting; Oxidation; Titanium Alloys; Wear Resistance*

## 09

### RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronomical facilities see *14 Ground Support Systems and Facilities (Space)*.

**20070027249** Library of Congress, Washington, DC USA

**Environmental Impacts of Airport Operations: Maintenance, and Expansion**

Luther, Linda; Apr 5, 2007; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466859; CRS-RL33949; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Funding authorization for Federal Aviation Administration (FAA) programs set forth in the Vision 100 Century of Aviation Reauthorization Act (P.L. 108-176, hereafter referred to as Vision 100) are set to expire at the end of FY2007. During the current reauthorization process, methods to address the environmental impacts associated with airport operations and expansion are likely to be debated. This issue is important to various stakeholders, particularly those whose health, property values, and quality of life may be affected by such impacts. The concerns of community members and local, state, and tribal agencies regarding environmental impacts have led to the delay and cancellation of some airport expansion projects. To address these concerns, airports may be required to implement projects that would minimize the environmental impacts of their operations. Some of these projects qualify for federal funding. For example, in its FY2008 budget, the FAA requested \$354 million to meet its Environmental Stewardship goals. Projects funded under this category address the environmental impacts of airports, primarily to abate airport noise (e.g., soundproofing homes, purchasing noise barriers and monitors, and relocating persons or businesses). Among other uses, funds may be spent on projects to minimize water quality impacts (e.g., funding projects that would control the discharge of deicing chemicals) and to reduce airport-controllable air emissions (e.g., purchasing alternative fuel vehicles to replace the airport's ground services equipment). Funds also are authorized for researching new aircraft technology that would reduce noise and air emissions.

DTIC

*Airports; Environmental Surveys; Maintenance*

**20070027423** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Rapid Runway Repair (RRR): An Optimization for Minimum Operating Strip (MOS) Selection**

Duncan, David; Mar 2007; 125 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467547; AFIT/GEM/ENV/07-M4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Minimum Operating Strip (MOS) selection determines the exact placement of the MOS on the damaged runway, and therefore, the amount of munitions that need to be neutralized and the amount of damage that will need to be repaired. MOS selection, in essence, is the key determinant of the time required to attain an operational takeoff and recovery surface. Since the MOS selection stage determines the events and scope of work for all of the Rapid Runway Repair (RRR) stages that follow, it could be argued that this is the most important stage in the entire RRR process. The primary purpose of this research was to evaluate the application of a decision analysis methodology for the selection of a MOS during the RRR process. The secondary purpose was to determine the effect of additional considerations on both the MOS selected and the repair time. MOSs selected utilizing the outlined methodology were compared to a MOS selected using the current USAF method. Results showed that additional considerations have an impact on both MOS selection and time to repair. Results also showed that the outlined methodology selected a MOS with a shorter repair time, despite additional damage, than the MOS selected using the current USAF method.

DTIC

*Maintenance; Runways*

**20070027526** Army Engineer Research and Development Center, Vicksburg, MS USA

**Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement**

Mann, Travis A; Freeman, Reed B; Anderton, Gary L; Apr 2007; 132 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467797; ERDC/GSL-TR-07-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. military must have the ability to rapidly deploy troops and equipment anywhere in the world as part of a contingency operation. Recent military operations have highlighted the critical need for rapid repair procedures and materials for military use on substandard, in-theater airfields. The U.S. Army Engineer Research and Development Center is currently addressing these problems through a 6-year demonstration-based research and development program called JRAC (Joint Rapid Airfield Construction). This study involves the development of a method using rapid setting grouts and recycled concrete pavement (RCP) to repair portland cement concrete pavements. A laboratory study was conducted to evaluate material properties in order to gain an understanding of expected field performance. Eight full scale repairs were constructed using two rapid setting grouts, two types of equipment, and two concrete slabs. The repairs were successfully trafficked with simulated C-17 aircraft wheel loads to verify the structural capacity and, ultimately, the procedures.

DTIC

*Airports; Cements; Concretes; Grout; Impregnating; Landing Sites; Pavements*

**20070029722** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Decks for Rapid Runway Mat Application (Postprint)**

Foster, Dean C; Apr 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A468966; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468966>

Since the 1960s the Air Force has employed an aluminum matting system, AM-2, for rapid aircraft parking ramp expansion (RPRE) in austere environments. While functional and durable, AM-2 is heavy and cumbersome to install. The restrictive weight of AM-2 and its tedious installation complicate the process of deploying aircraft. The Air Force Research laboratory (AFRL) is developing an AM-2 alternative made from composite materials. This next generation matting system, AM-X, consists of a lightweight foam core sandwiched between composite face sheets. The critical key performance parameters (KPP) for AM-X are a unit weight between 154.7 N/m<sup>2</sup> (3.23 lbs/ft<sup>2</sup>) and 232.7 N/m<sup>2</sup> (4.86 lbs/ft<sup>2</sup>), and a useful life requirement between 1500 and 1000 passes by a tire carrying a 133,733N (30,000 lb) load creating a surface pressure of

241.9N/cm<sup>2</sup> (350 psi) over a soil with a California Bearing Ration (CBR) value of 6 with no more than 3.81cm (1.5 in) deflection in the panel. In addition, the panel size is also critical for transportability requirements enabling the use of the standard 463L pallet. Successful proof-of-concept tests were completed in June 2003 demonstrating that the panel deflection requirement can be met. Design iterations focusing on optimizing the panel properties and geometries with respect to deflection are complete. Further mat tests took place in August 2005, June 2006 and September 2006. Results of the design iterations, full scale field testing, and a comparison of design vs. actual deflection of the panels will be reported.

DTIC

*Airports; Composite Materials; Runways; Sandwich Structures*

## 12

### ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

**20070027609** Air Force Research Lab., Edwards AFB, CA USA

#### **Fully Reusable Access to Space Technology (FAST) Methane Rocket**

Doupe, Cole; Sponable, Jess; Zweber, Jeffrey; Cohn, Richard; Mar 16, 2007; 42 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A467945; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper provides an overview of the Fully Reusable Access to Space Technology (FAST) program. The program is an Air Force Research Laboratory initiative to methodically mature the technologies required for next generation operationally responsive space access - an Air Force Space Command mission. Program goals and requirements are delineated as well as technology approaches. The acquisition strategy matures key technologies in ground experiments through 2011, and then integrates the experiments into a subscale X-aircraft for ground or potentially flight test by 2013. The airframe experiment includes propellant tanks, structure and thermal protection systems fabricated and tested at the X-aircraft scale. In addition, subsystems experiments shall be accomplished such as a Flight Operations Control Center, avionics, adaptive GN&C, Integrated Systems Health Management, etc. An approach is also identified for either using an off-the-shelf propulsion system or a low cost, high ops tempo propulsion experiment. Key program goals include ensuring component demonstrations are scaleable to larger future operational systems, and that the technology demonstrations directly transition to fabrication and flight test of the experimental flight test vehicle. Potential future applications of the technologies are also briefly reviewed.

DTIC

*Aerospace Engineering; Methane*

**20070028422** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

#### **Prioritizing Satellite Payload Selection via Optimization**

Kallemyn, Benjamin S; Mar 2007; 128 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468455; AFIT/GOR/ENS/07-14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis develops optimization models for prioritizing payloads for inclusion on satellite buses with volume, power, weight and budget constraints. The first model considers a single satellite launch for which the budget is uncertain and constellation requirements are not considered. Subsequently, we include constellation requirements and provide a more enhanced model. Both single-launch models provide a prioritized list of payloads to include on the launch before the budget is realized. The single-launch models are subsequently extended to a sequence of multiple launches in two cases, both of which incorporate an explicit dependence on the constellation composition at each launch epoch. The first case ignores future launches and solves a series of independent single-launch problems. The second case considers all launches simultaneously. The optimization models for single- and multiple-launch cases are evaluated through a computational study. It was found that, when the budget distribution is skewed, the prioritization model outperforms a greedy payload selection heuristic in the single-launch model. For the multiple-launch models, it was found that the consideration of future launches can significantly improve the objective function values.

DTIC

*Artificial Satellites; Optimization; Payloads*

**20070029376** Ingrassia Fisher and Lorenz, P.C., Scottsdale, AZ, USA

**Deployable Solar Array Assembly**

Stribling, R. A., Inventor; Schwartz, J. A., Inventor; 12 Feb 04; 20 pp.; In English

Contract(s)/Grant(s): USAF-F29601-01-2-0042

Patent Info.: Filed 12 Feb 04; US-Patent-Appl-SN-10-779 063

Report No.(s): PB2007-104647; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Solar array assemblies and systems and methods for deploying solar cell arrays from a spacecraft are provided. A solar cell panel assembly comprises a first flexible solar panel and a rotational member. A first extension assembly is disposed proximate to a first end of the rotational member and a second extension assembly is disposed proximate to a second end of the rotational member. The solar cell panel assembly further comprises a first support member and a second support member. The first end of the first support member is coupled to the first end of the rotational member and the first end of the second support member is coupled to the second end of the rotational member. The second ends of the support members are coupled to the first flexible solar panel. A tether assembly couples the extension assemblies to the support members.

NTIS

*Solar Arrays; Solar Cells*

**20070029567** National Defense Univ., Norfolk, VA USA

**Joint Space Forces in Theater: Coordination is No Longer Sufficient**

Livergood, Brian K; Apr 2007; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468768; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468768>

The role of space operations in the USA military has matured significantly since the end of the Cold War. The transformation from strategic applications to tactical integration has increased the demands for effects achievable through joint space capabilities on and off the battlefield. The explosive growth of and demand for joint space capabilities have outstripped the joint community's ability to provide unifying doctrine and a command and control structure to meet the demands. Consequently, the military services have independently developed solutions and doctrine to meet the needs of their respective joint force component commander. The thesis of this research is the US military must create a jointly focused command and control organization to meet the Joint Force Commander's growing demand for synchronized joint space capabilities. Although joint doctrine addresses the need for a space coordinating authority (SCA) separate from a commander to achieve space superiority, it does not provide sufficient joint authority to effectively execute the SCA role. Consequently, the Joint Force Air Component Commander has attempted to combine the roles in the Joint Air Operations Center resulting in a less than optimum integration of space into US joint warfighting. To establish clear lines of authority and enable a joint forces wide perspective of space power, a Joint Space Synchronization Authority supported by a Joint Space Synchronization Officer, Theater Space Integration Cell, and Joint Space Superiority Cell is proposed. While these organizations could operate independently of each other at different locations, the greatest synergy is obtained by co-locating them in a Joint Space Integration Division in the JAOC. This construct allows for a jointly recognized and focused approach to space force synchronization and integration across all components.

DTIC

*Command and Control; Coordination; Military Operations; Space Missions*

**13**

**ASTRODYNAMICS**

Includes powered and free flight trajectories; orbital and launching dynamics.

**20070027341** Naval Postgraduate School, Monterey, CA USA

**Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa**

Ernest, Richard D; Mar 2007; 90 pp.; In English

Report No.(s): AD-A467189; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Community Radiative Transfer Model (CRTM) has been used to determine which polar-orbiter satellite channels are best suited to remotely sense in a cloud-free environment the lower-tropospheric temperature and moisture gradients that determine the location and intensity of the African Easterly Jet over West Africa. This study evaluates the capability of five microwave sensors and three infrared sensors, including both conical- and cross-track scanning instruments. Atmospheric

profiles obtained during the JET2000 field experiment blended with the European Center for Medium-range Weather Forecasting model analyses are input in the CRTM to obtain brightness temperature outputs. To address separately the moisture (temperature) signature, the average of the northern and southern temperature (moisture) profiles were combined with the real moisture (temperature) profiles. The effects of land surface emissivity uncertainty of +/-3% for microwave and +/-1% for infrared were tested. From the total set of 423 channels evaluated, 11 microwave and 21 infrared channels were found appropriate for obtaining moisture gradient information, but after applying emissivity perturbations this list was reduced to two microwave and 20 infrared channels. Temperature gradient information was determined to be available from 35 microwave channels and 95 infrared channels, with no impacts noted due to emissivity perturbations.

DTIC

*Africa; Artificial Satellites; Forecasting; Infrared Detectors; Microwave Equipment; Polar Orbits; Radiative Transfer; Trajectories*

**20070027414** Naval Postgraduate School, Monterey, CA USA

### **Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint)**

Shaffer, Patrick J; Ross, I M; Oppenheimer, Michael W; Doman, David B; Bollino, Kevin P; Dec 2006; 39 pp.; In English  
Contract(s)/Grant(s): Proj-A03G

Report No.(s): AD-A467516; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reconfigurable inner-loop control laws improve the fault tolerance of a vehicle to control effector failures; however, in order to preserve stability, the unfailed effectors may be deployed to off-nominal positions to compensate for undesirable perturbations caused by the failed effectors. The effectors acting under the influence of a reconfigurable control law can produce significant perturbations to the nominal forces produced by the wing and body and can also affect the range of flight conditions over which the vehicle can be controlled. Three degree-of-freedom (3 DOF) dynamical models used in trajectory optimization for aerospace vehicles typically include wing-body aerodynamic force effects but ignore the aerodynamic forces produced by the control surfaces. In this work, a method for including these trim effects as well as control induced trajectory constraints in a 3 DOF model is presented.

DTIC

*Aerodynamic Forces; Aerospace Vehicles; Fault Tolerance; Launch Vehicles; Reusable Launch Vehicles; Trajectories*

## 15

### LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

**20070026358** Space and Naval Warfare Systems Center, San Diego, CA USA

### **Video Enabling the Combatant Commander's Headquarters**

Lee, Justin; Nakagawa, Arthur; Jun 2004; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A465993; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA465993>

A combatant commander's decisions are based on critical and timely information. Today the information is more and more graphical and video based. Video information may take many forms---imagery from intelligence satellites, weather satellites, tactical reconnaissance platforms, biographical information data bases; graphical information including common operational picture, 3D terrain modeling, signals analysis, trend analysis and are all used in formulating courses of action. This is complicated by the need for collaboration among staff, inter agency and through chain of command. The result is that the headquarters for a combatant commander needs to be video enabled to allow the high speed transfer of digital imagery and graphics and use of advanced collaborative technologies. This paper discusses the audio-visual (A-V) systems which have been designed for the headquarters for USA Pacific Command (HQ USPACOM) and installed in the Nimitz-MacArthur Pacific Command Center (NMPCC), USPACOM's new headquarters building. These systems are being employed through the design and implementation of an integrated A-V systems architecture that enables the proliferation and sharing of video information and promotes collaboration both internally within HQ USPACOM and with external organizations. The A-V systems architecture includes multimedia communications systems that enable advanced internal briefing capabilities, video

teleconferencing at multiple security levels, mass multimedia distribution capabilities and an advanced A-V control system that integrates control and access of multimedia information.

DTIC

*Artificial Satellites; Audio Equipment; Image Processing; Video Signals; Visual Aids*

**20070026413** New Mexico State Univ., Las Cruces, NM USA

**On-Orbit Identification of Inertia Properties of Spacecraft using Robotics Technology**

Ma, Ou; Dec 2006; 52 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0284

Report No.(s): AD-A466116; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466116>

This technical report describes the results of a 6-month research project conducted by Dr. Ou Ma and one of his graduate students at the New Mexico State University under the AFOSR grant number FA9550-06-1-0284 starting in May 2006. In the project, a methodology of on-orbit identification of spacecraft inertia properties (i.e., the mass, the location of the mass center, and the inertia tensor) using a robotic arm was investigated. The extension of the method to using a solar array (instead of a robot) was also preliminarily investigated. The investigation was done in theory and by simulation only because of the time and funding limitations. The ultimate goal of this research is to enhance the control and operation of spacecraft for more challenging autonomous on-orbit service missions in the future.

DTIC

*Inertia; Robotics; Simulation*

**20070026430** Cornell Univ., Ithaca, NY USA

**Mission Support for the Communications/Navigation Outage Forecast Satellite**

Hysell, D L; Aug 30, 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-03-C-0067; Proj-1010

Report No.(s): AD-A466144; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466144>

This is a project to provide mission support for the Communication/Navigation Outage Forecast System (C/NOFS) under BAA VS-O3-O1 during its first four years of operation. Cornell is required to support the mission with ground-based radar observations of background ionospheric parameters and of Equatorial Spread F (ESF) events from the Jicamarca Radio Observatory near Lima, Peru. In the pre-launch period for C/NOFS, Cornell and Jicamarca contributed to the project by measuring plasma density, drift, temperature, and composition profiles during eight campaign periods. Cornell's theoretical studies based on the radar observations of the postsunset bottomside F region have also identified a new plasma shear instability that acts as a seed for the observed large-scale density irregularities. In this report, the field-line averaged linear growth rate of the instability and its comparison with that of the generalized Rayleigh-Taylor instability are presented. The shear instability may be used as a tool for understanding and forecasting of ESF. The instability model and its forecasting capability will improve when C/NOFS measurements are available.

DTIC

*Artificial Satellites; Forecasting; Magnetohydrodynamic Stability; Navigation Satellites; Telecommunication*

**20070026726** Space and Missile Systems Organization, El Segundo, CA USA

**The Independent Readiness Team (IRRT) of SMC**

Schwartz, Bernie; Freitag, Thomas A; Moore, David P; Nov 14, 2006; 9 pp.; In English

Report No.(s): AD-A466834; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466834>

The Independent Readiness Review Team (IRRT) performs risk assessment of space launch missions and reports findings in pre-launch reviews to SMC Leadership. To date, the IRRT has performed reviews on the Evolved Expendable Launch Vehicle (EELV) Atlas V and Delta IV boosters, Heritage boosters such as Titan II, Delta II and Minotaur, and payloads including DSP, GPS, SBIRS, DMSP, Milstar, AEHF, WGS and selected space test programs. Since the inception of the IRRT, SMC has experienced an unprecedented 46 straight mission successes in a row.

DTIC

*Booster Rocket Engines; Launch Vehicles; Risk*



**20070026758** Temple Univ., Philadelphia, PA USA

**System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory**

Won, Chang-Hee; Mar 28, 2007; 31 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0293

Report No.(s): AD-A467129; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467129>

We investigated a hierarchical hybrid system architecture to implement an autonomous multiple satellite control scheme for the low earth orbit remote sensing satellites. We networked multiple satellites and ground control station into a hierarchical hybrid system and applied hybrid automata theory onto the different tiers of the system. Compared with the traditional satellite control concept, the hierarchical hybrid system is more autonomous, effective, scalable, and robust for the space remote sensing applications. In this paper, we developed the mathematical model for the multiple satellite control model and simulated the model with Matlab, Simulink and Stateflow. The simulation results show that the hierarchical hybrid system theory is feasible for the autonomous control of multiple satellite.

DTIC

*Architecture (Computers); Artificial Satellites; Automata Theory; Computerized Simulation; Detection; Remote Sensing; Satellite Control*

**20070027253** Garvey Spacecraft Corp., Long Beach, CA USA

**Air Force-Navy Team Achieves Important Flight Test Milestone for Responsive Space Lift**

Garvey, John; Oct 5, 2006; 11 pp.; In English

Contract(s)/Grant(s): FA0300-05-M-3010

Report No.(s): AD-A466871; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A joint service team consisting of the Air Force Research Laboratory's Propulsion Directorate (AFRL/PR), the Space and Missile Systems Center (SMC) and the Naval Air Warfare Center (NAVAIR) achieved a significant milestone on 28 September 2006 with an initial demonstration of responsive launch operations from the Navy's San Nicolas Island. Using an early prototype of the first stage for a reusable launch vehicle (RLV), the test focused on programmatic processes and issues that are considered to be critical factors to enabling responsive space lift with future launch systems. San Nicolas Island, which is situated off the coast of southern California and is a key element of NAVAIR's Sea Range, was chosen to host this test because it shares many of the same features relative to geography, facilities and logistics as other candidate launch sites that SMC is assessing as part of its Generic Approach to Launch Transformation (GALT) initiative.

DTIC

*Flight Tests; Launch Vehicles; Navy*

**20070027302** Air Force Research Lab., Kirkland AFB, NM USA

**Chamber Core Structures for Fairing Acoustic Mitigation**

Lane, Steven A; Henderson, Kyle; Williams, Andrew; Ardelean, Emil; Feb 2007; 9 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A467095; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Air Force Research Laboratory is pursuing an innovative composite structure design called chamber core for constructing launch vehicle payload fairings. A composite chamber core fairing consists of many axial tubes sandwiched between face sheets, tubes that can be used as acoustic dampers to reduce low-frequency interior noise with virtually no added mass. This paper presents the results of experimental studies of noise transmission through a 1.51 m diameter x 1.42 m tall chamber core cylinder. It was tested in a semireverberant acoustics laboratory using band-limited random noise at sound pressure levels up to 110 dB. The bare cylinder provided approximately 12.7 dB of attenuation over the 0-500 Hz bandwidth and 15.3 dB over 0-2000 Hz. The noise reduction increased to over 18 dB for both bandwidths with the axial tubes acting as acoustic dampers. Narrowband reductions in excess of 15 dB were measured around specific acoustic resonances. This was accomplished with virtually no added mass to the composite cylinder. Results were compared with the performance provided by a 2.5 cm acoustic blanket treatment. The acoustic dampers were as effective as the acoustic blanket at low frequency, but not at higher frequencies. The acoustic dampers were better able to couple with and damp the low-frequency acoustic modes. Together, the acoustic blanket and dampers provided over 10 dB more noise reduction over the 2000 Hz bandwidth than the bare cylinder.

DTIC

*Composite Structures; Fairings; Launch Vehicles; Noise Reduction; Resonators; Sound Generators*

**20070027338** Naval Postgraduate School, Monterey, CA USA

**Fine Pointing of Military Spacecraft**

Sands, Timothy A; Mar 2007; 154 pp.; In English

Report No.(s): AD-A467186; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In 1923, Herman Oberth, considered by some to be the father of it all for space flight, wrote a book called *Die Rakete zu den Planetenraeumen* (i.e., *Dreams of Planets*) inspiring today's modern space flight. Amongst his suggestions was placing a telescope in space, so astronomical observations may be made without atmospheric distortion. Nearly a century later, the Hubble Space telescope is imaging distant stars with high accuracy. If Hubble were placed on the ground of the West Coast of the USA, it would be able to target a small coin placed on the Lincoln memorial on the East Coast of the USA. This startling accuracy has become useful for military spacecraft missions as well even though the mission is much more challenging. Military spacecraft perform aggressive slew maneuvers to acquire targets, but the actuators are complicated by singularities that can often lead to loss of attitude control during aggressive maneuvers. After acquiring the target, the spacecraft must rapidly settle and track the target as the spacecraft races by overhead. This dissertation addresses these challenges by introducing a new optimized geometry for installation of the spacecraft actuators to minimize the impact of singularities. Methods are discussed to orient the direction of maximum slew capability in a desired direction. In addition to the optimal geometry, a new algorithm is presented that reduces those remaining singularities that could lead to loss of attitude control. A newly developed algorithm is proven to fly through the singularities without losing attitude control. The advancements introduced here increase aggressive maneuver performance aiding military spacecraft rapidly acquire earthly targets.

DTIC

*Attitude Control; Gyroscopes; Military Operations; Military Spacecraft; Spaceborne Telescopes; Telescopes*

**20070027492** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Real Options as a Strategic Management Framework: A Case Study of the Operationally Responsive Space Initiative**

Mitchell, Jr, Robert H; Mar 2007; 102 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467722; AFIT/GRD/ENV/07-M2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research was to examine the potential for applying the concept of real options to the DoD acquisition system. The key premise of real options is the application of strategic decision making and flexibility in the face of future uncertainties. This thesis sought to answer three research questions, how could real options be applied to the acquisition system, how could the acquisition system benefit, and what are the potential challenges to implementation within the acquisition system. These research questions were addressed through a comprehensive literature and a case study of the Operationally Responsive Space (ORS) initiative. The ORS initiative is a transformational activity sponsored by the DoD to develop a strategy for deploying a flexible and responsive satellite system architecture for meeting the direct needs of the Combatant Commanders. Transcripts from interviews with six members of the ORS initiative, representing senior decision makers and project leads, were reviewed to gain insight into the goals and strategies of ORS. This research identified several consistent themes in the execution of the ORS initiative that present opportunities for the implementation of a real options framework in the defense acquisition system: the need for a new business strategy; the need for flexibility in our systems and processes to respond to future threats; and the need to exploit emerging capabilities and technologies. The culmination of this research is recommendations for further study of the real options, in particular how it might be codified for the use within the defense acquisition system.

DTIC

*Artificial Satellites; Decision Making*

**20070027504** Air Force Research Lab., Edwards AFB, CA USA

**Investigation of Advanced Propellants to Enable Single Stage to Orbit Launch Vehicles**

Mossman, Jason; Oct 30, 2006; 91 pp.; In English

Contract(s)/Grant(s): Proj-48470255

Report No.(s): AD-A467749; AFRL-PR-ED-TP-2006-267; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Single-Stage-To-Orbit (SSTO) launch vehicles designs offer the promise of reduced complexity and cost compared to multi-stage vehicles, as only one stage need be developed, produced, and maintained. Despite well-funded development efforts, no SSTO vehicles have been fielded to date. Existing chemical rocket and vehicle technologies do not enable feasible SSTO designs. In the future, new propellants with advanced properties could enable SSTO launch vehicles. A parametric sizing study was conducted to determine the rocket propulsion performance required. Bulk density, specific impulse, and main

propulsion thrust-to-weight level were varied to determine the sensitivity of SSTO vehicle size to these parameters. Advanced propellants including strained-ring hydrocarbons and polynitrogen compounds are evaluated for their suitability in SSTO applications.

DTIC

*Launch Vehicles; Propellants; Propulsion*

**20070027513** Air Force Research Lab., Edwards AFB, CA USA

**Wave Front Sensor for Solar Concentrator Control**

Beasley, Joseph N; Aug 31, 2006; 64 pp.; In English

Contract(s)/Grant(s): Proj-10110062

Report No.(s): AD-A467765; AFRL-PR-ED-JA-2006-299; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This article is the culmination of research directed into finding a system to control the position of the focal spot of paraboloid concentrators for use in terrestrial and space solar concentration applications. After a brief introduction into the area of study, the article describes how a normal Shack-Hartmann wavefront sensor is modified for use in detecting and tracking the focal spot. The first experiment describes how the wavefront sensor is to be utilized in a solar application and shows the adjustment from lenslets to cylindrical mirrors on a thruster. Next, the paper details the analysis and development of the algorithms used in locating the focal spot on a thruster absorber utilizing a correlation method and an area centroid method. The article concludes with a paragraph on suitable future work.

DTIC

*Detectors; Solar Collectors; Solar Energy; Wave Fronts*

**20070027551** Advatech Pacific, Inc., Redlands, CA USA

**Minimization of Thruster Plume Effects on Spacecraft Surfaces**

Rohl, Peter J; Velez, Juan; Koo, Justin W; Gorrilla, Michael; May 2007; 37 pp.; In English

Contract(s)/Grant(s): FA9300-06-D-0002; Proj-SBIR

Report No.(s): AD-A467840; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For the past several years, Advatech Pacific has been maintaining and enhancing the COLISEUM plume simulation environment under the direction of AFRL/PRSS. COLISEUM is a software environment used to model the propagation of a plasma plume and its interactions with solid surfaces (including both sputtering and re-deposition). A recent addition to the capabilities of COLISEUM is its integration with ModelCenter, the optimization and integration framework developed by Phoenix Integration. With the help of ModelCenter, the thrust directions of four Hall Effect Thrusters (HETs) for a representative satellite geometry are optimized such that the overall sputtering on the solar panels is minimized, subject to performance constraints on the overall thrust and torque. The satellite is assumed to be in a geosynchronous orbit, with the solar panels always facing the sun. Different positions in the satellite's orbit are considered, as is a case where one thruster is disabled. All cases considered showed smooth convergence behavior, and sputtering on the solar panels could be reduced significantly while meeting all performance constraints.

DTIC

*Computerized Simulation; Exhaust Gases; Hall Effect; Hall Thrusters; Optimization; Plumes*

**20070027592** Air Force Research Lab., Edwards AFB, CA USA

**Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint)**

Tomczak, Sandra J; Minton, Timothy K; Brunsvold, Amy L; Vij, Vandana; Wright, Michael E; Petteys, Brian J; Guenther, Andrew J; Svejda, Steven A; Mabry, Joseph M; Mar 6, 2007; 15 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0276; F49620-01-1-0335

Report No.(s): AD-A467920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Kapton(Registered) is used extensively in spacecraft thermal blankets, solar arrays, and space inflatable structures. This material is chosen due to its thermal and physical properties, however it is degraded severely in low Earth orbit (LEO) by atomic oxygen (AO). SiO<sub>2</sub> coatings impart remarkable oxidation resistance to Kapton(Registered), yet imperfections in the SiO<sub>2</sub> application process and micrometeoroid debris impact in orbit may damage the SiO<sub>2</sub> coating and lead to Kapton(Registered) erosion. Polyhedral oligomeric silsesquioxane (POSS) is a silicon and oxygen cage-like structure surrounded by organic groups. POSS-diamine and the monomers of Kapton(Registered) were polymerized and cured to form POSS-polyimide (POSS-PI) films. These POSS-copolymers are self-passivating by the formation of a silica layer upon

exposure to AO. Evidence of a SiO<sub>2</sub> passivation layer has been shown by X-ray photoelectron spectroscopy studies on AO exposed 3.5, 7.0, and 8.75 weight % Si<sub>8</sub>O<sub>11</sub> main chain (MC)-POSS-PI samples with erosion yields of 3.7, 0.98, and 0.3 percent, respectively, of the erosion yield for Kapton H(Registered) at a fluence of 8.5 x 10<sup>20</sup> O atoms cm<sup>-2</sup>. The self-passivation of POSS-PIs has also been demonstrated by monitoring a 1 micron deep scratch in AO-exposed main-chain-POSS-PI (MC-POSS-PI) after a second exposure to AO. A study of the effect of temperature on the AO erosion of POSS-PI samples showed that although the erosion of MC-POSS-PIs increased with temperature, they erode significantly less than their no-POSS analogues at elevated temperatures. POSS-polyimides flown for 3.9 years in low Earth orbit on the Materials International Space Station Experiment (MISSE) showed dramatically increased survival relative to 0 % POSS-polyimide. These results and physical property characterization of POSS-PIs exposed to AO, evidence that POSS-PIs are a viable Kapton(Registered) replacement material.

DTIC

*Aerospace Systems; International Space Station; Kapton (Trademark); Oxygen Atoms; Polyimides; Polymeric Films*

**20070027650** Library of Congress, Washington, DC USA

#### **China's Anti-Satellite Weapon Test**

Kan, Shirley; Apr 23, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468025; CRS/DC-RS22652; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On January 11, 2007, the People's Republic of China (PRC) conducted its first successful direct-ascent anti-satellite (ASAT) weapons test in destroying one of its own satellites in space. The test raised international concerns about more space debris. Longer-term, the test raised questions about China's capability and intention to attack U.S. satellites. The purpose of this CRS Report, based on open sources and interviews, is to discuss that ASAT test by China's military, the People's Liberation Army (PLA), and issues about U.S. assessments and policies. This report will not be updated.

DTIC

*China; Weapon Systems*

**20070027726** CSA Engineering, Inc., Albuquerque, NM USA

#### **Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses**

Gooding, James C; Babuska, Vit; Griffith, D T; Ingram, Brea R; Robertson, III, Lawrence M; Apr 2007; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468392; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Signal and power harnesses on spacecraft buses and payloads can alter structural dynamics, as has been noted in previous flight programs. The community, however, has never undertaken a thorough study to understand the impact of harness dynamics on spacecraft structures. The Air Force Research Laboratory is leading a test and analysis program to develop fundamental knowledge of how spacecraft harnesses impact dynamics and develop tools that structural designers could use to achieve accurate predictions of cable-dressed structures. The work described in this paper involved a beam under simulated free boundary conditions that served as a validation test bed for model development.

DTIC

*Beams (Supports); Dynamic Response; Dynamic Structural Analysis; Electric Wire; Harnesses; Perturbation*

**20070027763** BAE Systems Information and Electronic System Integration, Inc., Manassas, VA USA

#### **A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint)**

Li, Bin; Bumgarner, Adam; Pirkel, Daniel; Stobie, James; Neiderer, Wayne; Granziano, Michael; Burcin, Laura; Storey, Thomas; Orlovsky, Brian; Hunt, Kenneth K; Jan 29, 2007; 9 pp.; In English

Contract(s)/Grant(s): FA9453-04-C-0052; Proj-2181

Report No.(s): AD-A468501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A 4Mbit non-volatile Chalcogenide-Random Access Memory (C-RAM)(tm) has been designed and fabricated in RH25, a radiation hardened CMOS technology. The top-down design focused on accommodating chalcogenide process variations and satisfying space system specifications. The optimized band-gap circuit supplies reference current and voltage that meet temperature and voltage requirements. The innovative write circuitry supplies appropriate currents (amplitude and shape) to the chalcogenide memory cells to allow them to be programmed either in amorphous state (write '0') or crystalline state (write '1'). The on-chip pulse generator circuit can provide multiple pulse widths for write '0' and write '1', as well as preconditioning pulse. The write circuits have a dedicated power supply, which can be removed to place the part in a read only mode. The read circuitry includes a voltage limiting circuitry, an adjustable current reference, an adjustable pre-charge circuitry,

and a sense amplifier to accurately sense the current difference between cells programmed as '0' or '1'. A localized redundant cell architecture is implemented with shared read/write circuits to improve yield without impacting access times. The redundant cells can be tested prior to laser fusing or used to monitor endurance. Considerations for testability such as direct chalcogenide cell access, margin test, analog monitors, and endurance acceleration have been implemented. Noise and power reduction techniques have also been used globally.

DTIC

*Chalcogenides; Computer Storage Devices; Random Access Memory; Technology Utilization*

**20070027822** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Nanoscience and Technology at the Air Force Research Laboratory (AFRL)**

Vaia, Richard A; Miracle, Daniel; Cruse, Thomas; Feb 2005; 45 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468586; No Copyright; Avail.: Defense Technical Information Center (DTIC)

OUTLINE: (1) An AF Perspective of Nanotechnology; (2) Nanoscience and Technology in AFRL: Past and Present; (3) A Strategic Plan for the Future; (4) Summary.

DTIC

*Management Planning; Military Technology; Nanotechnology; Research and Development; Technology Assessment*

**20070027826** Aerospace Corp., El Segundo, CA USA

**Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2**

Fuqua, P D; Panetta, C J; Barrie, J D; Feb 20, 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A468592; TR-2007(8565)-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Silicon wafers were mounted on the exterior of the International Space Station as a part of MISSE. Post-flight ellipsometry and reflectometry were employed to show that the silicon wafers gained about a 420-Å-thick layer of a silica-like contaminant with BRDF scatter values around 1 x 10% per steradian.

DTIC

*Bidirectional Reflectance; Contamination; Distribution Functions; International Space Station; Silicon Dioxide; Space Stations; Trays; Wafers*

**20070029570** Phillips Lab., Kirtland AFB, NM USA

**Payload Isolation System for Launch Vehicles**

Wilke, Paul S; Fosness, Eugene R; Mar 1997; 13 pp.; In English

Contract(s)/Grant(s): F29601-94-C-0127

Report No.(s): AD-A468783; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468783>

A spacecraft is subjected to very large dynamic forces from its launch vehicle during its ascent into orbit. These large forces place stringent design requirements on the spacecraft and its components to assure that the trip to orbit will be survived. The severe launch environment accounts for much of the expense of designing, qualifying, and testing satellite components. Reduction of launch loads would allow more sensitive equipment to be included in missions, reduce risk of equipment or component failure, and possibly allow the mass of the spacecraft bus to be reduced. These benefits apply to military as well as commercial satellites. This paper reports the design and testing of a prototype whole-spacecraft isolation system which will replace current payload attach fittings is passive-only in nature, and provides lateral isolation to a spacecraft which is mounted on it. This isolation system is being designed for a medium launch vehicle and a 6500 lb spacecraft but the isolation technology is applicable to practically all launch vehicles and spacecraft, small and large. The feasibility of such a system on a small launch vehicle has been demonstrated with a system-level analysis which shows great improvements. The isolator significantly reduces the launch loads seen by the spacecraft. Follow-on contracts will produce isolating payload attach fittings for commercial and government launches.

DTIC

*Isolation; Launch Vehicles; Payloads; Vibration*

**20070029598** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

**Novel Collective Protection Filters for Emerging TIC Requirements: Axial and Radial-Flow Filter Designs**

Peterson, Gregory W; Karwacki, Christopher J; Rossin, Joseph A; May 2007; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-BA05PR0103

Report No.(s): AD-A468847; ECBC-TR-497; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468847>

Adsorbents have recently been developed for enhanced protection against toxic industrial chemicals such as ammonia, ethylene oxide, and nitrogen dioxide. Current collective protection filters employing ASZM-TEDA, an adsorbent developed for heavy organic and acid-forming chemicals, seriously lack protection against these chemicals and other toxic industrial materials. This report explores the development of novel collective protection filters in multiple configurations employing a layered bed of ASZM-TEDA and newly developed zeolites.

DTIC

*Axial Flow; Protection; Radial Flow*

**20070029954** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint)**

Michalak, Travis E; Yerkes, Kirk L; Puterbaugh, Rebekah; Jan 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A468416; AFRL-PR-WP-TP-2007-222; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468416>

This paper discusses the effects of a variable-gravity environment on the performance of a subcooled partially-confined spray. An experiment was flown on the NASA KC-135, providing various gravity levels (-0.16, 0.35, 1.0, and 1.8 g). The experiment consists of a nozzle spraying on a Thick Film Resistor (TFR) heater which is mounted on an insulating glass pedestal. The working fluid is FC-72. Non-dimensional heat input varied over the range  $35 < (1-f)G\Delta < 190$ , with a heat flux of  $20 < (1-f)q' < 70$  W/cm<sup>2</sup>. The non-dimensional grouping  $(Fr/2Ga)^{1/2}$ , a ratio of inertia and acceleration forces to viscous forces, varied over the range  $35 < (Fr/2Ga)^{1/2} < 70$ . Subcooling temperature ranged from  $24 \text{ deg C} < T_{sc} < 30 \text{ deg C}$ . For this data, from one flight week of three flights,  $\Delta T = T_s - T_{sat}$  is found to decrease with decreasing values of  $(Fr/2Ga)^{1/2}$ . It appears that higher values for subcooling may enhance this acceleration effect. Changing the flow rate may affect how much the acceleration level affects the 2-phase heat transfer coefficient ( $h_{2-p}$ ), with the higher flow rate showing less of a change in  $h_{2-p}$  as the acceleration level changes.

DTIC

*Confinement; Cooling; Electronic Equipment; Gravitational Effects; Temperature Control*

**20070029955** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint)**

Puterbaugh, Rebekah L; Yerkes, Kirk L; Michala, Travis E; Thomas, Scott K; Jan 2007; 14 pp.; In English

Report No.(s): AD-A468418; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468418>

This paper discusses the heat transfer performance of a partially-confined FC-72 spray with varying dissolved air concentrations. An experimental test rig was used to obtain critical heat flux (CHF) data. A nozzle allowed the fluid to be sprayed onto a thick-film resistor heater, which was mounted onto a glass post, with a sump system to allow removal of excess fluid. Type-E thermocouples were imbedded in the post to obtain temperature data. The parametric ranges for testing were: volume-percent concentration of dissolved air,  $1 < C < 20\%$ , chamber saturation pressure,  $6.90E+4 < P_{sat} < 8.27E+4$  N/m<sup>2</sup>, subcooling,  $2 < \Delta T_{sc} < 12$  deg C, volumetric flow rate,  $6.31E-6 < V < 10.5E-6$  m<sup>3</sup>/s. Test data were obtained for comparison of CHF with varying C while controlling the spray chamber pressure. An empirical mathematical relationship allowing for determination of surface heat flux with varying flow rate was also developed. The model was obtained using test data at flow rates of  $V = 6.31E-6, 8.41E-6, \text{ and } 10.5E-6$  m<sup>3</sup>/s, and was validated using experimental data obtained for flow rates of  $V = 7.36E-6$  and  $9.46E-6$  m<sup>3</sup>/s.

DTIC

*Confinement; Cooling; Electronic Equipment; Temperature Control*

## SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety*; *15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

**20070028556** NASA Johnson Space Center, Houston, TX, USA

### **Changing the Cultural Paradigm to Meet Emerging Requirements**

Robbins, William W.; August 19, 2007; 16 pp.; In English; SOLE 2007 Conference and Expo, 19-23 Aug. 2007, Pittsburgh, PA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028556>

This viewgraph presentation reviews changes that are required in Space Transportation. This new transportation paradigm from the reliance on the Space Shuttle to a mixture of space transportation vehicles, i.e., the Russian Progress, vehicle, the Japanese HTV, the European ATV and other commercial orbital transportation systems, requires a new cultural paradigm. This new paradigm is outlined, and reviewed.

CASI

*Space Transportation; International Cooperation; Planning; Space Logistics*

**20070028560** NASA Johnson Space Center, Houston, TX, USA

### **Learning from Past Experiences**

Hulet, Michael W.; [2007]; 1 pp.; In English; NASA Project Management (PM) Challenge 2008, 5th Annual NASA Project Management Conference, 26-27 Feb, 2008, Daytona, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Space flight is a risky business. This truism has been bandied about since the earliest days of the space program. When asked by the young daughter of a coworker, one of the Mercury astronauts likened launching into space to 'riding a Roman candle' -- it was both exciting and dangerous. Even in these more technologically advanced days, the solid rocket boosters and external tanks of the space shuttle provide a no less exciting, or dangerous, ride into space. However much the phrase 'risk mitigation' is bandied about within the U.S. space program, there is still the history of the Apollo 1 fire during a ground test at Cape Canaveral, Fla., the loss of the shuttle Challenger during liftoff, and the loss of the shuttle Columbia when returning to Earth to remind us that while we give lip-service to risk management, we have not learned to manage risk as well as we ought. Moreover, there are many more less dramatic, but equally critical, incidents that have occurred in association with the space program that also highlight our inability to accurately gauge and manage risk. Why do we seem caught in a senseless spiral in which we focus most on risk only after a tragedy? Why do we repeat serious mishaps and not learn from our mistakes? This paper reviews some possible explanations for our risk-taking behavior and provides examples of interest to the NASA centers, while also discussing inter center and intra-center opportunities for sharing information to mitigate risk.

Author

*Risk; Space Programs; Safety Management; Aerospace Safety; Accident Prevention*

**20070029226** NASA Johnson Space Center, Houston, TX, USA

### **Sonic Boom Assessment for the Crew Exploration Vehicle**

Herron, Marissa; August 20, 2007; 22 pp.; In English; AIAA, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029226>

The Constellation Environmental Impact Statement (Cx EIS) requires that an assessment be performed on the environmental impact of sonic booms during the reentry of the Crew Exploration Vehicle (CEV). This included an analysis of current planned vehicle trajectories for the Crew Module (CM) and the Service Module (SM) debris and the determination of the potential impact to the overflown environment.

Author

*Sonic Booms; Crew Exploration Vehicle; Environmental Surveys; Trajectories; Debris*

**20070029424** NASA Langley Research Center, Hampton, VA, USA

**Shuttle Entry Imaging Using Infrared Thermography**

Horvath, Thomas; Berry, Scott; Alter, Stephen; Blanchard, Robert; Schwartz, Richard; Ross, Martin; Tack, Steve; June 25, 2007; 20 pp.; In English; 39th AIAA Thermophysics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNL06AA23A; WBS 732759.07.05

Report No.(s): AIAA Paper 2007-4267; Copyright; Avail.: CASI: **A03**, Hardcopy

During the Columbia Accident Investigation, imaging teams supporting debris shedding analysis were hampered by poor entry image quality and the general lack of information on optical signatures associated with a nominal Shuttle entry. After the accident, recommendations were made to NASA management to develop and maintain a state-of-the-art imagery database for Shuttle engineering performance assessments and to improve entry imaging capability to support anomaly and contingency analysis during a mission. As a result, the Space Shuttle Program sponsored an observation campaign to qualitatively characterize a nominal Shuttle entry over the widest possible Mach number range. The initial objectives focused on an assessment of capability to identify/resolve debris liberated from the Shuttle during entry, characterization of potential anomalous events associated with RCS jet firings and unusual phenomenon associated with the plasma trail. The aeroheating technical community viewed the Space Shuttle Program sponsored activity as an opportunity to influence the observation objectives and incrementally demonstrate key elements of a quantitative spatially resolved temperature measurement capability over a series of flights. One long-term desire of the Shuttle engineering community is to calibrate boundary layer transition prediction methodologies that are presently part of the Shuttle damage assessment process using flight data provided by a controlled Shuttle flight experiment. Quantitative global imaging may offer a complementary method of data collection to more traditional methods such as surface thermocouples. This paper reviews the process used by the engineering community to influence data collection methods and analysis of global infrared images of the Shuttle obtained during hypersonic entry. Emphasis is placed upon airborne imaging assets sponsored by the Shuttle program during Return to Flight. Visual and IR entry imagery were obtained with available airborne imaging platforms used within DoD along with agency assets developed and optimized for use during Shuttle ascent to demonstrate capability (i.e., tracking, acquisition of multispectral data, spatial resolution) and identify system limitations (i.e., radiance modeling, saturation) using state-of-the-art imaging instrumentation and communication systems. Global infrared intensity data have been transformed to temperature by comparison to Shuttle flight thermocouple data. Reasonable agreement is found between the flight thermography images and numerical prediction. A discussion of lessons learned and potential application to a potential Shuttle boundary layer transition flight test is presented.

Author

*Imaging Techniques; Infrared Imagery; Thermography; Space Shuttles; Boundary Layer Transition; Atmospheric Entry; Flight Tests; Damage Assessment; Accident Investigation*

17

**SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING**

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

**20070026652** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Determining Logistics Ground Support Manpower Requirements for a Reusable Military Launch Vehicle**

Michalski, Sydney C; Mar 2007; 253 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466653; AFIT/GLM/ENS/07-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466653>

Successful space-based technologies like satellite imagery and GPS have increased military demand for a rapid-response launch capability. AF Space Command's Operationally Responsive Spacelift program was developed to ensure that the AF has the capability to launch a payload into orbit within hours of a tasking notification, and requires development of a new space launch vehicle. The Reusable Military Launch Vehicle (RMLV) is currently in the design phase. The AF Research Laboratory sponsored development of the MILEPOST simulation model in order to assess the turnaround time, and thus responsiveness, of various design alternatives. The focus of this thesis is to improve the fidelity of the MILEPOST model by assessing the logistics manpower required to support the modeled turnaround activities. The research determined the appropriate AF organizational structure and manpower requirements for RMLV ground support agencies based on the activities modeled in



MILEPOST. This information will be incorporated into the model in future research efforts, resulting in the capability to evaluate RMLV design alternatives based on both turnaround time and workforce requirements.

DTIC

*Global Positioning System; Launch Vehicles; Logistics Management; Manpower; Reusable Launch Vehicles; Support Systems*

## 18

### SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance*; *39 Structural Mechanics*; and *16 Space Transportation and Safety*.

**20070028865** NASA Langley Research Center, Hampton, VA, USA

#### **Probabilistic Modeling of Space Shuttle Debris Impact**

Huyse, Luc J.; Asce, M.; Waldhart, Chris J.; Riha, David S.; Larsen, Curtis E.; Gomez, Reynaldo J.; Stuart, Phillip C.; June 03, 2007; 6 pp.; In English; 18th Engineering Mechanics Division Conference of the American Society of Civil Engineers, 3-6 Jun. 2007, Blacksburg, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 843515.02.01.07.03.01.08; SwRI Proj. 18.10592.03; Copyright; Avail.: CASI: [A02](#), Hardcopy

On Feb 1, 2003, the Shuttle Columbia was lost during its return to Earth. As a result of the conclusion that debris impact caused the damage to the left wing of the Columbia Space Shuttle Vehicle (SSV) during ascent, the Columbia Accident Investigation Board recommended that an assessment be performed of the debris environment experienced by the SSV during ascent. A flight rationale based on probabilistic assessment is used for the SSV return-to-flight. The assessment entails identifying all potential debris sources, their probable geometric and aerodynamic characteristics, and their potential for impacting and damaging critical Shuttle components. A probabilistic analysis tool, based on the SwRI-developed NESSUS probabilistic analysis software, predicts the probability of impact and damage to the space shuttle wing leading edge and thermal protection system components. Among other parameters, the likelihood of unacceptable damage depends on the time of release (Mach number of the orbiter) and the divot mass as well as the impact velocity and impact angle. A typical result is visualized in the figures below. Probability of impact and damage, as well as the sensitivities thereof with respect to the distribution assumptions, can be computed and visualized at each point on the orbiter or summarized per wing panel or tile zone.

Author

*Debris; Probability Theory; Space Shuttles; Mathematical Models; Computational Fluid Dynamics; Impact Velocity*

**20070029233** NASA Langley Research Center, Hampton, VA, USA

#### **Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter**

Mazaheri, Ali R.; Wood, William A.; June 25, 2007; 12 pp.; In English; 37th AIAA Fluid Dynamics Conference and Exhibit, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNL06AC49T; WBS 732759.07.05

Report No.(s): AIAA Paper 2007-4148; Copyright; Avail.: CASI: [A03](#), Hardcopy

Computational re-entry aerothermodynamic analysis of the Space Shuttle Orbiter's tile overlay repair (TOR) sub-assembly is presented. Entry aeroheating analyses are conducted to characterize the aerothermodynamic environment of the TOR and to provide necessary inputs for future TOR thermal and structural analyses. The TOR sub-assembly consists of a thin plate and several augers and spacers that serve as the TOR fasteners. For the computational analysis, the Langley Aerothermodynamic Upwind Relaxation Algorithm (LAURA) is used. A 5-species non-equilibrium chemistry model with a finite rate catalytic recombination model and a radiation equilibrium wall condition are used. It is assumed that wall properties are the same as reaction cured glass (RCG) properties with a surface emissivity of  $\epsilon = 0.89$ . Surface heat transfer rates for the TOR and tile repair augers (TRA) are computed at a STS-107 trajectory point corresponding to Mach 18 free stream conditions. Computational results show that the average heating bump factor (BF), which is a ratio of local heat transfer rate to a design reference point located at the damage site, for the auger head alone is about 1.9. It is also shown that the average BF for the combined auger and washer heads is about 2.0.

Author

*Aerodynamic Heating; Tiles; Space Shuttle Orbiters; Aerothermodynamics; Algorithms; Structural Analysis; Heat Transfer; Damage*

**20070029236** NASA Langley Research Center, Hampton, VA, USA

**Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking**

Dec, John A.; Gasbarre, Joseph F.; Amundsen, Ruth M.; July 09, 2007; 8 pp.; In English; 37th International Conference on Environmental Systems (ICES), 9-12 Jul. 2007, Chicago, IL, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 441261.04.03.01.04

Report No.(s): 07ICES-64; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029236>

The Mars Reconnaissance Orbiter (MRO) launched on August 12, 2005 and started aerobraking at Mars in March 2006. During the spacecraft's design phase, thermal models of the solar panels and instruments were developed to determine which components would be the most limiting thermally during aerobraking. Having determined the most limiting components, thermal limits in terms of heat rate were established. Advanced thermal modeling techniques were developed utilizing Thermal Desktop and Patran Thermal. Heat transfer coefficients were calculated using a Direct Simulation Monte Carlo technique. Analysis established that the solar panels were the most limiting components during the aerobraking phase of the mission.

Author

*Mars Reconnaissance Orbiter; Solar Instruments; Aerobraking; Temperature Distribution; Solar Cells; Spacecraft Design; Heat Transfer Coefficients*

## 20

### SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, *15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

**20070028662** Westinghouse Savannah River Co., Aiken, SC, USA

**Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace**

Smith, A. C.; Blanton, P. S.; Gelder, L. F.; Lutz, R. N.; January 2007; 7 pp.; In English

Report No.(s): DE2007-899960; WSRC-STI-2007-00018; No Copyright; Avail.: National Technical Information Service (NTIS)

The 9977 / 9978 General Purpose Fissile Package (GFPF) was designed by SRNL to replace the DOT 6M Specification Package and ship Plutonium and Uranium metals and oxides. Urethane foam was used for the overpack to ensure the package would withstand the 10CFR71.73(c)(2) crush test, which is a severe test for drum-type packages. In addition, it was necessary to confirm that the urethane foam configuration provided adequate thermal protection for the containment vessel during the subsequent 10CFR71.73(c)(4) thermal test. Development tests were performed on early prototype test specimens of different diameter overpacks and a range of urethane foam densities. The thermal test was performed using an industrial furnace. Test results were used to optimize the selection of package diameter and foam density, and provided the basis for design enhancements incorporated into the final package design.

NTIS

*Fissionable Materials; Furnaces; Packaging; Prototypes; Radioactive Materials*

## 23

### CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

**20070026389** Ludwig-Maximilians-Univ., Munich, Germany

**Insensitive High-Performance Replacements for RDX in Explosive and Propellant Formulations**

Klapoetke, Thomas M; Mar 16, 2007; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N62558-05-C-0027

Report No.(s): AD-A466070; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466070>

The objective of the proposed research project is to investigate and explore the chemistry of neutral (covalent) high-nitrogen compounds and high-nitrogen salts as potential energetic ingredients for gun propellant charges and

replacements for RDX. The new high-nitrogen compounds and salts should be less environmentally hazardous, have no greater sensitivities, and have equal or better performance.

DTIC

*Explosives; Nitrogen Compounds; Propellants; RDX*

**20070026390** Virginia Univ., Charlottesville, VA USA

**An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems**

Hass, D D; Dharmasena, K; Wadley, H N; Jan 2002; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0438

Report No.(s): AD-A466071; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466071>

The next generation of thermal barriers coating (TBC) systems used on turbine engines must be able to endure higher operating temperatures. The thermally protective top coat layers of these TBC systems must therefore exhibit lower thermal conductivity and improved thermochemical stability. The underlying bond coat layers should have substantially improved oxidation resistance and increased high temperature strength. These properties strongly depend upon coating composition. However, as these layers become increasingly complex the relationship between composition and properties becomes difficult to predict and thus, the development of advanced materials systems is slowed. To accelerate the design and manufacture of advanced coatings we have developed a combinatorial synthesis approach. A library of compositions is created and their properties are measured using parallel measurement techniques to allow rapid investigation of a wide range of compositions. Compositionally graded libraries are directly deposited using multi-source electron beam evaporation in conjunction with an inert, transonic gas jet. The properties of the gas jet control the degree of intermixing between co-evaporated melt pools and thus, the compositional gradient of the library. Direct Simulation Monte Carlo simulations along with binary collision theory has been used to investigate the origin of the lateral compositional variation. Deposition conditions which lead to sharp, lateral composition gradients across a substrate have been identified.

DTIC

*Coating; Combinatorial Analysis; Electron Beams; Gas Turbines; Monte Carlo Method; Thermal Control Coatings*

**20070026403** Weston (Roy F.), Inc., West Chester, PA USA

**Novel Technology Evaluation for Volatile Organic Compounds Emission Control**

Corbin, M H; Metzger, N; Puglionesi, P S; Mar 1987; 141 pp.; In English

Contract(s)/Grant(s): DAAK11-85-D-0007

Report No.(s): AD-A466104; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466104>

Novel technologies for volatile organic compound (VOC) emission control were evaluated to assess the potential for future application on emissions from USATHAMA installation restoration treatment processes. The novel technologies were compared with conventional technologies on the basis of performance and cost-effectiveness. Fluidized bed catalytic oxidation was recommended.

DTIC

*Installing; Organic Compounds; Restoration; Volatile Organic Compounds*

**20070026461** SRI International Corp., Menlo Park, CA USA

**Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations**

Lim, Peter; Oct 2005; 11 pp.; In English

Contract(s)/Grant(s): DAMD17-03-C-0111

Report No.(s): AD-A466189; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466189>

During the annual contract period, September 22, 2004 to September 21, 2005, the project personnel continued to perform chemical/physical analyses on bulk pharmaceutical substances and formulated drug products, and to develop and (with borrowed labor) manufacture dosage formulations of interest to the USAMRMC Drug Development Program for parasitic and infectious diseases, chemical and biological defense, etc. Specific objectives were to design, develop, validate, and apply

methods to determine chemical and physical characteristics of the bulk drugs, drug products, and to determine their stability under defined conditions, and to develop and to manufacture dosage formulations.

DTIC

*Chemical Analysis; Drugs; Infectious Diseases; Organic Chemistry*

**20070026563** Army Research Lab., Aberdeen Proving Ground, MD USA

**Nanoengineered Additives for Active Coatings**

Rawlett, Adam M; Orlicki, Joshua A; La Scala, John J; Piehler, Lars T; Zander, Nicole; Smith, Pauline M; Demaree, J D; Kosik, Wendy E; McKnight, Steven H; Rice, Norman; Kagumba, Lawino; Giaya, Arjan; Apr 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-H76

Report No.(s): AD-A466478; ART-TN-273; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466478>

Novel additives for polymeric coatings have been developed based on modified hyperbranched polymers. The additives are polyfunctional and have been prepared to spontaneously segregate to the surface of the polymer in which they are dispersed. They have been used to install active sites in polymeric films, with little or no change in the formulation, bulk properties, or application of the coating.

DTIC

*Additives; Protective Coatings*

**20070026746** Weston (Roy F.), Inc., West Chester, PA USA

**Literature Review of Biodegradation in Soil of Selected Rocky Mountain Arsenal Contaminants: Isodrin, Dieldrin, Diisopropylmethyl-Phosphonate, 1,2-Dibromo-3-Chloropropane, and p-Chloro-Phenylmethylsulfoxide**

Apr 1987; 24 pp.; In English

Report No.(s): AD-A467011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467011>

Soils and groundwater at the Rocky Mountain Arsenal (RMA), Colorado have been contaminated with a variety of organic chemicals. Among these chemicals are 1,2-dibromo-3-chloro- propane (DBCP), diisopropylmethylphosphonate (DIMP), p-chloro- phenylmethylsulfoxide (PCPMSO), isodrin, and dieldrin. The U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) is investigating the possibility that microorganisms in soil may transform these five compounds to intermediates or innocuous end products. WESTON is conducting a laboratory study to evaluate the biodegradability of these compounds in soil under RMA relevant conditions. As part of this study, WESTON is conducting a literature review to determine the current state of knowledge regarding these subject areas.

DTIC

*Biodegradation; Dieldrin; Mountains; Soils*

**20070026770** Dames and Moore, Bethesda, MD USA

**Quarterly Groundwater Monitoring First Quarter Sampling Results fort Dix, New Jersey**

Nunyuie, Mensa; May 29, 1990; 70 pp.; In English

Contract(s)/Grant(s): DAAA15-88-D-0008

Report No.(s): AD-A467331; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467331>

The first quarter sampling activities included a reconnaissance survey to locate and inspect the wells at the landfill and to select those to be included in the Monitoring Program. As a result of the survey, two wells (MW-8 and WES-3), which were vandalized or otherwise damaged, were excluded from the Monitoring Program. The selected wells and some related data are listed in Table 1. The locations of the wells are shown in Figure 1. The wells were purged and sampled in accordance with procedures specified in the Draft Sampling and Analysis Plan (SAP), Fort Dix Follow-on Remedial Investigation/Feasibility Study, prepared by Dames & Moore. The sample containers were labeled, packed on ice in coolers, and shipped overnight with completed chain-of-custody forms to ESE for chemical analysis. The samples were analyzed for VOCs as well as for total and dissolved priority pollutant metals and iron. The analytical results are presented in Tables 2 and 3. Table 2 shows only the results for analyte concentrations above detection limits while Table 3 presents all analytical data.

DTIC

*Ground Water; Sampling; Trichloroethylene; Water; Water Pollution; Wells*

**20070026794** ABB Environmental Services, Inc., Portland, ME USA

**No Further Action Decision Under CERCLA, Study Area 43P Historic Gas Station Sites, Fort Devens, Massachusetts**

Jan 1995; 38 pp.; In English

Contract(s)/Grant(s): DAAA15-91-D-0008

Report No.(s): AD-A467459; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467459>

Investigations of Study Area 43P (Historic Gas Station Site) at Fort Devens, Massachusetts have resulted in the decision that no further hazardous waste studies or remediation are required at this site. Study Area 43P was identified in the Federal Facilities Agreement between the U.S. Environmental Protection Agency and the U.S. Department of Defense as a potential site of contamination. Field investigation of Study Area 43P was initiated in 1992 in conjunction with the other 12 Groups 2, 7, and Historic Gas Stations Study Areas at Fort Devens. The Study Area 43P site investigation consisted of collecting subsurface soil samples, field analysis of those samples, and one soil boring. Eleven TerraProbe points were advanced to refusal at each location and up to three subsurface soil samples per point (21 total) were collected for field analysis. The samples were analyzed for benzene, toluene, ethylbenzene, and xylenes and total petroleum hydrocarbons. Benzene, toluene, ethylbenzene, and xylenes were not detected in any of the samples, and total petroleum hydrocarbon compounds were detected in only one sample at 220 parts per million. On the basis of findings at Study Area 43P and the Preliminary Risk Evaluation, there is no evidence or reason to conclude that petroleum contamination due to the former underground storage tank has caused significant environmental contamination or poses a threat to human health. The decision has been made to remove Study Area 43P from further consideration in the Installation Restoration Program.

DTIC

*Contamination; Hydrocarbons; Petroleum Products*

**20070026812** Ehime Univ., Japan

**A New Synthesis of Porphyrins with Extended Conjugation and their Photophysics**

Ono, Noboru; Apr 21, 2005; 27 pp.; In English

Report No.(s): AD-A467515; AOARD-05-4051; AOARD-04-0403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467515>

The contractor investigated the synthesis and characteristics of highly conjugated porphyrins, with the purpose to relate molecular structure to material properties. These molecules useful non-linear optical and optoelectronic properties. The contractor used a synthesis method based on the retro Diels-Alder reaction of porphyrins fused with bicyclo[2.2.2]octadiene units. This yields a new series of conjugated porphyrins that are difficult to be prepared by any other methods.

DTIC

*Conjugation; Porphyrins*

**20070026847** ABB Environmental Services, Inc., Portland, ME USA

**No Further Action Decision Under CERCLA Study Area 43E Historic Gas Station Sites Fort Devens, Massachusetts**

Jan 1995; 34 pp.; In English

Contract(s)/Grant(s): DAAA15-91-D-0008; Proj-7053-12

Report No.(s): AD-A467970; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467970>

Investigations of Study Area 43E (Historic Gas Station Site) at Fort Devens, Massachusetts have resulted in the decision that no further hazardous waste studies or remediation are required at this site. Study Area 43E was identified in the Federal Facilities Agreement between the U.S. Environmental Protection Agency and the U.S. Department of Defense as a potential site of contamination. Fort Devens was placed on the National Priorities List under the Comprehensive Environmental Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act on December 21, 1989. In addition, under Public Law 101-510, the Defense Base Realignment and Closure Act of 1990, Fort Devens was selected for cessation of operations and closure. In accordance with these acts, numerous studies, including a Master Environmental Plan, an Enhanced Preliminary Assessment, and a Site Investigation, have been conducted which address Study Area 43E. Field investigation of Study Area 43E was initiated in 1992 in conjunction with the other 12 Groups 2, 7, and Historic Gas Stations Study Areas at Fort Devens. The Study Area 43E site investigation consisted of surficial geophysical surveys, which included a metal detector and ground penetrating radar survey. The geophysical surveys indicated that one abandoned underground storage tank was present on the northern side of Building 2020. This tank was removed by ATEC Environmental Consultants on September 3, 1992. No visually contaminated soil was observed in the excavation, and

groundwater was not encountered. ATEC Environmental Consultants performed field screening for volatile organic compounds and total petroleum hydrocarbons on 10 soil samples collected from the walls of the excavation. The photoionization detector headspace screening showed volatile organic compound concentrations ranging from 0.2 to 0.5 parts per million.

DTIC

*Petroleum Products; Stations*

**20070027278** Air Force Research Lab., Kirkland AFB, NM USA

**Infrared and Electrical Properties of Amorphous Sputtered (LaxAl<sub>1-x</sub>)<sub>2</sub>O<sub>3</sub> films**

Devine, R A; Jan 2003; 6 pp.; In English

Contract(s)/Grant(s): F296201-01-C-0241; Proj-4846

Report No.(s): AD-A467033; AFRL-VS-PS-JA-2007-1007; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Amorphous (LaxAl(sub 1-x))(sub 2)O<sub>3</sub> (0.61 less than or equal to x less than or equal 0.73) films have been deposited by sputtering in a partially reactive atmosphere. The average dielectric constant of the as-deposited films was 13.4 and 12.5 following annealing at 700 C for 60 min in N<sub>2</sub>; both values were much lower than the single crystal values ~24 and 28 for LaAlO<sub>3</sub> and La<sub>2</sub>O<sub>3</sub>, respectively. Leakage current densities were ~10-8 A /sq cm for an applied field of 1 MV /cm for film thicknesses ~75 nm. Fourier transform infrared spectroscopy reveals transverse optic mode peaks at 723 and 400 /cm and corresponding longitudinal optic modes at 821 and 509 /cm. The density of the amorphous phase is estimated to be ~0.9 times DTIC

*Amorphous Materials; Dielectric Properties; Dielectrics; Electrical Properties; Infrared Radiation; Infrared Spectroscopy; Sputtering; Thin Films*

**20070027307** Naval Postgraduate School, Monterey, CA USA

**A Possible Solution for the U.S. Navy's Addiction to Petroleum: A Business Case Analysis for Transitioning the U.S. Navy From Petroleum to Synthetic Fuel Resources**

Benedetto, Michael; Mar 2007; 130 pp.; In English

Report No.(s): AD-A467107; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Considering the variable cost of petroleum, it is fiscally prudent for the Department of the Navy (DON) to consider alternative energy sources for propulsion. The cost of petroleum fuels for the DON have increased fifty-five percent from 2004 to 2005 and the increase is equivalent to the annual cost of over seven thousand personnel or three littoral combat ships. For the near-term and mid-term futures (five to thirty years), these alternative energy sources must be compatible with current power systems. The Chief of Naval Operations Strategic Studies Group XXV (SSG) proposed a Navy Synthetic Fuels Program (NSFP) which recommended embarking on a public-private venture to make synthetic fuels to satisfy the U.S. Navy's needs. This thesis examines one aspect of SSG's NSFP by specifically investigating the construction and operating costs of a coal to liquid synthetic fuel plant using domestic coal resources. The purpose of this study is to show the conditions where domestic coal to liquid (CTL) fuel production facility investment is financially practical, as well as those where it is financially impractical. This analysis develops cost estimates, provides business case analysis and reviews global estimates for developing a coal to liquid synthetic fuel production facility. It identifies and qualifies risks and sensitivities. It also examines various projected coal and crude oil markets and how each case influences the decision to pursue a synthetic fuel program. It concludes with a decision matrix comparing the pursuit of a synthetic fuel program with maintaining the status quo of the use of fuel from petroleum.

DTIC

*Commerce; Crude Oil; Navy; Petroleum Products; Synthetic Fuels*

**20070027372** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint)**

Yu, Zhou; Hagen, Josh A; Grote, James G; Steckl, Andrew J; Feb 2006; 6 pp.; In English

Report No.(s): AD-A467302; No Copyright; Avail.: Defense Technical Information Center (DTIC)

DNA and PPMA were doped with the laser dye sulforhodamine 640. Red emission was observed from both dye-doped DNA and PMMA upon photoexcitation. Photoluminescence (PL) emission was studied as a function of dye concentration. The

maximum PL intensity of dye in DNA host material is at least 17 times higher than that in PMMA. The DNA host shows higher doping concentration without optical quenching than PMMA does.

DTIC

*Deoxyribonucleic Acid; Doped Crystals; Dyes; Lasers; Photoluminescence*

**20070027427** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities**

Hudock, David M; Mar 2007; 132 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467551; AFIT/GES/ENV/07-M3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Surface coating operations at aircraft depot facilities are common throughout the Department of Defense (DoD). During paint application processes at Navy and Marine Corps Fleet Readiness Centers (FRCs), spray paints emit volatile organic compounds (VOCs) known to have harmful effects on human health and the environment. FRC East at Marine Corps Air Station Cherry Point, does not control the emissions of VOCs from any of its paint booths. The purpose of this research is to determine if FRC East and its surrounding area can benefit both economically and environmentally from a biofiltration system for air pollution control (APC) rather than the current conventional method of dry filtration. Dry filtration reduces only particulate matter in waste air streams and though there was no regulatory requirement to control VOC emissions at FRC East, the possibility exists that such legislation may be enacted in the future, affecting this facility and other similar DoD facilities. Three biofilters were designed for this study. The cost of each was analyzed using a net present value calculation and compared to potential monetary savings amongst the local population should VOC emissions from FRC East be controlled. Results show that FRC East and similar DoD facilities can benefit environmentally and economically from VOC control using biofiltration technologies.

DTIC

*Air Pollution; Coating; Control Equipment; Control Surfaces; Defense Program; Paints; Pollution Control*

**20070027501** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Development of ASTM Precision Bearing Grease Guide**

Rhee, In-Sik; Mar 30, 2007; 14 pp.; In English

Report No.(s): AD-A467746; TARDEC-17017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Lubricating grease is one of important operational parameter in the rolling bearing applications. Specially, the selection of the lubricating grease for the precision bearing applications is very risky due to many other factors unique to any specific precision bearing environments. For this reason, ASTM F-34 Tribology Subcommittee did a study to develop a Precision Bearing Grease Selection Guide in joint effort with the Department of Defense (DoD). The purpose of this study was to take a broad spectrum of lubricating greases used in precision bearings, including instrument bearings, and do a comprehensive series of tests so their properties could be compared. This study is also meant to be a design guide for choosing lubricating greases for future precision bearing applications. As a part of this study, thirty-eight lubricating greases, currently used in the precision bearings, were evaluated in comprehensive series of laboratory tests. Vital recommendations were then made based on a collective effort by members of this community, who span the spectrum from bearing manufacturers, original equipment manufactures (OEMs), grease manufacturers and suppliers, procurement specialists, quality assurance representatives (QARs) from DoD, and end users both inside and outside DoD. This study has been completed within ASTM F-34 Tribology Subcommittee and published as a new ASTM Standard Guide, F-2489. This paper presents the results of the grease testing program, grease selection guide, and recommendations.

DTIC

*Ball Bearings; Esters; Greases; Hydrocarbons*

**20070028577** Shapiro and Dupont, LLP, Santa Monica, CA, CA, USA

**Supported Metal Catalyst with Improved Thermal Stability**

Carter, E. A., Inventor; Jarvis, E. A., Inventor; 12 Jun 03; 7 pp.; In English

Contract(s)/Grant(s): AFOSR-F49620-00-1-0054

Patent Info.: Filed Filed 12 Jun 03; US-Patent-Appl-SN-10-518-129

Report No.(s): PB2007-104193; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Catalytic systems are provided that include a metallic catalyst attached to a ceramic support that has alumina as a principal ingredient. The ceramic support is doped with an adhesive agent so that the surface of the support includes the adhesive agent. The adhesive agent is designed to form an open-shell electronic structure at the interface between the metallic catalyst and

the support. The open-shell structure promotes extended useful catalyst lifetimes. The adhesive agents are early transition metals that include titanium, zirconium, scandium, hafnium, lanthanum and yttrium. Doping of the ceramic support surface with the adhesive agent also increases the adhesion between the ceramic support and metallic monoliths to which the ceramic support may be attached.

NTIS

*Catalysts; Thermal Stability; Metals; Aluminum Oxides*

**20070028582** California Univ., Berkeley, CA, USA

**Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein**

Vale, R. D., Inventor; Thorn, K., Inventor; Cooke, R., Inventor; Matuska, M., Inventor; Naber, N., Inventor; 14 Dec 04; 17 pp.; In English

Contract(s)/Grant(s): NIH-AR42895

Patent Info.: Filed Filed 14 Dec 04; US-Patent-Appl-SN-11-012-853

Report No.(s): PB2007-104187; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention features methods for purifying polypeptides of interest using a modified Fluorescein arsenical helix binder (FIAsH) compound immobilized on a solid support. An exemplary FIAsH target sequence motif is also presented. Examples of modification of the FIAsH compound which allow immobilization to a solid support are also provided. The present invention also provides DNA constructs for producing a dual affinity tagged polypeptide and methods for purification thereof.

NTIS

*Proteins; Arsenic; Purification; Polypeptides*

**20070028584** Jagtiani and Guttag, Fairfax, VA, USA

**Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings**

Gorman, M. D., Inventor; Spitsberg, I., Inventor; Boutwell, B. A., Inventor; Darolia, R., Inventor; Bruce, R. W., Inventor; 22 Apr 04; 11 pp.; In English

Contract(s)/Grant(s): N00019-96-C-0176

Patent Info.: Filed Filed 22 Apr 04; US-Patent-Appl-SN-10-830-685

Report No.(s): PB2007-104152; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Ceramic compositions comprising a main ceramic component comprising from about 63 to about 99 mole % zirconia and from about 1 to about 37 mole % hafnia. These compositions further comprise at least about 4 mole % of a stabilizer metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india, lanthana, gadolinia, neodymia, samaria, dysprosia, erbia, ytterbia, europia, praseodymia, and mixtures thereof. These ceramic compositions are useful in preparing thermal barrier coatings having reduced thermal conductivity for the substrate of articles that operate at, or are exposed to, high temperatures, as well as good producibility and impact/erosion resistance. Inclusion of hafnia also maintains the reduced conductivity of the thermal barrier coating after thermal exposure due to better sintering resistance.

NTIS

*Ceramics; Metal Oxides; Thermal Control Coatings; Zirconium Oxides*

**20070028586** Massachusetts Univ., Lowell, MA, USA

**Post-Coupling Synthetic Approach for Polymeric Antioxidants**

Cholli, A. L., Inventor; Dhawan, A., Inventor; Kumar, V., Inventor; 21 Jan 05; 13 pp.; In English

Contract(s)/Grant(s): NSF-DMR-9986644

Patent Info.: Filed Filed 21 Jan 05; US-Patent-Appl-SN-11-040-913

Report No.(s): PB2007-104149; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of preparing an antioxidant polymer includes forming or obtaining a first polymer having reactive pendant groups, where the first polymer does not include cyclic anhydride repeat units, and derivatizing the first polymer with an antioxidant. Another method of preparing an antioxidant polymer includes forming or obtaining a first polymer having reactive pendant groups and derivatizing the first polymer with an antioxidant, where the antioxidant is attached to the first polymer by an acetal, amide, amine, carbamate, carbonate, ester, ether or thioether linkage or by a carbon-carbon bond. The invention is also directed to polymers that are generally prepared by these methods, compositions that include such polymers and methods of using such polymers.

NTIS

*Antioxidants; Polymers; Coupling*



**20070028588** Choate, Hall and Stewart, Boston, MA, USA

**pH Triggerable Polymeric Particles**

Little, S. R., Inventor; Lynn, D. M., Inventor; Anderson, D. G., Inventor; Langer, R. S., Inventor; 2 Dec 04; 106 pp.; In English

Contract(s)/Grant(s): NSF-ECC9843342; NIH-EB00244

Patent Info.: Filed Filed 2 Dec 04; US-Patent-Appl-SN-11-002 542

Report No.(s): PB2007-104019; No Copyright; Avail.: CASI: [A06](#), Hardcopy

A drug delivery system comprising pH triggerable particles is described. The pH triggerable particles comprise and agent(s) to be delivered, which is encapsulated in a matrix comprising a pH trigger agent and a polymer. Agents including nucleic acids may be delivered intracellularly using the inventive pH triggerable particles. Upon exposure to an acidic environment such as the endosome or phagosome of a cell, the particles dissolve or disrupt due to protonation or an increase in solubility of the pH triggering agent. Pharmaceutical compositions and methods of preparing and administering these particles are also described. These particles may be particularly useful in genetic vaccination.

NTIS

*Drugs; pH; Polymers; Particles*

**20070028605** Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA

**Compliant, Nanoscale Free-Standing Multilayer Films**

Tsukruk, V. V., Inventor; 27 Sep 04; 33 pp.; In English

Contract(s)/Grant(s): F496200210205; NSF-CTS0210005

Patent Info.: Filed Filed 27 Sep 04; US-Patent-Appl-SN-10-951-035

Report No.(s): PB2007-104585; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The central metal interlayer can be used in sensors to enhance an optical response and detect surface plasmon resonances from the deflected membranes as will be discussed hereinbelow. Uniform nanoscale films that have a thickness in the range from 20 to 70 nm, depending on the numbers of layers, can be constructed using with a spin-assisted layer-by-layer LbL (SA-LbL) assembly method. The films can be fabricated within several minutes unlike usual methods requiring several hours. The films of the invention can sustain significant, multiple elastic deformations with a life time of at least ten million cycles. The parameters achieved here (the elastic modulus of about 10-50 GPa, e.g., about 30-40 GPa, the ultimate strain of 2%, and the ultimate tensile strength of 130 MPa) surpass those known for much thicker (microns) nanoparticle-containing free standing LbL films. The membrane of the present invention can be prepared by a process comprising depositing layers of the cationic polymer, the anionic polymer, and the inert nanoparticles layer-by-layer using spin-assisted deposition, onto the surface of a substrate.

NTIS

*Elastic Properties; Thin Films; Nanotechnology; Fabrication*

**20070028689** Michigan Biotechnology Inst., Lansing, MI USA

**Large Scale Green Synthesis of 1,2,4-Butanetriol**

Saffron, Christopher; Frost, John W; Mar 31, 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0207

Report No.(s): AD-A466203; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466203>

*Escherichia coli* W3110 was successfully modified to produce D-1,2,4-butanetriol (D-BT) in concentrations exceeding 10 g/L by conversion of D-xylose. The modified strain, *E. coli* WN13, was scaled from 1 L (bench scale) to 100 L (pilot scale) fermentor working volumes at MBI International. D-BT was isolated from fermentation broth by a succession of downstream unit operations, including: filtration, ion exchange, evaporation and distillation. Five-hundred milliliters of D-BT was collected and delivered to the Indian Head Division of the Naval Surface Warfare Center for nitration and testing. 'Green' D-BT was nitrated to D-1,2,4-butanetriol trinitrate (D-BTTN) and formulations including this D-BTTN had comparable performance metrics as synthetic D-BTTN. An economic model was constructed to determine the efficacy of the current process and to provide direction for the green production of D-BT.

DTIC

*Alcohols; Synthesis (Chemistry)*

**20070028732** National Inst. for Aviation Research, Wichita, KS, USA

**Best Practice in Adhesive-Bonded Structures and Repairs**

Davis, M.; Tomblin, J.; Apr. 2007; 58 pp.; In English

Report No.(s): PB2007-109833; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The opinions expressed in this technical note were presented at the Federal Aviation Administration (FAA) Bonded Structures workshop in 2004. The FAA, realizing their value, commissioned a written record of these observations and recommendations. These observations and recommendations represent the experiences, some anecdotal, in the application and maintenance of bonded structures on one group. This document does not represent a comprehensive survey and analysis of the failures or best corrective actions for bonded structures, but data that resulted from real-world applications and experience with disbands and other adhesive failures in structural applications.

NTIS

*Adhesive Bonding; Procedures; Bonded Joints*

**20070028734** Rice Univ., Houston, TX USA

**Development and Testing of Flame Retardant Additives and Polymers**

Jurs, J. L.; Apr. 2007; 303 pp.; In English

Report No.(s): PB2007-109832; No Copyright; Avail.: CASI: [A14](#), Hardcopy

Novel flame-retardant chemical additives and polymers were synthesized and their flammability measured in the Underwriters Laboratory test for flammability of plastics (UL94). Self-extinguishing (V-0) compositions were obtained for poly (acrylonitrile-butadiene-styrene) and high-impact polystyrene by adding as little as 10 weight percent of boronic acid derivatives or halogen-containing bisphenylethenes (BPH). Self-extinguishing (V-2) compositions were obtained for polyethylene by adding as little as 10 weight percent BPH. The efficacy of BPH additives as flame-retardants suggested incorporating these moieties directly into the polymer to further reduce flammability. Polymers and copolymers were synthesized having BPH backbone and pendant groups, including backbone copolymers containing acetylene and phosphineoxide. The thermal combustion properties of polymers containing a BPH backbone or pendant groups were measured by microscale combustion calorimetry and found to be among the lowest values ever recorded, suggesting that aircraft cabin materials made from these polymers would be ultra-fire-resistant.

NTIS

*Additives; Flame Retardants; Flammability*

**20070028735** Lawrence Livermore National Lab., Livermore, CA USA

**Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance**

Chinn, S. C.; Herberg, J. L.; Gjersing, E. L.; Cook, A.; Sawvel, A. M.; Oct. 03, 2006; 7 pp.; In English

Report No.(s): DE2007-896607; UCRL-CONF-224975; No Copyright; Avail.: National Technical Information Service (NTIS)

In an effort to develop a magnetic resonance based diagnostic tool to be used for polymer production and surveillance, we have investigated the use of magnetic resonance imaging (MRI) and unilateral relaxometry. MRI provides a spatial map of the polymer, which can be correlated to the structure heterogeneity. Though highly detailed information can be obtained with MRI, the high equipment cost and expertise required to operate the system makes it a poor choice for a production setting. Unilateral relaxometry via the NMR MOUSE provides rapid, inexpensive polymer screening, useful in the development in new polymer parts or to identify potentially defective components. The NMR ProFiler (originally called the NMR MOUSE) was procured by Kansas City originally for production support of the W80 LEP with future applications as a surveillance diagnostic. A robotic autosampler has been designed allowing the detection of several components without the need for any human interaction. A summary of the qualification experiments and results to date from the ProFiler and the robotic unit will be presented.

NTIS

*Diagnosis; Magnetic Resonance; Surveillance; Polymers*

**20070028878** Lawrence Livermore National Lab., Livermore, CA USA

**Final Report LDRD 04-ERD-021**

Bringa, E.; Feb. 28, 2007; 6 pp.; In English

Report No.(s): DE2007-902248; UCRL-TR-228484; No Copyright; Avail.: Department of Energy Information Bridge

In this project, we performed experiments and simulations to establish constitutive models for plastic behavior and to

determine the deformation mechanism of nanocrystalline materials at different grain sizes (<100 nm) and high strain rates (>10<sup>6</sup>/s). The experiments used both laser-induced shocks and isentropic compression to investigate, for the first time, the high-strain-rate deformation of nanocrystalline Ni. Samples were characterized using transmission electron microscopy, nanoindentation, profilometry, and x-ray diffraction before and after loading. We validated constitutive models using both atomistic molecular dynamics and continuum simulations performed at the boundary of their current computational possibilities to match experimental scales.

NTIS

*Nanoindentation; Nanocrystals*

**20070029271** Jenkins, Wilson, Taylor and Hunt, P.A., Durham, NC, USA  
**Cloning and Characterization of SLC26A7 and SLC26A9 Anion Exchangers**

Romero, M. F., Inventor; Mount, D. B., Inventor; 28 Feb 03; 70 pp.; In English

Contract(s)/Grant(s): RO1-DK038226; RO1-DK56218

Patent Info.: Filed 28 Feb 03; US-Patent-Appl-SN-10-505 316

Report No.(s): PB2007-104627; No Copyright; Avail.: CASI: A04, Hardcopy

Isolated nucleic acids encoding SLC26A7 and SLC26A9 anion transporter polypeptides, recombinantly expressed SLC26A7 and SLC26A9 anion transporter polypeptides, heterologous expression systems for recombinant expression of SLC26A7 and SLC26A9 anion transporter polypeptides, assay methods employing the same, and methods for modulation of anion transport activity.

NTIS

*Anions; Characterization; Cloning (Biology); Microbiology*

**20070029272** National Defence Research Establishment, Umea, Sweden  
**Kapillaerelektrofores i Tva Dimensioner. Slutrapport Fran Innovationsprojekt 14215 (Two-Dimensional Capillary Electrophoresis Final Report of the Innovative Project 14215)**

Bergstroem, T.; Oestin, A.; Nilsson, C.; Dec. 2005; 36 pp.; In Swedish

Report No.(s): PB2007-106438; FOI-R-1778-SE; No Copyright; Avail.: National Technical Information Service (NTIS)

When analyzing complex protein mixtures, two-dimensional gel electrophoresis is often used. This technique is time-consuming, demands special instrumentation and includes many manual steps. By using capillary based methods in a two-dimensional combination, smaller sample amounts can be used, the total time of analysis is shortened and the manual steps are reduced. The first dimension is capillaryisoelectric focusing, where proteins are separated according to the pI. The separated and focused proteins are then transformed to the second dimension via an enzymatic column where they are digested into peptides. In the second dimension, these peptides are separated by liquid chromatography coupled to mass spectrometry. In the mass spectrometer, these individual peptides are identified and thereby the original proteins. This two-dimensional combination can both be used for analyzing complex protein mixtures and as a tool to get detailed information about the ricin toxin.

NTIS

*Electrophoresis; Capillary Tubes; Proteins; Mixtures*

**20070029276** Media and Process Technology, Inc., Pittsburgh, PA USA  
**Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor. Semi-Annual Technical Progress Report for April 1, 2006 to September 30, 2006**

Liu, P. K. T.; Jan. 12, 2007; 21 pp.; In English

Report No.(s): DE2007-900971; No Copyright; Avail.: National Technical Information Service (NTIS)

In the last report, we covered the experimental verification of the mathematical model we developed for WGS-MR, specifically in the aspect of CO conversion ratio, and the effect of the permeate sweep. Bench-top experimental study has been continuing in this period to verify the remaining aspects of the reactor performance, including hydrogen recovery ratio, hydrogen purity and CO contaminant level. Based upon the comparison of experimental vs simulated results in this period along with the results reported in the last period, we conclude that our mathematical model can predict reliably all aspects of the membrane reactor performance for WGS using typical coal gasifier off-gas as feed under the proposed operating condition. In addition to 250DGC, the experimental study at 225DGC was performed. As obtained at 250DGC, the predicted values match well with the experimental results at this lower temperature.

NTIS

*Coal; Gasification; Hydrogen; Hydrogen Production; Membranes*

**20070029344** Lawrence Livermore National Lab., Livermore, CA USA

**Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants**

Farmer, J. C.; Haslam, J.; Day, S.; Lian, T.; Saw, C.; Oct. 20, 2006; 14 pp.; In English

Report No.(s): DE2007-900167; UCRL-PROC-225429; No Copyright; Avail.: National Technical Information Service (NTIS)

Yttrium-containing SAM1651 (Fe48.0Cr15.0Mo14.0B6.0C15.0Y2.0), has a critical cooling rate (CCR) of approximately 80 Kelvin per second, while SAM2X5 (Fe49.7Cr17.7Mn1.9Mo7.4W1.6B15.2C3.8Si2.4) with no yttrium has a higher critical cooling rate of approximately 600 Kelvin per second. SAM1651s low CCR enables it to be rendered as a completely amorphous material in practical materials processes. Chromium (Cr), molybdenum (Mo) and tungsten (W) provide corrosion resistance; boron (B) enables glass formation; and rare earths such as yttrium (Y) lower critical cooling rate (CCR). The passive film stability of these Fe-based amorphous metal formulations have been found to be superior to that of conventional stainless steels, and comparable to that of Ni-based alloys, based on electrochemical measurements of the passive film breakdown potential and general corrosion rates.

NTIS

*Amorphous Materials; Brines; Calcium Chlorides; Corrosion Resistance; Iron; Metals; Sea Water; Tungsten; Yttrium*

**20070029349** Fish and Richardson, P.C., USA

**Storage, Generation, and Use of Hydrogen**

McClaine, A. W., Inventor; Rolfe, J. L., Inventor; Larsen, C. A., Inventor; Konduri, R. K., Inventor; Becker, F. E., Inventor; 7 Mar 05; 13 pp.; In English

Patent Info.: Filed Filed 7 Mar 05; US-Patent-Appl-SN-11-074 360

Report No.(s): PB2007-104620; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A composition comprising a carrier liquid; a dispersant; and a chemical hydride. The composition can be used in a hydrogen generator to generate hydrogen for use, e.g., as a fuel. A regenerator recovers elemental metal from byproducts of the hydrogen generation process.

NTIS

*Hydrogen; Regenerators; By-Products*

**20070029352** Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C., Boston, MA, USA; Yale Univ., New Haven, CT, USA

**Bioreactive Allosteric Polynucleotides**

Breaker, R. R., Inventor; 6 Oct 03; 54 pp.; In English

Contract(s)/Grant(s): NIH-GM-09343

Patent Info.: Filed Filed 6 Oct 03; US-Patent-Appl-SN-10-680 067

Report No.(s): PB2007-104615; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Polynucleotides having allosteric properties that modify a function or configuration of the polynucleotide with a chemical effector and/or physical signal are employed primarily as biosensors and/or enzymes for diagnostic and catalytic purposes. In some preferred embodiments, the polynucleotides are DNA enzymes that are used in solution/suspension or attached to a solid support as biosensors to detect the presence or absence of a compound, its concentration, or physical change in a sample by observation of self-catalysis. Chemical effectors include organic compounds such as amino acids, amino acid derivatives, peptides, nucleosides, nucleotides, steroids, and mixtures of these with each other and with metal ions, cellular metabolites or blood components obtained from biological samples, steroids, pharmaceuticals, pesticides, herbicides, food toxins, and the like. Physical signals include radiation, temperature changes, and combinations thereof.

NTIS

*Polynucleotides; Deoxyribonucleic Acid; Enzymes; Detection*

**20070029354** Lawrence Livermore National Lab., Livermore, CA USA

**X ray Diffraction Techniques for Structural Determination of Amorphous Materials**

Saw, C. K.; Lian, T.; Day, S. D.; Farmer, J. C.; Oct. 18, 2006; 30 pp.; In English

Report No.(s): DE2007-900132; UCRL-TR-225388; No Copyright; Avail.: Department of Energy Information Bridge

Prevention of corrosion is a vital goal for the Department of Defense when billions of dollars are spent every year. Corrosion resistant materials have applications in all sort of military vehicles, and more importantly in naval vessels and submarines which come in contact with the seawater. An important application of the corrosion resistant material is in the

radioactive waste disposable field where the vessels or containers are expected to hold the radioactive toxic materials for thousands of years to surpass the half life of the radiation. It has been known that corrosion resistance can be improved by the used of structurally designed materials in the amorphous state where the atoms are arranged in a non-periodic conditions, even though, some local chemical short range ordering may occur in the amorphous arrangement. On the other hand, the final material can also be elementally tailored to specific application. This work documents in details the characterization effort for the amorphous materials using x-ray diffraction technique as part of the High Performance Corrosion-Resistant Material Structural Amorphous Metal (HPCRM-SAM) program here at LLNL. The samples are in the form of powders, ribbons and coatings deposited onto parts. Some brief theoretical background is given in order to interpret the results, instrumentation will also be described. The results suggest that the formation of amorphous phase in the metal alloys powders greatly depends on the processing conditions. In most of the powders, especially lot number 06, the result indicates that the materials are amorphous with a very small amount of iron boron alloy. In the ribbon samples, all the samples and of different compositions as well are observed to be amorphous. In most cases, starting from an amorphous powder sample, the coatings are also observed to be amorphous with a small amount of iron oxide, probably due to exposure to air during the thermal spraying process.

NTIS

*Amorphous Materials; X Ray Diffraction*

**20070029355** Lawrence Livermore National Lab., Livermore, CA USA

**Sinodal Decomposition and Order Disorder Transformation in a Water Quenched U-6wt%Nb Alloy**

Hsiung, L.; Zhou, J.; Sep. 14, 2006; 30 pp.; In English

Report No.(s): DE2007-900131; UCRL-TR-224432; No Copyright; Avail.: National Technical Information Service (NTIS)

A combinative approach of microhardness testing, tensile testing, and TEM microstructural analysis has been employed to study phase stability and aging mechanisms of a water-quenched U-6wt%Nb (WQU6Nb) alloy subjected to different aging schedules that include artificial aging of WQ-U6Nb at 200 degrees C, natural aging of WQ-U6Nb at ambient temperatures for 15 to 18 years, and accelerative aging of the naturally aged (NA) alloy at 200 degrees C. During the early stages of artificial aging at 200 degrees C, the microhardness values continuously increase as a result of the development of a fine-scale compositional modulation (wavelength: 3 nm) caused by spinodal decomposition. Coarsening of the modulated structure occurs after prolonged aging of WQ-U6Nb at 200 degrees C for 16 hours, which leads to a decrease of microhardness. Phase instability has also been found to occur in the NA alloy, in which the formation of partially ordered phase domains resulting from an atomic-scale spinodal modulation (wavelength: 0.5 nm) renders the appearance of antiphase domain boundaries (APBs) in TEM images. Although 18-year natural aging does not cause a significant change in hardness, it affects dramatically the aging mechanism of WQ-U6Nb subjected to the accelerative aging at 200 degrees C. The result of microhardness measurement shows that the hardness values continuously increase until after aging for 239 hours, and the total hardness increment is twice in magnitude than that in the case of the artificial aging of water-quenched alloy at 200 degrees C. The anomalous increment of hardness for the accelerative aging of NA alloy can be attributed to the precipitation of an ordered U3Nb phase. It is accordingly concluded that the long-term natural aging at ambient temperatures can detour the transformation pathway of WQ U(sub 3)6Nb alloy; it leads to the order-disorder transformation and precipitation of ordered phase in the alloy.

NTIS

*Decomposition; Order-Disorder Transformations; Water*

**20070029360** Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA

**Immobilized Iminophosphatranes Useful for Transesterification**

Verkade, J. G., Inventor; Liu, V. S. Y., Inventor; Sarkar, A., Inventor; 16 Nov 04; 14 pp.; In English

Contract(s)/Grant(s): 2001-52104-11227

Patent Info.: Filed Filed 16 Nov 04; US-Patent-Appl-SN-10-989 538

Report No.(s): PB2007-104625; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides a method for transesterifying an ester, comprising combining the ester, a C(sub 1)-C(sub 3) alcohol, and a heterogeneous catalyst of formula (I) or formula (II) wherein R', R'' and R''' are each H, (C(sub 1)-C(sub 8))alkyl, (C(sub 6)-C(sub 9))aryl, or (alk)(sub 3)Si, wherein each alk is (C(sub 1)-C(sub 4))alkyl; L is an organic linking moiety and X is a solid support material, and the salts thereof under conditions wherein the catalyst catalyzes the formation of the (C(sub 1)-C(sub 3)) ester of the acid portion of the ester and the corresponding free alcohol of the ester.

NTIS

*Esters; Alcohols; Catalysts; Catalytic Activity*

**20070029367** Burns Doane Swecker and Mathis, LLP, Alexandria, VA, USA

**High Throughput Screening of Crystallization of Materials**

Quake, S. R., Inventor; Hansen, C. L., Inventor; Berger, J. M., Inventor; 12 Apr 05; 64 pp.; In English

Contract(s)/Grant(s): NIH-HG-01642-02

Patent Info.: Filed Filed 12 Apr 05; US-Patent-Appl-SN-11-103 599

Report No.(s): PB2007-104652; No Copyright; Avail.: CASI: [A04](#), Hardcopy

High throughput screening of crystallization of a target material is accomplished by simultaneously introducing a solution of the target material into a plurality of chambers of a microfabricated fluidic device. The microfabricated fluidic device is then manipulated to vary the solution condition in the chambers, thereby simultaneously providing a large number of crystallization environments. Control over changed solution conditions may result from a variety of techniques, including but not limited to metering volumes of crystallizing agent into the chamber by volume exclusion, by entrapment of volumes of crystallizing agent determined by the dimensions of the microfabricated structure, or by cross-channel injection of sample and crystallizing agent into an array of junctions defined by intersecting orthogonal flow channels.

NTIS

*Crystallization; Targets*

**20070029368** Peabody (Nixon), LLP, Rochester, NY, USA

**Liquid Mixing Reactor for Biochemical Assays**

Franck, C. P., Inventor; Lis, J. T., Inventor; Boehm, A. K., Inventor; 3 Sep 04; 15 pp.; In English

Contract(s)/Grant(s): NSF-DMR-0079992

Patent Info.: Filed Filed 3 Sep 04; US-Patent-Appl-SN-10-934 894

Report No.(s): PB2007-104614; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates to methods of reacting a receptor and a target. A reaction liquid having one or more receptors and one or more targets is provided. A confining fluid that is immiscible with the reaction liquid is positioned adjacent a first surface of the reaction liquid. The confining fluid is stirred, thereby allowing the one or more receptors and one or more targets to react with each other. Alternatively, a coverplate is positioned adjacent a first surface of the reaction liquid and reaction between the receptors and targets occurs upon rotating the coverplate. Also disclosed is a system for reacting a receptor and a target. The system involves a holding device having a reaction liquid, a confining fluid adjacent a first surface of the reaction liquid, and a mixing device positioned within the confining fluid. Alternatively, the system can be a substrate, a rotating coverplate, and a reaction liquid between the substrate and the coverplate.

NTIS

*Assaying; Biochemistry; Targets; Surface Reactions*

**20070029370** Williams (Hovey), LLP, Kansas City, MO, USA

**Microsystem Enclosure and Method of Hermetic Sealing**

Morgenstern, H., Inventor; Kautz, D., Inventor; Blazek, R. J., Inventor; 15 Mar 05; 6 pp.; In English

Contract(s)/Grant(s): DE-AC04-01; DE-AL66850

Patent Info.: Filed Filed 15 Mar 05; US-Patent-Appl-SN-11-079 985

Report No.(s): PB2007-104649; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A microsystem enclosure for hermetically sealing and thereby protecting a microsystem located on a substrate from the potentially damaging effects of exposure to moisture, dust, and other external environmental or operating conditions. The enclosure broadly comprises a single-piece hermetic cover structure and a single solder preform. The preform facilitates sealing the cover to the substrate in high-temperature, single-step process so as to create a hermetic cavity wherein the microsystem resides.

NTIS

*Enclosure; Hermetic Seals; Sealing*

**20070029373** Senterfitt (Akerman), West Palm Beach, FL, USA

**High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus**

Beu, S. C., Inventor; Blakney, G. T., Inventor; Quinn, J. P., Inventor; Hendrickson, C. L., Inventor; Marshall, A. G., Inventor; 4 Feb 05; 23 pp.; In English

Contract(s)/Grant(s): NSF-CHE-99-09502

Patent Info.: Filed Filed 4 Feb 05; US-Patent-Appl-SN-11-051 092

Report No.(s): PB2007-104645; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A high resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) mass spectrometry system includes excitation circuitry including an excitation amplifier for generating an electrical excitation signal and excitation electrodes for applying an oscillating electric field to excite ions in the system. Detection circuitry including detection electrodes measures a detection signal which includes a plurality of signal values including signal values induced by the ions. Structure is provided for reducing or canceling coupling of the excitation signal into the detection signal, wherein simultaneous excitation and detection is used. A computing structure generates a Fourier transformed frequency domain representation of the detection signal and deconvolves the frequency domain representation using complex division to separate a dispersion spectrum portion and an absorption spectrum portion.

NTIS

*Cyclotron Resonance; Fourier Transformation; High Resolution; Ion Cyclotron Radiation; Mass Spectroscopy*

**20070029375** Orrick, Herrington and Sutcliffe, LLP, Irvine, CA, USA; California Univ., Oakland, CA, USA

**Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials**

Allbritton, N., Inventor; Sims, C. E., Inventor; Li, G. P., Inventor; Backman, M., Inventor; Hu, S., Inventor; 13 May 03; 32 pp.; In English

Contract(s)/Grant(s): NIH-CA78858; NIH-RR/CA114892

Patent Info.: Filed Filed 13 May 03; US-Patent-Appl-SN-10-511 788

Report No.(s): PB2007-104129; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Polymer-based biomaterials are popular due to ease of fabrication and low costs. However, many polymer substrates have undesirable surface properties. The invention provides a procedure to covalently apply a graft polymer to the surface of a polymer substrate by ultraviolet graft polymerization. The graft polymer is formed from monomers such as PEG, AA, monomethoxy acrylate PEG, HEMA, or DMA. Also, mixed monomers may be used to create the graft and the surface properties of the graft may be tailored for different properties, including hydrophobicity, friction coefficient, electroosmotic mobilities and electrophoretic separations. The invention has particular utility in tailoring surface chemistries in ocular lenses and polymer microdevices.

NTIS

*Grafting; Patent Applications; Polymers; Surface Properties*

**20070029383** Caesar, Rivise, Bernstein, Cohen and Pokotilow, Ltd., Philadelphia, PA, USA

**Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof**

Levy, R. J., Inventor; Alferiev, I., Inventor; Stachelek, S. J., Inventor; 8 Jul 04; 38 pp.; In English

Contract(s)/Grant(s): NHLBI-HL-59730

Patent Info.: Filed Filed 8 Jul 04; US-Patent-Appl-SN-10-521 994

Report No.(s): PB2007-104109; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A modified polyurethane including a lipid substituent pendant from at least one urethane nitrogen and/or at least one carbon atom of the modified polyurethane, methods of preparing modified polyurethanes and the use thereof as an implantable biomaterial.

NTIS

*Implantation; Lipids; Patent Applications; Polyurethane Resins; Steroids*

**20070029390** Needle and Rosenberg, P.C., Atlanta, GA, USA

**Crosslinked Compounds and Methods of Making and Using Thereof**

Prestwich, G. D., Inventor; Shu, X. Z., Inventor; Luo, Y., Inventor; Kirker, K. R., Inventor; Liu, Y., Inventor; 15 May 03; 52 pp.; In English

Contract(s)/Grant(s): NIH-5R01-DC04663

Patent Info.: Filed Filed 15 May 03; US-Patent-Appl-SN-10-519 173

Report No.(s): PB2007-104640; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Described herein are crosslinked compounds useful in numerous treatments. Described herein are methods of making crosslinked compounds via (1) the oxidative coupling of two or more thiol compounds or (2) by the reaction between at least one thiol compound with at least one thiol-reactive compound.

NTIS

*Crosslinking; Reactivity; Thiols*

**20070029409** Reed Intellectual Property Law Group, USA; California Inst. of Tech., Pasadena, CA USA  
**Telechelic Alkadiene Polymers with Crosslinkable End Groups and Methods for Making the Same**  
Maughon, B. R., Inventor; Morita, T., Inventor; Grubbs, R. H., Inventor; 22 Feb 05; 17 pp.; In English  
Contract(s)/Grant(s): CHE-9509745

Patent Info.: Filed Filed 22 Feb 05; US-Patent-Appl-SN-11-064 033

Report No.(s): PB2007-104630; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates to telechelic polymers and methods for making the same. More particularly, the present invention relates to telechelic polymer segments of controlled molecular weight having crosslinkable end groups and methods for preparing the same.

NTIS

*Crosslinking; Polymers*

**20070029410** Heslin Rothenberg Faley and Mesiti, P.C., Albany, NY, USA

**High Throughput Screening of Potential Displacer Molecules**

Cramer, S. M., Inventor; Rege, K., Inventor; Dordick, J., Inventor; Tugcu, N., Inventor; 11 Apr 05; 21 pp.; In English  
Contract(s)/Grant(s): GM47372-04A2

Patent Info.: Filed Filed 11 Apr 05; US-Patent-Appl-SN-11-103 293

Report No.(s): PB2007-104629; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A bioproduct may be selectively separated from one or more impurities by means of a displacement chromatography system that includes a solvent, a chromatographic resin and a chemically selective displacer. The method includes: dissolving the bioproduct and the one or more impurities in a solvent; loading the bioproduct and the one or more impurities, in the solvent, on a chromatographic resin; displacing the bioproduct from the chromatographic resin with chemically selective displacer; and retaining the one or more impurities on the chromatographic resin. For this method, the bioproduct and the impurities have similar binding affinity for the chromatographic resin in the absence of the displacer.

NTIS

*Molecules; Displacement; Chromatography*

**20070029427** Stanford Linear Accelerator Center, CA, USA

**Theory for the RF Surface Field for Various Metals at the Destructive Breakdown Limit**

Wilson, P. B.; Feb. 2007; 15 pp.; In English

Report No.(s): DE2007-900599; SLAC-PUB-12354; No Copyright; Avail.: Department of Energy Information Bridge

This is a slightly revised version of the paper that will be published in the AAC06 proceedings. A number of minor changes have been made in the interest of clarity. A significant revision, however, has been made in the treatment of backscattering of incident electrons from a metal surface. In the conference publication it was assumed that incident electrons were backscattered without energy loss. In this publication the energy spectrum of the backscattered electrons is taken into account. This revision does not significantly change the conclusions concerning the relative resistance of various metals to breakdown.

NTIS

*Destruction; Electromagnetic Fields; Metals; Radio Frequencies*

**20070029439** Environmental Protection Agency, Washington, DC, USA

**Health Effects Support Document for Terbacil**

Aug. 2006; 56 pp.; In English

Report No.(s): PB2007-109909; EPA/822/R-06-010; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The U.S. Environmental Protection Agency (EPA) has prepared this Health Effects Support Document for Terbacil to support a determination regarding whether to regulate terbacil with a National Primary Drinking Water Regulation (NPDWR). The available data on occurrence, exposure, and other risk considerations suggest that, because terbacil does not occur in public water systems at frequencies and levels of public health concern, regulating terbacil will not present a meaningful opportunity to reduce health risk. EPA will present a determination and further analysis in the Federal Register Notice covering the CCL proposals.

NTIS

*Animals; Chemical Analysis; Hazards; Methyl Compounds; Radicals; Uracil; Water Pollution; Public Health*



**20070029457** Association of American Railroads, Pueblo, CO, USA

**In-Track Demonstration of Laser-Treated Rail to Reduce Friction and Wear**

Reiff, R.; May 2007; 76 pp.; In English

Contract(s)/Grant(s): DTFR-53-00-C-00012

Report No.(s): PB2007-110334; No Copyright; Avail.: National Technical Information Service (NTIS)

In-track evaluations of a laser-treated rail intended to provide a permanent reduction of the friction level and increased wear life were conducted at the Transportation Technology Centers Facility for Accelerated Service Testing, Heavy Axle Load track in Pueblo, CO. These evaluations were conducted during the October 2005 operating period. Results suggest that the cracks formed during the laser treatment process led to early spalling and chipping of the gage corner, requiring removal of the test rail from the track. Limited data suggests that the treatment process did not significantly reduce gage face rolling friction.

NTIS

*Friction Reduction; Industries; Lasers; Rail Transportation; Rails; Wear*

**20070029465** Texas A&M Univ., College Station, TX USA

**Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates**

Lytton, R.; Arambula, E.; Bhasin, A.; Branco, V. C.; Howson, J.; Aug. 2006; 2 pp.; In English

Report No.(s): PB2007-110223; REPT-0-4524-S; No Copyright; Avail.: CASI: [A01](#), Hardcopy

Moisture damage in asphalt mixtures can occur within the asphalt mastic (cohesive fracture) or at the aggregate-mastic interface (adhesive fracture or failure). Whether or not a cohesive or adhesive failure occurs depends on the nature of the mastic and the relative thickness of the mastic. The majority of previous studies on this subject focused on the development of mixture tests and empirical parameters to quantify moisture sensitivity of asphalt mixtures. This project was conducted to attain fundamental understanding of the moisture damage process by carefully considering the mechanisms that influence durability of the adhesive interface between aggregate and asphalt and the cohesive strength and durability of the mastic.

NTIS

*Aggregates; Asphalt; Concretes; Damage; Moisture; Surface Energy*

**20070029467** Texas A&M Univ., College Station, TX USA

**System for the Evaluation of Moisture Damage Using Fundamental Material Properties**

Howson, J.; Masad, E. A.; Bhasin, A.; Branco, V. C.; Arambula, E.; May 2007; 188 pp.; In English

Report No.(s): PB2007-110219; REPT-0-4524-1; No Copyright; Avail.: National Technical Information Service (NTIS)

Moisture damage in asphalt mixtures can occur within the mastic (cohesive fracture) or at the aggregate-mastic interface (adhesive fracture or failure). Whether or not a cohesive or adhesive failure occurs depends on the nature of the mastic and the relative thickness of the mastic. This report is part of a project that focused on fundamental understanding of the moisture damage process by carefully considering the micro-mechanisms that influence the adhesive interface between aggregate and asphalt and the cohesive strength and durability of the mastic. The first phase of the project focused on the validation of the surface energy measurements and the dynamic mechanical analysis (DMA) of mastics through the evaluation of the moisture susceptibility of materials with known field performance. The results of the first phase of this project were documented in TxDOT report 0-4524-2. The second phase of the project, which is documented in this report, focused on the evaluation of the surface energy and moisture susceptibility of wide combinations of aggregates and asphalts.

NTIS

*Asphalt; Damage; Moisture; Pavements; Systems Analysis*

**20070029470** Carrithers Law Office, PLLC, Louisville, KY, USA

**Tubular Carbon Nano/micro Structures and Method of Making Same**

Sunkara, M. K., Inventor; Bhimarasetti, G., Inventor; 9 Sep 04; 16 pp.; In English

Contract(s)/Grant(s): NSF-9876259

Patent Info.: Filed 9 Sep 04; US-Patent-Appl-SN-10 937 738

Report No.(s): PB2007-104137; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of synthesizing and controlling the internal diameters, conical angles, and morphology of tubular carbon nano/micro structures. Different morphologies can be synthesized included but not limited to cones, straight tubes, nozzles, cone-on-tube (funnels), tube-on-cone, cone-tube-cone, n-staged structures, multijunctioned tubes, Y-junctions, dumbbell (pinched morphology) and capsules. The process is based on changing the wetting behavior of a low melting metals such as

gallium, indium, and aluminum with carbon using a growth environment of different gas phase chemistries. The described carbon tubular morphologies can be synthesized using any kind of gas phase excitation such as, but not limited to, microwave excitation, hot filament excitation, thermal excitation and Radio Frequency (RF) excitations. The deposition area is only limited by the substrate area in the equipment used and not limited by the process. The internal diameters of the carbon tubular structures can be varied from a few nm to as high as about 20 microns. The wall thickness is about 10-20 nm. The carbon tubular structures can be formed open on both ends are directly applicable to micro-fluidics. Gallium required for the growth of the carbon tubes can be supplied either as a thin film on the substrate or could be supplied through the gas phase with different precursors such as Tri-methyl gallium. Seamless Y-junctions with no internal obstructions can be synthesized without the need of templates. Multi-channeled junctions can also be synthesized without any internal obstructions. Gallium that partially fills the carbon structures can be removed from the tubes by simple heating in vacuum at temperature above 600 degree.

NTIS

*Carbon; Carbon Nanotubes; Morphology; Patent Applications; Synthesis (Chemistry)*

**20070029471** Battelle Memorial Inst., Columbus, OH USA

**Chemical Management Resource Guide for School Administrators**

Dec. 2006; 42 pp.; In English

Contract(s)/Grant(s): EPA-EP-W-04-021

Report No.(s): PB2007-110360; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The sources of dangerous chemicals in schools are not always obvious. This guidance applies to any school that purchases, uses, stores, or disposes of chemicals or products containing dangerous materials. Some of the most common dangerous chemical products in schools include: Laboratory chemicals (e.g., acids, bases, solvents, metals, salts); Industrial arts or shop classes (e.g., inks, degreasers); Art supplies (e.g., paints, photographic chemicals); Pesticides, fertilizers, and de-icers; Maintenance supplies and equipment (e.g., drain cleaners, floor stripping products, paints, oils, boiler cleaners, fuels, mercury switches and gauges); Health care equipment (e.g., mercury thermometers).

NTIS

*Schools; Chemicals; Management*

**20070029474** Fulbright and Jaworski, San Antonio, TX, USA

**System and Method for Field Testing a Tack Coat Layer**

Tandon, V., Inventor; 9 Sep 04; 26 pp.; In English

Contract(s)/Grant(s): DOT-0-4129

Patent Info.: Filed 9 Sep. 04; US-Patent-Appl-SN-10-937 102

Report No.(s): PB2007-104134; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Methods and systems are disclosed for evaluating an adhesive layer such as a tack coat. In one embodiment, a portable apparatus is provided to test a tack coat layer prior to applying an overlay. The portable apparatus includes a tripod configuration placed on a surface, a plate conformed to the surface by a load and a torque wrench-applying a pull-off force to test the strength of the surface. In other embodiments, a portable apparatus is provided to test a tack coat layer prior to applying an overlay, where the portable apparatus does not include support members.

NTIS

*Adhesion Tests; Bitumens; Field Tests; Patent Applications*

**20070029478** Christie, Parker and Half, LLP, Pasadena, CA, USA

**Polymers for Orientation and Stability of Liquid Crystals**

Kornfield, J. A., Inventor; Kempe, M. D., Inventor; 19 Nov 04; 21 pp.; In English

Contract(s)/Grant(s): F49620-97-1-0014

Patent Info.: Filed 19 Nov. 04; US-Patent-Appl-SN-10-993 575

Report No.(s): PB2007-108627; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An electro-optically active polymer gel material comprising a high molecular weight alignment polymer adapted to be homogeneously dispersed throughout a liquid crystal to control the alignment of the liquid crystal molecules and/or confer mechanical stability is provided. The electro-optically active polymer gel comprises a homogenous gel in which the polymer strands of the gel are provided in low concentration and are well solvated by the small molecule liquid crystal without producing unacceptable slowing of its electrooptic response. During formation of the gel, a desired orientation is locked into

the gel by physical or chemical cross-linking of the polymer chains. The electro-optically active polymer is then utilized to direct the orientation in the liquid crystal gel in the 'field off' state of a liquid crystal display. The electro-optically active polymer also provides a memory of the mesostructural arrangement of the liquid crystal and acts to suppress the formation of large scale deviations, such as, for example, fan-type defects in a FLC when subjected to a mechanical shock. A method of making an electro-optically active polymer gel material and an electrooptic device utilizing the electro-optically active polymer gel of the present invention is also provided.

NTIS

*Liquid Crystals; Stability; Polymers*

**20070029479** Princeton Resources, Inc., NJ, USA; Army Materiel Command, Aberdeen Proving Ground, MD, USA

**Proceedings of the Symposium on Ferroelectricity and Piezoelectricity (IMRC 2005)**

Cole, M. W.; Cobas, L. F.; January 2005; 212 pp.; In English; Symposium on Ferroelectricity and Piezoelectricity (IMRC 2005). Volume 83 (2006), 21-25 Aug. 2005, Cancun, Mexico

Report No.(s): PB2007-107283; Copyright; Avail.: National Technical Information Service (NTIS)

;Contents: Guest Editorial: Ferroelectricity and Piezoelectricity; Piezoresponse Force Microscopy of PLD-Grown Multiferroic BiFeO (sub 3) Films and Mesostructures; Performance of Microfabricated Piezoelectric Vibration Energy Harvesters; Synthesis and Magnetoelectric Characterization of Cobalt Ferrite-Barium Titanate Composites Using A New Pulsed Magnetic Field Method; Structural Characterization of Bi(sub 6)Ti(sub 3)Fe(Sub 2)O(sub 18) Obtained by Molten Salt Synthesis; Effective Coefficients for Two Phase Magneto-Electroelastic Fibrous Composite with Square Symmetry Cell In-Plane Mechanical Displacement and Out-of-Plane Electric and Magnetic Field Case; Polarization Variations Due to Dislocation Configurations in Heteroepitaxial Ferroelectric Layers; Structural and Ferroelectric Properties of (Pb(sub 0.93)La(sub 0.07))(Zr(sub 0.53)Ti(sub 0.47))O(sub 3) Thin Films; Microwave Magnetoelectric Effects and Signal Processing Devices; Material Properties of MOSD Derived Ba(sub 1-x)Sr(sub x)TiO(sub 3)-Based Thin Films for Pyroelectric Sensor Applications; Structural Characterization and Dielectric Properties of Gd Doped SrBi(sub 2)Ta(sub 2)O(sub 9); Crystallographically Aligned Terfenol-D/Polymer Composites for a Hybrid Sonar Device; Direct Integration of Thin Film Piezoelectric Sensors with Structural Materials for Structural Health Monitoring; Orientation Effects in Single Crystal Relaxer Rhombohedral Ferroelectric PZN -4.5% PT; In Situ Measurements of Stress with Temperatures in Thin Film Pb(sub x)Ba(sub 1-x)TiO(sub 3); Phase Transformation Characteristics of Ferroelectric Paraelectric Bilayers; Author Index; Color Plates; and Announcements.

NTIS

*Conferences; Ferroelectricity; Piezoelectricity*

**20070029480** UT-Battelle, LLC, Oak Ridge, TN, USA

**Motor Frame Cooling with Hot Liquid Refrigerant and Internal Liquid**

Hsu, J. S., Inventor; Ayers, C. W., Inventor; Coomer, C., Inventor; 25 Apr 05; 9 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Patent Info.: Filed 25 Apr. 05; US-Patent-Appl-SN-11-113 927

Report No.(s): PB2007-108626; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This invention presents the device and method for cooling electric machines with hot liquid refrigerant in a floating refrigerant loop and using an internal liquid such as oil for enhancing the cooling effects. The electric machine cooling apparatus has at least one refrigerant tube disposed in the electric machine. The refrigerant tube is in thermal communication with the electric machine. An internal liquid is disposed inside the frame of the electric machine. The internal liquid is in thermal communication with the electric machine and at least one refrigerant tube. The refrigerant is at least partially a hot liquid refrigerant supplied from a floating refrigerant loop.

NTIS

*Cooling; Electric Motors; Electronic Equipment; Refrigerants*

**20070029489** Proskauer Rose, LLP, Boston, MA, USA

**Mesostructured Zeolitic Materials, and Methods of Making and Using the Same**

Ying, J. Y., Inventor; Martinez, J. G., Inventor; 23 Apr 04; 33 pp.; In English

Contract(s)/Grant(s): DAAD19-02-D0002

Patent Info.: Filed 23 Apr 04; US-Patent-Appl-SN-10-830 714

Report No.(s): PB2007-104089; No Copyright; Avail.: CASI: A03, Hardcopy

One aspect of the present invention relates to mesostructured zeolites. The invention also relates to a method of preparing mesostructured zeolites, as well as using them as cracking catalysts for organic compounds and degradation catalysts for polymers.

NTIS

*Synthesis (Chemistry); Zeolites*

**20070029574** California Inst. of Tech., Pasadena, CA USA

**High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion**

Dimotakis, Paul E; May 25, 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0253; FA9550-07-1-0091; Proj-5094

Report No.(s): AD-A468803; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468803>

This report summarizes an equipment and instrumentation system for high-speed digital image data acquisition and processing. The research program targets the physics of turbulence, mixing, and combustion, focusing on high-speed environments. The system includes components for Planar Laser Induced Fluorescence (PLIF), flame-speed, and ignition and extinction measurements of laminar flames at variable pressure; tracking flow structures in a high-speed mixing layer using high-speed color schlieren; laser-beam manipulation and volume scanning for three-dimensional turbulence measurements; and an expanded infrastructure capability for processing experimental and numerical-simulation data.

DTIC

*Combustion; Data Acquisition; Digital Data; High Speed; Hydrocarbons; Image Processing; Laser Induced Fluorescence; Subsonic Flow; Supersonic Flow; Turbulence; Turbulent Mixing*

**20070029703** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection**

Logan, Thomas P; Allen, Edward D; Way, Mark R; Swift, Austin T; Soni, Sunil-Datta; Koplovitz, Irwin; Jan 2006; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468903; USAMRICD-P05-022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468903>

Preparation and analysis of tabun (GA) solutions are necessary for the continued development of countermeasures to this nerve agent. GA solutions must be stable and compatible for use in the test systems chosen for study; however, GA is very unstable in saline solutions. In the past we have found GA in saline at 2 micrograms/mL to be stable for a month or less at -70 degrees C, whereas saline solutions of sarin (GB), soman (GD), and cyclosarin (GF) were stable for many months. Previous studies have shown that Multisol (48.5% H<sub>2</sub>O, 40% propylene glycol, 10% ethanol, and 1.5% benzyl alcohol) provides stable solutions of GA. We confirmed the stability of GA in Multisol with phosphorus nuclear magnetic resonance (P-NMR) and developed a method for the analysis of GA in Multisol using gas chromatographic flame photometric detection (GCFPD) in the phosphorus mode. The GC method used acetonitrile (CH<sub>3</sub>CN) for a dilution solvent because of its miscibility with GA in chloroform (CHCl<sub>3</sub>) standards and GA in Multisol samples at 1% (v/v). Furthermore, the dilutions with CH<sub>3</sub>CN made the phosphorus mode interference peak present in CHCl<sub>3</sub> analytically manageable, reduced the interferences of Multisol in the GC separation, and contributed to a safe and reliable analysis of GA at 20 microgram/mL. We demonstrated the stability of GA in Multisol stored for more than a year at 70 degrees C. This method contributes a suitable technique for the preparation and analysis of reliable solutions of GA in nerve agent medical research and demonstrates the extended stability of GA in Multisol.

DTIC

*Detection; Flames; Gas Chromatography; Photometry*

**20070029938** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents**

Shih, Tsung-Ming; Kan, Robert K; McDonough, John H; Oct 26, 2005; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468835; USAMRICD-P05-006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468835>

The purpose of this project was to determine and compare the time-related changes in blood, brain, and tissue

acetylcholinesterase (AChE) activity during the first hour after exposure to six organophosphorus nerve agents (GA, GB, GD, GF, VR, and VX) in Hartley guinea pigs. Animals were pretreated with atropine methyl nitrate (1% .0 mg/kg, i.m.) to minimize peripheral toxic effects 15 min before they were given a 1.0 x LD50 subcutaneous dose of a nerve agent. At 0,5, 10, 15,30, and 60min after nerve agent, animals were humanely euthanized. Blood was collected and brain regions (brainstem, cortex, hippocampus, midbrain, cerebellum, striatum, and spinal cord) and peripheral tissues (diaphragm, skeletal muscle, and heart) were dissected and processed for AChE activity. All six nerve agents produced maximum inhibition of AChE in red blood cells between 5 and 10% of the control within 10min after exposure. In whole blood, differential effects were observed among the agents: GB, GD, and GF produced more rapid and greater inhibition than did GA, VR, and Vx. GF was the most rapid, producing a maximum inhibition to 5% of the control in 5 min. while VR and VX were slower reaching maximum inhibition to 30% of the control at 15 min. The enzyme activity in the majority of the brain regions was more markedly inhibited by the G-agents than by the V-agents. The G-agents caused rapid AChE inhibition, reaching maximum levels (20-30% of control) at 15 min and GA produced the most rapid effects. V-agents produced much slower and less AChE inhibition, reaching maximum (35-60% of control) at 30 min. In the diaphragm, VR, VX, and GD produced more rapid and greater AChE inhibition than other G-agents; GA produced the slowest and least inhibition. In the skeletal muscle, VX induced the most rapid and severe inhibition, while GA the least inhibition. In the heart, all agents produced very rapid inhibition, and GD produced the most severe inhibition of AChE activity.

DTIC

*Cholinesterase; In Vivo Methods and Tests; Inhibitors; Nerves; Organic Phosphorus Compounds*

**20070029969** Ohio State Univ., Columbus, OH, USA; Los Alamos National Lab., NM USA

**Micro and Nano-structure Development and Multiscale Physics at Sliding Metal Interfaces. Final Report May 2006**

Rigney, D. A.; Feb. 28, 2006; 28 pp.; In English

Contract(s)/Grant(s): DE-FG03-03NA00069

Report No.(s): DE2007-882935; DOE/NA/00069-FINAL; No Copyright; Avail.: National Technical Information Service (NTIS)

This final report describes research on the response of ductile materials to extreme loading conditions and high strain rates during impact combined with sliding friction. The work has involved a collaboration among two groups at Los Alamos National Laboratory and a tribology research group at The Ohio State University. The project involved experimental work and computer simulations at both laboratories and continuum mechanics analysis at OSU, supplemented by testing at AWE, Harwell, UK. Results demonstrated the importance of vorticity and mechanical mixing near the sliding interface in the development of nanocrystalline tribomaterial that is far from equilibrium. The work also revealed that strain rate sensitivity is an important materials property for determining the development of the velocity profile during sliding. As such, it is a property that is key to understanding the evolution of sliding behavior.

NTIS

*Ductility; Microstructure; Nanostructure (Characteristics); Sliding*

**20070029977** Louisiana State Univ., Baton Rouge, LA, USA

**Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions**

Fleeger, J. W.; Marlborough, S. J.; Gust, K. A.; Carman, K. R.; Silva, S.; May 2007; 40 pp.; In English

Report No.(s): PB2007-110196; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Studies suggest that metal-PAH interactions may be common among benthic copepods and that strong nonadditive effects observed in binary mixtures may be moderated in more diverse contaminant mixtures. Acute and sublethal mixture toxicology of the contaminants cadmium (Cd), mercury (Hg), lead (Pb), fluoranthene, and phenanthrene was investigated by using two species of meiobenthic harpacticoid copepod, *Schizopera knabeni* and *Amphiascoides atopus*. Contaminant effects were delineated using toxic unit methodology and factorial experiments. Adult *S. knabeni* were tolerant of exposures to the individual contaminants. When *S. knabeni* were exposed to the metals mixture, Cd-induced lethality was reduced, suggesting an antagonism among the metals. When exposed to a mixture of Cd, Hg, Pb, and phenanthrene, a greater than additive response was demonstrated. A Cd-phenanthrene synergism was observed in both sediment and aqueous exposures. Grazing-rate bioassays suggest a response-additive sublethal toxicology between metals and phenanthrene. Experiments with *A. atopus* revealed that phenanthrene and fluoranthene are synergistic with Cd.

NTIS

*Contaminants; Hydrocarbons; Metals; Polycyclic Aromatic Hydrocarbons; Sediments; Toxicity*

**20070029979** Pabst Patent Group, LLP, Atlanta, GA, USA

**Antimicrobial Polymeric Surfaces**

Tiller, J. C., Inventor; Liao, C. J., Inventor; Lewis, K., Inventor; Klibanov, A. M., Inventor; 14 Apr 05; 37 pp.; In English  
Contract(s)/Grant(s): NIH-GM26698; NSF DMR-94-00334

Patent Info.: Filed Filed 14 Apr 05; US-Patent-Appl-SN-11-107 412

Report No.(s): PB2007-108641; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Bactericidal compositions are disclosed that comprise a polymeric compound immobilized on a material. Medical devices are also disclosed which comprise such a bactericidal composition. Methods are disclosed for covalently derivatizing the surfaces of common materials with an antibacterial polycation, e.g., poly(vinyl-N-pyridinium bromide); the first step of the methods involves coating the surface with a nanolayer of silica. Various commercial synthetic polymers derivatized in this manner are bactericidal, i.e., they kill on contact up to 99% of deposited Gram-positive and Gram-negative bacteria, whether deposited through air or water.

NTIS

*Antibiotics; Antiinfectives and Antibacterials; Microorganisms; Patent Applications; Polymers; Surface Properties*

**20070030018** Army Research Lab., Aberdeen Proving Ground, MD USA

**Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces**

Rawlett, Adam M; Orlicki, Joshua A; Zander, Nicole; Karikari, Afia; Long, Tim; Apr 2007; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469154; ARL-TN-275; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469154>

The formation of hierarchically ordered arrays of spherical cavities on polymer films is of interest due to potential applications in the reparation of photonic bandgaps materials, environmental sensors, and patterned light-emitting diodes. While many methods are known for the preparation of these porous materials, the breath figure approach has received significant scrutiny because of the simple and robust mechanism of pattern formation. Breath figures are patterned arrays of micrometer-sized defects in a polymer film, formed when water droplets condense onto a polymer solution surface during film drying. By control variables such as relative humidity and solvent, the feature size and uniformity of the resultant pattern can be control The breath figure approach is valuable because it is versatile, inexpensive, and provides the advantages of large area ordering in the nano and micrometer regime. The self assembly of regular arrays of nano and microscale pores in polymer matrices generated using the breath figure technique is being explored. Experimental parameters are modified to vary the size, spacing, organization, and long-range order of these self-organizing surfaces. Utilizing these regular arrays of pores as templates, we have patterned analogous arrays of pillars (inverse pores) from a polymer film cast onto the patterned surface. These micro/nano-textured surfaces have enhanced the hydrophobicity of the textured polymer when measured by contact angle. This method of producing ultrahydrophobic textured surfaces should be amenable to high-throughput, low-cost manufacturing of myriad polymeric surfaces.

DTIC

*Hydrophobicity; Polymeric Films; Cavities; Light Emitting Diodes; Energy Gaps (Solid State)*

## 24

### COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

**20070026579** Kagoshima Univ., Japan

**Numerical Investigation for the Microstructural Effects on the Crack Growth Behavior of Particulate Composite Materials**

Okada, Hiroshi; Jul 26, 2006; 64 pp.; In English

Contract(s)/Grant(s): FA5209-04-P-0397

Report No.(s): AD-A466507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466507>

In present investigation, analyses for the damage evolution behavior of particulate composite materials by using the finite element method (FEM) and the s-version finite element method (s-FEM) were carried out. The analyses were carried out in particular interest in the phenomenon of crack propagation. Prior to crack propagation, material damage develops in the material. The material damage may be in the forms of microvoid and/or microcracks in the binder (matrix) and in the form

of binder (matrix)/particle separation that is known to be dewetting. In a macroscopic sense, the reinforcing particles distribute evenly in matrix. However, at microscopic level, the density of the distributed particles varies. This means that the stiffness and strength of the material also have some spatial variations. Material damages initiate at the weak material locations and then propagate the surroundings. When cracks are present in the material, the cracks interact with the surroundings and the material. To simulate such scenarios, we adopted two kinds of damage constitutive models. One is isotropic damage model and the other is "separate dilatational/deviatoric damage constitutive model" in which the contributions of hydrostatic and of deviatoric stresses are accounted for independently. A parameter in the separate dilatational/ deviatoric damage model can characterize which, hydrostatic or deviatoric stress component, has dominant influence to the damage behavior of the material. A series of analyses on uncracked and cracked specimen with statistically varying material stiffness at a microscopic level were carried out. The results revealed that the damage behavior is highly influenced by the damage mode.

DTIC

*Composite Materials; Crack Propagation; Finite Element Method; Mathematical Models; Microstructure; Particulates*

**20070026606** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint)**

Lindgren, Eric; Welter, John; Sathish, Shamachary; Ripberger, Erik; Feb 2007; 10 pp.; In English

Contract(s)/Grant(s): F33615-03-C-5219; Proj-4349

Report No.(s): AD-A466556; AFRL-ML-WP-TP-2007-413; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466556>

Polymer matrix composite mechanical properties have been shown to decrease significantly with the presence of thermal damage. For aerospace applications, this type of damage typically occurs as a result of exposure to elevated temperatures from localized heating, such as lightning strikes, exhaust wash, or improper maintenance/repair procedures. Mechanical testing has shown that this type of damage, known as incipient damage, is present even when no visible damage is observable and can cause significant reduction in mechanical properties. Incipient damage is not currently readily detected with conventional nondestructive evaluation (NDE) tools. This presentation describes a NDE method that combines mechanical excitation with thermal imaging to detect the presence of surface and through-the-thickness incipient thermal damage without direct contact to the part being tested. It compares the results from samples with and without known damage using the thermo-elastic technique with similar inspection results from conventional NDE techniques, such as ultrasonic C-scan and thermography. These results indicate the thermo-elastic method identifies incipient damage that the other techniques fail to detect. In addition, an approach to analyze the thermo-elastic data to potentially determine the severity of the thermal damage is reviewed.

DTIC

*Damage; Matrix Materials; Nondestructive Tests; Polymer Matrix Composites*

**20070027401** Naval Air Warfare Center, Patuxent River, MD USA

**Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear**

Choi, Sung R; Kowalik, Robert W; Alexander, Donald J; Bansal, Narottam P; Mar 2, 2007; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467438; NAWCADPAX/TR-2007/5; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Assessments of life limiting behavior of a gas-turbine grade, melt-infiltrated Hi-Nicalon SiC continuous fiber-reinforced SiC ceramic matrix composite (CMC) were made in interlaminar shear using both stress rupture and constant stress-rate testing at 1316°C in air. The composite exhibited appreciable life limiting behavior with a life susceptibility parameter of  $n \approx 22-24$ , estimated based on a proposed phenomenological life prediction model together with the experimental data. The phenomenological life model was in good agreement in prediction between the stress rupture and the constant stress-rate data, validating its appropriateness in describing the life limiting phenomenon of the CMC coupons subjected to interlaminar shear. Despite some limitations in material availability, time to failure and shear strength data exhibited a statistical relation, typically observed in Mode I loading for many isotropic brittle solids. The results of this work also indicated that the governing mechanism(s) associated with failure in interlaminar shear remained almost unchanged, regardless of the type of loading configurations, either in stress rupture or in constant stress rate. This additionally indicates that simplistic constant shear stress-rate testing can be used as a possible means of life prediction test methodology for CMCs even in interlaminar shear at elevated temperatures when relatively short lifetimes are expected.

DTIC

*Ceramic Matrix Composites; High Temperature; Shear Stress; Silicon Carbides*

**20070027415** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint)**

Roy, Ajit K; Ganguli, Sabyasachi; Sihn, Sangwook; Qu, Liangti; Dai, Liming; Dec 2006; 8 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A467527; AFRL-ML-WP-TP-2007-447; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One of the barriers in achieving adequate through-thickness thermal conductivity in composite materials and also in composite joints is the extremely low thermal conductivity of resins (polymer) or adhesives (typically 0.3 W/mK). In this paper, a material configuration aligning Multi-wall Nanotube (MWNT) in the thickness direction in adhesive joint is studied to enhance through-thickness thermal conductivity. Initial numerical study indicated that the thermal contact of the conductive phase (in this case is the MWNT) with the adherent surfaces is essential to achieve the desirable through-thickness thermal conductivity in joints. To demonstrate the concept, conductive graphite face sheets were used along with aligned MWNT aligned along the joint thickness. Aligned MWNT infused with resin (adhesive) is processed in joints with plasma etching the surfaces ensuring the ends of the MWNT make thermal contact with the adherent surfaces. The MWNT modified adhesive joint through-thickness thermal conductivity measure to be over 250 W/mK, which exceeded the thermal conductivity of adhesive by several orders of magnitude. Thus, the study demonstrates a new approach as well as opportunities of much needed thermal property tailoring in structural joints.

DTIC

*Adhesives; Bonded Joints; Composite Materials; Thermal Conductivity; Thermodynamics; Thickness*

**20070027512** Connecticut Univ., Storrs, CT USA

**Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer**

Wu, Jian; Mather, Patrick T; Haddad, Timothy S; Kim, Gyeong-Man; Aug 24, 2006; 33 pp.; In English

Contract(s)/Grant(s): Proj-23080521

Report No.(s): AD-A467764; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report on the linear viscoelastic properties of a family of entangled linear thermoplastic non-polar hybrid inorganic-organic polymers: random copolymers of polystyrene (PS) and styryl-based polyhedral oligosilsesquioxane (POSS),  $R_7(\text{Si}_8\text{O}_{12})(\text{C}_6\text{H}_4\text{CH}=\text{CH}_2)$ , with R = isobutyl (iBu). A series of styrene-styryl POSS random copolymers with 0, 6, 15, 30, 50 wt% iBuPOSS were investigated. WAXS and TEM demonstrate that the iBuPOSS disperses in the polymeric matrix at a molecular level. It is observed that the iBuPOSS plays a plasticizer-like effect, yielding a monotonic decrease of the glass transition temperature with increasing iBuPOSS content. Rheological measurements revealed that linear viscoelastic behavior of the copolymers is also profoundly influenced by the presence of iBuPOSS. The incorporation of iBuPOSS dramatically decreases the rubbery plateau modulus, suggesting a strong dilation effect of isobutyl-POSS on entanglement density. Additionally, the apparent flow activation energy, obtained by fitting the Vogel-Fulcher-Tamman-Hesse equation, monotonically increases with increasing iBuPOSS content, indicating a lower sensitivity of POSS copolymers to changes of temperature. We attribute observations of the microscopic topology of constituent polymer chains to be altered by iBuPOSS comonomers that act as compact volumetric branches. Conversely, intermolecular interactions between iBuPOSS and PS segments do not play an essential role in determining the rheological behavior.

DTIC

*Copolymers; Polystyrene; Rheology; Thermoplasticity; Viscoelasticity*

**20070027565** Dayton Univ. Research Inst., OH USA

**Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint)**

Welter, John; Sathish, Shamachary; Ripberger, Erik; Lindgren, Eric; Feb 2007; 16 pp.; In English

Contract(s)/Grant(s): F33615-03-C-5219; Proj-4349

Report No.(s): AD-A467863; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reduction of strength of polymer matrix composites when exposed to high temperatures is a major concern in aerospace industry. Loss of mechanical strength can be measured only through established destructive techniques; there is a need for detection and evaluation of heat damage in PMC. This paper describes a thermo-elastic based non-contact nondestructive technique for detection and evaluation of heat damage in PMC. The efficiency of the material to convert acoustic energy into heat is used as a means to detect and evaluate the heat damage in the material. A panel subjected to local heat damage at several locations is tested using air coupled ultrasonic C-scan and thermo-elastic measurements. The results show that the ultrasonic C-scan detects only the major damage. On the other hand the thermo-elastic method detects both high and low level heat



damages in the panel. The efficiency of the conversion of acoustic energy into heat, in undamaged and damaged regions and its role in detecting damage are discussed.

DTIC

*Composite Materials; Damage; Heat; Nondestructive Tests; Polymer Matrix Composites; Thermoelasticity*

**20070027742** Air Force Research Lab., Kirkland AFB, NM USA

**2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates**

Welsh, Jeffery S; Mayes, J S; Biskner, Adam C; Jan 2006; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468444; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In previous research, a series of a thickness-tapered cruciform specimen configurations have been used to determine the biaxial (two-dimensional, in-plane) and triaxial (three-dimensional) strength of several carbon/epoxy and glass/vinyl-ester laminate configurations. Refinements to the cruciform geometry have been shown capable of producing acceptable results for cross-ply laminate configurations. However, the presence of a biaxial strengthening effect in quasi-isotropic, laminates have brought into question whether the cruciform geometry could be used to successfully generate two-dimensional strength envelopes. In the present study, a two-dimensional failure envelope for a IM7/977-2 carbon/epoxy laminate was developed, using a triaxial test facility. Results are promising as they indicated that failure in the majority of the IM7/977-2 specimens occurred in the gage section. This leads the authors to believe that maximum biaxial stress states were correctly generated within the test specimen. In addition to the data presented, multi-continuum theory (MCT) was used to predict and analyze the onset of damage and ultimate failure of a biaxially loaded IM7/977-2 laminate. Damage in a composite material typically begins at the constituent level and may, in fact, be limited to only one constituent in some situations. An accurate prediction of constituent failure at sampling points throughout the laminate provides a genesis for progressively analyzing damage propagation in a composite specimen allowing identification of intermediate damage modes. A constituent-based, quadratic, stress-interactive, failure criterion was used to take advantage of the micro-scale information provided by MCT. There was reasonable correlation between analytically and experimentally developed IM7/977-2 2D failure envelope which leads us to believe that the thickness-tapered cruciform specimen can be used to determine the biaxial strength of quasi-isotropic laminates.

DTIC

*Epoxy Matrix Composites; Epoxy Resins; Failure; Fiber Composites; Graphite-Epoxy Composites; Isotropy; Laminates*

**20070027756** Denver Research Inst., Denver, CO USA

**Acoustic Identification of Filler Materials in Unexploded Ordnance**

Cobb, Wesley; Apr 2006; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W912HQ-04-C-0015; Proj-1382

Report No.(s): AD-A468491; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project is to utilize acoustic waves to identify the materials inside sealed unexploded ordnance (UXO). Acoustic waves are high frequency pressure fluctuations (sound) that travel through materials. Small sensors clamped to the outside of the ordnance send low-energy acoustic waves through the container walls and filler. The received signals are analyzed to determine the characteristic acoustic properties of the filler material. To identify the filler, these measured properties are compared to a database of properties for known explosive and inert filler materials. A device based on this acoustic technique would permit personnel to quickly identify common inert UXO items, and optimize subsequent verification. Significant cost savings can be achieved through more efficient and safer clean-up procedures and the reduction of blow in place remediation procedures. Currently, 75 % of the costs associated with cleanup of UXO contaminated sites are derived from remediating non-hazardous items.

DTIC

*Acoustic Properties; Ammunition; Fillers; Ordnance*

**20070028680** Forest Products Lab., Madison, WI USA

**Use of Saltcedar and Utah Juniper as Fillers in Wood-Plastic Composites**

Clemons, C.; Stark, N.; Apr. 2007; 19 pp.; In English

Report No.(s): PB2007-109933; FPL-RP-641; No Copyright; Avail.: CASI: A03, Hardcopy

Invasive and small-diameter species have become more prevalent, creating numerous environmental and ecological problems. One potential method to control and eliminate invasive species and thereby promote natural rangeland restoration

is developing new, value-added uses for them. Saltcedar (*Tamarisk ramosissima*) and Utah juniper (*Juniperus osteosperma*) were investigated for use as fillers in woodplastic composites (WPCs).

NTIS

*Fillers; Wood*

**20070028825** Watov and Kipnes, P.C., Princeton Junction, NJ, USA

**Composite Materials Containing a Nanostructured Carbon Binder Phase and High Pressure Process for Making the Same**

Dear, Bernard H., Inventor; Voronov, Oleg A., Inventor; 25 Aug. 2005; 17 pp.; In English

Contract(s)/Grant(s): NAS1-03045; N00014-01-C-0370; N00014-01-1-0079; DAAH-01-OO-CR008

Patent Info.: Filed 23 Mar. 2004; US-Patent-Appl-SN-10-807090; US 2005/0186104

Report No.(s): PB2007-104723; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028825>

A composite material composed of a matrix phase bonded by a carbon binder phase derived from sintered carbon nanoparticles such as, for example, fullerenes. The present invention further relates to a method of making such composite materials which includes the steps of dispersing a sufficient amount of carbon nanoparticles into a matrix phase, and compressing the carbon nanoparticles-containing matrix phase at a sufficient pressure and temperature over a sufficient time to facilitate the conversion of the carbon nanoparticles into a nanostructured carbon binder phase, thereby yielding the composite material.

Author

*Binders (Materials); Carbon; Composite Materials; High Pressure*

**20070029231** NASA Langley Research Center, Hampton, VA, USA

**Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends**

Ghose, S.; Watson, K. A.; Working, D. C.; Connell, J. W.; Smith, J. G.; Lin, Y.; Sun, Y. P.; June 03, 2007; 14 pp.; In English; SAMPE 2007 Symposium and Exhibition (52nd ISSE), 3-7 Jun. 2007, Baltimore, MD, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07

Report No.(s): Paper ID# B68; Copyright; Avail.: CASI: [A03](#), Hardcopy

The development of flexible, thermally conductive fabrics and plastic tubes for the Liquid Cooling and Ventilation Garment (LCVG) are needed to reduce weight and improve the mobility, comfort, and performance of future spacesuits. Such improvements would allow astronauts to operate more efficiently and safely for extended extravehicular activities. As a continuation of our work on the improvement of thermal conductivity (TC) of polymeric materials, nanocomposites were prepared from copoly(ethylene vinyl acetate), trade name Elvax 260TradeMark), metallized carbon nanofibers (CNFs), nickel (Ni) nanostrands, boron nitride both alone and as mixtures with aluminum powder. The nanocomposites were prepared by melt mixing at various loading levels and subsequently fabricated into several material forms (i.e., ribbons, tubes, and compression molded plaques) for analysis. Ribbons and tubes were extruded to form samples in which the nanoparticles were aligned in the direction of flow. The degree of dispersion and alignment of the nanoparticles were investigated using high-resolution scanning electron microscopy. Tensile properties of the aligned samples were determined at room temperature. TC measurements were performed using a laser flash (NanoflashTradeMark) technique. The TC of the samples was measured in both the direction of alignment as well as transverse. Tubing of comparable dimensions to that used in the LCVG was extruded from select compositions and the thermal conductivities of the tubes measured.

Author

*Space Suits; Nanocomposites; Garments; Thermal Conductivity; Liquid Cooling; Powdered Aluminum*

**20070029295** Lawrence Livermore National Lab., Livermore, CA USA

**Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers**

Marzik, J. V.; Croft, W. J.; Staples, R. J.; MoberlyChan, W. J.; Dec. 11, 2006; 8 pp.; In English

Report No.(s): DE2007-900880; UCRL-PROC-226742; No Copyright; Avail.: National Technical Information Service (NTIS)

Silicon carbide (SiC) fibers made by chemical vapor deposition (CVD) are of interest for organic, ceramic, and metal matrix composite materials due their high strength, high elastic modulus, and retention of mechanical properties at elevated

processing and operating temperatures. The properties of SCS-6 silicon carbide fibers, which are made by a commercial process and consist largely of stoichiometric SiC, were compared with an experimental carbon rich CVD SiC fiber, to which excess carbon was added during the CVD process. The concentration, homogeneity, and distribution of carbon were measured using energy dispersive x-ray spectroscopy (SEM/EDS). The effect of excess carbon on the tensile strength, elastic modulus, and the crystallographic and microstructural properties of CVD silicon carbide fibers was investigated using tensile testing, x-ray diffraction, scanning electron microscopy (SEM), and transmission electron microscopy (TEM).

NTIS

*Carbon; Composite Materials; Crystallography; Mechanical Properties; Microstructure; Silicon Carbides; Vapor Deposition*

**20070029401** Lawrence Livermore National Lab., Livermore, CA USA

**Stab Sensitivity of Energetic Nanolaminates**

Gash, A.; Barbee, T.; Cervantes, O.; May 24, 2006; 15 pp.; In English

Report No.(s): DE2007-900454; UCRL-PROC-221604; No Copyright; Avail.: National Technical Information Service (NTIS)

This work details the stab ignition, small-scale safety, and energy release characteristics of bimetallic Al/Ni(V) and Al/Monel energetic nanolaminate freestanding thin films. The influence of the engineered nanostructural features of the energetic multilayers is correlated with both stab initiation and small-scale energetic materials testing results. Structural parameters of the energetic thin films found to be important include the bi-layer period, total thickness of the film, and presence or absence of aluminum coating layers. In general the most sensitive nanolaminates were those that were relatively thick, possessed fine bi-layer periods, and were not coated. Energetic nanolaminates were tested for their stab sensitivity as freestanding continuous parts and as coarse powders. The stab sensitivity of mock M55 detonators loaded with energetic nanolaminate was found to depend strongly upon both the particle size of the material and the configuration of nanolaminate material, in the detonator cup. In these instances stab ignition was observed with input energies as low as 5 mJ for a coarse powder with an average particle dimension of 400  $\mu\text{m}$ . Selected experiments indicate that the reacting nanolaminate can be used to ignite other energetic materials such as sol-gel nanostructured thermite, and conventional thermite that was either coated onto the multilayer substrate or pressed on it.

NTIS

*Chemical Reactions; Laminates; Sensitivity; Surface Reactions*

**20070029503** Advanced Composite Products and Technology, Inc., Huntington Beach, CA, USA

**Development and Manufacture of Cost Effective Composite Drill Pipe. 2006 Annual Technical Progress Report**

Leslie, J. C.; Truong, L.; Heard, J. T.; Jan. 12, 2006; 16 pp.; In English

Contract(s)/Grant(s): DE-FC26-99FT40262

Report No.(s): DE2007-900202; No Copyright; Avail.: National Technical Information Service (NTIS)

This technical report presents the engineering research, process development and data accomplishments that have transpired to date in support of the development of Cost Effective Composite Drill Pipe (CDP). The report presents progress made from October 1, 2005 through September 30, 2006 and contains the following discussions: (1) Qualification Testing; (2) Prototype Development and Testing of Smart Design Configuration; (3) Field Test Demonstration; (4) Development of Ultra-Short Radius Composite Drill Pipe (USR-CDP); (5) Development of Smart USR-CDP.

NTIS

*Composite Materials; Cost Effectiveness; Manufacturing; Pipes (Tubes)*

**20070029579** Texas A&M Univ., College Station, TX USA

**Characterization of the Structure-Processing-Performance Relations of Phenylethynyl Phthalic Anhydride Crosslinked Fluorinated Polyimides (AFR-PEPA-N) and Their Carbon Fiber Composites**

Morgan, Roger J; Apr 12, 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0137

Report No.(s): AD-A468808; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468808>

The overall goals of this program were to conduct fundamental characterization and development studies of the structure-processing-performance relations of phenylethynyl phthalic anhydride crosslinked fluorinated polyimides (AFR-PEPA-N) and their carbon fiber composites for applications for future Air Force vehicles and associated propulsion systems. The technical areas that were primarily pursued and documented in this final report are i) The stress-thermal cycling of

polyimide composites in extreme thermal environments; ii) Cure characterization of the phenylethynyl oligomer end caps, oligomer morphology and chemical modification of oligomer end groups; iii) Characterization of optimum cure conditions versus onset of network degradation; and iv) Development of failure modeling methodology of composites in extreme service environments.

DTIC

*Anhydrides; Carbon Fibers; Composite Materials; Crosslinking; Fiber Composites; Polyimides*

**20070029588** Wichita State Univ., Wichita, KS USA

**Advanced Polymer Composite Molding Through Intelligent Process Analysis and Control**

Minaie, Bob; Mar 30, 2007; 74 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-05-1-0230

Report No.(s): AD-A468818; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468818>

To prevent dry spot formation in RTM, a control interface and four different adaptive control algorithms were developed and tested with numerical simulations. The interface is capable of controlling the flow pattern of resin as it fills a mold containing a preform. The mold is equipped with multiple inlet gates, a single vent and a spinal sensor system that continuously feeds the interface with the resin flow front location along the spine lines connecting the inlet gates to the vent. Four different adaptive control algorithms targeting on injection flow rate control, injection pressure control, linearly-corrected pressure control, and the combined flow rate and linearly-connected pressure control were developed. Placement of the gates-sensors in addition to the possibility of permeability disturbances (race-tracking) could affect the filling pattern and ultimately the controllability of the developed schemes. To overcome this a sue, the location of the gates-sensors was optimized based on the minimization of void formation and filling time. Particle Swarm Optimization (PSO) coupled with adaptive control was implemented on the aforementioned problem and results were compared to previous work using Selective Exhaustive Search (SES) and Genetic Algorithm (GA). Three journal papers and six conference papers have been published.

DTIC

*Casting; Composite Materials*

**20070029764** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Lightweight and Advanced Materials for Defense: Materials for Military Ground Vehicles**

Ostberg, Donald T; Jun 27, 2006; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469054; TARDEC-15959; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469054>

MATERIALS FOR TACTICAL TRUCKS: (1) Material must be readily available and fully developed. (RHA; High hard steel; Aluminum). (2) Research projects are ongoing to further develop advanced lightweight armors. (Composites; Ceramics; Titanium) (3) Long Term Armor Strategy (A+B design; Requirements are classified)

DTIC

*Combat; Surface Vehicles; Warfare*

**20070029830** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Tension-Compression Fatigue Behavior of a Carbon Fiber/Epoxy (IM7/EPON 862) Composite Fabricated Using Vacuum Assisted Resin Transfer Molding Process**

Katwyk, David W; Mar 2007; 116 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469179; AFIT/GA/ENY/07-M14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469179>

New composite materials and processing methods are continually being developed for use in high performance aerospace systems. One of these new processing methods is the vacuum assisted resin transfer molding (VARTM) process, which shows promise in producing large structural components that have good properties at a lower cost than traditional manufacturing methods. Future widespread use of components manufactured using the VARTM process depends on understanding how these components perform under service conditions, specifically under impact and fatigue conditions. The tension compression fatigue behavior of a four-harness satin weave carbon fiber/epoxy (IM7/EPON 862) composite manufactured using the VARTM process is investigated in this research. The results are compared to previous research done to determine the tension-tension fatigue behavior of the same material. An anti-buckling fixture was used to allow a long, thin specimen to be used for the tests without causing a buckling failure when the specimen was under compression loading. The

tension-compression fatigue tests were carried out at a percentage of the ultimate compressive strength at room temperature. Failed specimens were examined using an optical microscope and a scanning electron microscope to investigate and document damage mechanisms and failure modes. Fatigue life curves were developed for stress range, maximum stress, and normalized stress. Specimens tested under tension-compression loading were shown to have lower fatigue life than those under tension loading.

DTIC

*Carbon Fibers; Epoxy Matrix Composites; Fabrication; Fiber Composites; Resin Transfer Molding; Vacuum*

**20070029963** Los Alamos National Lab., NM USA

**Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory**

Lucero, J.; Hemez, F.; Ross, T.; Kline, K.; Hundhausen, J.; May 2006; 88 pp.; In English

Report No.(s): DE2007-884685; LA-14283; No Copyright; Avail.: National Technical Information Service (NTIS)

This work presents a survey of five theories to assess the uncertainty of projectile impact induced damage on multi-layered carbon-epoxy composite plates. Because the types of uncertainty dealt with in this application are multiple (variability, ambiguity, and conflict) and because the data sets collected are sparse, characterizing the amount of delamination damage with probability theory alone is possible but incomplete. This motivates the exploration of methods contained within a broad Generalized Information Theory (GIT) that rely on less restrictive assumptions than probability theory. Probability, fuzzy sets, possibility, and imprecise probability (probability boxes (p-boxes) and Dempster-Shafer) are used to assess the uncertainty in composite plate damage. Furthermore, this work highlights the usefulness of each theory. The purpose of the study is not to compare directly the different GIT methods but to show that they can be deployed on a practical application and to compare the assumptions upon which these theories are based. The data sets consist of experimental measurements and finite element predictions of the amount of delamination and fiber splitting damage as multilayered composite plates are impacted by a projectile at various velocities. The physical experiments consist of using a gas gun to impact suspended plates with a projectile accelerated to prescribed velocities, then, taking ultrasound images of the resulting delamination. The nonlinear, multiple length-scale numerical simulations couple local crack propagation implemented through cohesive zone modeling to global stress-displacement finite element analysis.

NTIS

*Damage; Fiber Composites; Information Theory; Laminates*

## 25

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

**20070026377** Air Force Research Lab., Kirkland AFB, NM USA

**Molecular Volume and Electronic and Vibrational Polarizabilities for Amorphous LaAlO<sub>3</sub>**

Busani, T.; Devine, R A; Dec 1, 2004; 7 pp.; In English

Contract(s)/Grant(s): F29601-01-C-0241; Proj-4846

Report No.(s): AD-A466053; AFRL-VS-PS-JA-2007-1005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466053>

Grazing incidence x-ray reflectivity measurements are used to determine the density of sputter-deposited LaAlO and anodized LaAl films. Together with refractive index and dielectric constant measurements, it is demonstrated that a coherent picture emerges explaining the low dielectric constant of the amorphous films (~13) as compared to the single-crystal value (~26). The importance of molecular volume dependence of the electronic and vibrational molecular polarizabilities is underlined.

DTIC

*Amorphous Materials; Dielectric Properties; Intermetallics; Lanthanum; Vibration*

**20070026386** ABB Environmental Services, Inc., Portland, ME USA

**Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan AASF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI**

Cuccaro, Joseph T; Nov 1996; 58 pp.; In English

Contract(s)/Grant(s): DACA31-94-D-0061-0010; Proj-9890-01

Report No.(s): AD-A466066; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466066>

This Management Plan has been prepared in accordance with Data Item A008 for the U.S. Army Environmental Center (USAEC) by ABB Environmental Services, Inc. (ABB-ES) in response to Delivery Order 0010 of Contract DACA31-94-D-0061 for a Site Inspection (SI) at Fort Allen in Juana Diaz, Puerto Rico and Preliminary Assessments (PAs) at the San Juan Army Aviation Support Facility (AASF) Puerto Rico, and Blair Hangar AASF on the island of St. Croix, USVI. The objectives of this Delivery Order are to conduct SIs at several areas of contamination (AOCs) and study areas at Fort Allen and to document the findings of the investigations. An additional objective is the completion of two PAs, at San Juan AASF and Blair Hangar AASF. The purpose of this Management Plan is to describe ABB-ES' organization, assignment of functions, duties and responsibilities, management procedures and policies, and reporting requirements for the completion of the work effort presented in the Accident Prevention Safety Program Plan (APSPP) and Quality Assurance Project Plan (QAPjP) (Data Item A004 and A006) and the Technical Plan (Data Item A003). Sections 2.0 and 3.0 of this plan describe the project management structure and controls to be used for this Delivery Order. Section 4.0 contains data management requirements which are specific to the Fort Allen SI. Costs and schedules will be monitored through the use of a detailed schedule and a Resource Utilization Plan (RUP) for each element in the Work Breakdown Structure (WBS). The project schedule and RUPs are presented in Sections 5.0 and 6.0, respectively. Descriptions of the reports to be prepared and delivered to the USAEC throughout the course of this project are presented in Section 7.0.

DTIC

*Chemical Analysis; Contamination; Data Management; Hangars; Inspection; Management Planning; Puerto Rico*

**20070026401** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Multireference Density Functional Approach to the Calculation of the Excited States of Uranium Ions**

Beck, Eric V; Mar 2007; 191 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466101; AFIT/DS/ENP/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466101>

An accurate and efficient hybrid Density Functional Theory (DFT)/Multireference Configuration Interaction (MRCI) model for computing electronic excitation energies in heavy element atoms and molecules was developed. This model incorporated relativistic effects essential for accurate qualitative and quantitative spectroscopic predictions on heavy elements, while simultaneously removing spin-multiplicity limitations inherent in the original model on which it is based. This model was used to successfully compute ground and low-lying electronic states for atoms in the first two rows of the period table, which were used for calibration. Once calibrated, calculations on carbon monoxide, bromine fluoride, the bromine atom, uranium +4 and +5 ions and the uranyl (UO<sub>2</sub><sup>2+</sup>) ion showed the model achieved reductions in relative error with respect to Time Dependent Density Functional Theory (TDDFT) of 11-42%, with a corresponding reduction in computational effort in terms of MRCI expansion sizes of a factor of 25-64.

DTIC

*Configuration Interaction; Density Functional Theory; Excitation; Ions; Uranium*

**20070026416** National Univ. of Singapore, Singapore

**Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorencarbonyl Methano[60]Fullerene Pentaads**

Elim, Hendry I; Ji, Wei; Anandakathir, Robinson; Chiang, Long Y; Jakubiak, Rachel; Tan, Loon-Seng; Oct 2006; 35 pp.; In English

Contract(s)/Grant(s): FA9950-05-0154

Report No.(s): AD-A466119; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466119>

We demonstrated an approach toward the design of starburst C<sub>60</sub>-keto-DPAF assembly by applying a combination of a starburst macromolecular configuration with C<sub>60</sub> as the core center, which is encapsulated by multiple bulky groups leading to the increase of intermolecular separation and aggregation barrier. Molecular compositions of the resulting triad and pentaads were clearly confirmed by MALDI-MS (positive ion) detection of protonated molecular mass ions. Both structural isomers,

3a and 3b exhibited nonlinear optical transmittance reduction responses in femtosecond (fs) region with a lower transmittance % value for the latter at the high laser power above 80 GW/sq cm. It was attributed to larger fs 2PA cross-section values of 3a and 3b than that of 2 in the same concentration and, apparently, correlated to a higher number of DPAF-C9 subunits in the structure of 3.

DTIC

*Carbon; Carbonyl Compounds; Fullerenes; Molecular Ions; Nonlinearity; Starburst Galaxies*

**20070026463** Princeton Univ., NJ USA

**First Principles and Multi-Scale Modeling of the Roles of Impurities and Dopants on Thermal Barrier Coating Failure**

Carter, Emily A; Mar 31, 2007; 12 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0119

Report No.(s): AD-A466193; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466193>

Optimization of thermal barrier coating materials is the main objective of this research, in order to increase the service lifetimes of aircraft engines. To this end, it is critical to first understand mechanisms of failure, and then use those insights to design materials countermeasures. This grant supported the following research efforts in those directions: (1) Developments of ultrasoft spin-dependent pseudopotential theory and a solid state phase transition path search algorithm; (2) Applications of first principles density functional theory to: (i) monoclinic-to-tetragonal phase transformation pathway in zirconia; (ii) atomic scale fatigue in silicon and alumina; (iii) metal/ceramic interfaces (MoSi<sub>2</sub>/SiO<sub>2</sub> and NiAl/Al<sub>2</sub>O<sub>3</sub>); (iv) adsorption of dopants (Hf, Pt) and impurities (S) on NiAl and segregation of same to NiAl/Al<sub>2</sub>O<sub>3</sub> interface; (v) formation and segregation of impurities, dopants, defects, and majority species in NiAl and alumina dopants added to alumina/late transition metal interfaces, with implications for high temperature catalysis.

DTIC

*Failure; Impurities; Protective Coatings; Thermal Control Coatings*

**20070026484** Hanyang Univ., Seoul, Korea, Republic of

**Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope**

Lee, Haiwon; Feb 16, 2007; 51 pp.; In English

Contract(s)/Grant(s): AOARD-05-4064

Report No.(s): AD-A466279; AOARD-044053; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466279>

Our work has been concentrated on both chemical attachments of functionalized carbon nanotubes (CNTs) and their alignments through chemical, electrical and optical manipulation on templates such as Si-wafer and gold, on which nanostructures can be formed by novellithographic techniques of atomic force microscope (AFM) anodic oxidation lithography or nanosphere lithography. As-grown CNTs were modified with functional groups like carboxylic acid, acid chloride and alkyl thiol groups to chemically bond CNTs to templates. The chemical bonding of functionalized CNTs on conducting templates was also performed by applying a direct current (DC) field to CNT suspension, resulting in the formation of uniform CNT films. Ultrasonic treatment allowed the electrodeposited CNTs to be aligned normal to the electrodes. In addition, the selective attachment of CNTs on templates was conducted by applying the lithographic techniques. A promising approach to manipulating CNTs was demonstrated using a linear polarized infrared optical trapping system. Various analytical methods such as AFM, TEM, SEM, Raman, FT-IR, and field emission measurement enabled the characterization of the CNTs.

DTIC

*Alignment; Atoms; Carbon Nanotubes; Chemical Bonds; Direct Current; Fabrication; Nanostructure (Characteristics); Nanostructures (Devices)*

**20070026500** Hanyang Univ., Seoul, Korea, Republic of

**Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope**

Lee, Haiwon; Mar 30, 2007; 46 pp.; In English

Contract(s)/Grant(s): AOARD-06-4056

Report No.(s): AD-A466334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466334>

This project focused on the behavior of single-wall carbon nanotubes (SWCNTs) in the electrophoresis cells and aligned

growth of SWCNTs by thermal chemical vapor deposition on selectively deposited metallic nanoparticles. Field emission characteristics of vertically aligned SWCNTs films were also studied.

DTIC

*Alignment; Atoms; Carbon Nanotubes; Composite Materials; Fabrication; Nanostructure (Characteristics); Vapor Deposition*

**20070026502** Army Engineer Research and Development Center, Vicksburg, MS USA

**Experimental Effects of Lime Application on Aquatic Macrophytes: 4. Growth Response of Three Species**

James, William F; Apr 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466338; ERDC/TN-APCRP-EA-14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466338>

This investigation examined the growth response of three macrophyte species (*Elodea canadensis*, *Stuckenia pectinata*, and *Vallisneria spiralis*) to lime application in experimental mesocosms.

DTIC

*Aquatic Plants; Calcium Oxides*

**20070026553** Army Research Lab., Aberdeen Proving Ground, MD USA

**Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods**

Pappas, Daphne; Copeland, Craig; Jensen, Robert; Mar 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-AH84

Report No.(s): AD-A466437; ARL-TR-4052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466437>

In this research, wettability testing was performed for nylon-6 and polyethylene films and ultra-high molecular weight polyethylene woven fabrics to examine the effects of surface atmospheric plasma treatment.

DTIC

*Fabrics; Molecular Weight; Polyethylenes; Polymeric Films; Surface Energy; Wettability; Wetting*

**20070026573** Seoul National Univ., Korea, Republic of

**Permeability Prediction of Three-Dimensional Woven Fabrics**

Lee, Woo Il; May 8, 2006; 16 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0401

Report No.(s): AD-A466492; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466492>

Liquid molding processes are becoming more popular among the composite manufacturing industries due to their versatility and economy among other merits. In analyzing the flow during the process, permeability is the most important parameter. Permeability has been regarded as a property of the porous medium. However, in many practical cases, the value may vary depending on the flow conditions such as the flow rate. It is speculated that this deviation is caused by inhomogeneous microstructure of the medium. In this study, numerical simulations as well as experimental measurements have been done to investigate the cause of deviation. Microstructure of porous medium was modeled as an array of porous cylinders. Resin flow through the array was simulated numerically. Simulations were performed for two different flow conditions, namely saturated flow and unsaturated flow. Based upon the results, permeabilities were estimated and compared for the two flow conditions. In addition, a model was proposed to predict the permeability for different flow conditions. Results showed that experimental data were in agreement with the prediction by the model.

DTIC

*Casting; Composite Materials; Fabrics; Permeability; Porosity*

**20070026582** Seoul National Univ., Korea, Republic of

**Surface-Templated Assembly for Mass-Production of ZnO Nanowire-Based Integrated Devices**

Hong, Seunghun; Apr 7, 2006; 9 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0084

Report No.(s): AD-A466510; AOARD-054008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466510>

A method to mass-produce ZnO nanowire-based integrated devices has been investigated. The approach is to employ



self-assembled monolayer patterns on the substrates, directly assemble and align ZnO nanowires from the solution without relying on any external forces. As a proof of concepts ZnO nanowires were assembled and aligned on Au and SiO<sub>2</sub> surfaces. Furthermore, the large-scale fabrication of ZnO nanowire-based circuits were successfully demonstrated. It is understood that this is the first successful demonstration for large-scale fabrication of ZnO-based integrated devices. The developed method can contribute to ZnO-based device commercial applications in the future.

DTIC

*Electromechanical Devices; Fabrication; Nanowires; Templates; Zinc Oxides*

**20070026585** National Tsing Hua Univ., Hsinchu, Taiwan, Province of China

**Nano-Dots Enhanced White Organic Light-Emitting Diodes**

Jou, Jwo-huei; Nov 30, 2006; 44 pp.; In English

Report No.(s): AD-A466515; AOARD-054088; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466515>

Significant improvement in electroluminescent performance was resulted by incorporating nano-dots in the small-molecule host composing and solution-processing emission layers for red, green, blue and white organic light-emitting devices (WOLEDs). The proper nano-dot was cadmium selenium (CdSe) prepared in organic solvent, which was miscible with the host solutions of 4,4'-bis (carba- zol-9-yl) biphenyl (CBP) doped with red dye of bis [2-(2'-benzothienyl)-pyridinato-N,C3'] (acetyl-acetonate) iri-dium (III), green dye of tris(2-phenylpyridine) iridium (III) and/or blue dye bis(3,5-difluoro-2-(2-pyridyl)-phenyl-(2-carboxypyridyl) iri- dium (III). The power efficiency of the red OLEDs increased from 1.7 to 2.5 lm/W on the addition of 0.006 wt% CdSe. For the green OLEDs, it increased from 7.8 to 9.9 lm/W by adding 0.006 wt% CdSe. For the blue OLEDs, it increased from 1.45 to 1.66 lm/W by adding 0.01 wt% CdSe. The incorporation effect of CdSe was the most marked on the red device and the least on the blue device; i.e. that the power efficiency increment was 47% for the red device and 14.5% for the blue device. For the WOLEDs, it changed from 3.9 to 4.5 lm/W with a 15.4% increase in power efficiency as 0.002 wt% CdSe was incorporated, accompanied by a 5.7% increase in the resulted maximum luminance.

DTIC

*Cadmium; Electroluminescence; Light Emitting Diodes; Selenium; Solvents*

**20070026596** Indian Inst. of Science, Bangalore, India

**Electrochemical Investigations of the Interface at Li/Li+ Ion Conducting Channel**

Nookala, Munichandraiah; Oct 4, 2006; 78 pp.; In English

Report No.(s): AD-A466535; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466535>

Dilithium phthalocyanine (Li<sub>2</sub>Pc) possesses mixed electronic-ionic conductivity due to overlap of pi-pi orbitals (electronic) and mobility of Li<sup>+</sup> ion (ionic) in a channel formed due to stacking of the macromolecules. Electrochemical impedance measurements provide separation of electronic and ionic conductivities. The temperature dependence studies are employed for calculation of activation energies. The electronic conductivity shows a marked increase on applying DC bias voltage across a symmetrical cell of Li<sub>2</sub>Pc with blocking electrodes, whereas the ionic conductivity is marginally influenced.

DTIC

*Electrochemistry; Phthalocyanin*

**20070026628** Memphis Univ., Memphis, TN USA

**Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds**

Kurtz, H A; Devine, R A; Aug 6, 2001; 4 pp.; In English

Contract(s)/Grant(s): F29601-01-C-0241; Proj-4846

Report No.(s): AD-A466591; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466591>

First-principles calculations have been employed to study clusters or Zr embedded in SiO<sub>2</sub>. Stable complexes are round with four, six, and seven oxygens coordinated to the Zr atom. Consistent with experiment, the higher coordinated complexes are the most stable. These also have a higher density, and hence, smaller molar volume. This smaller molar volume provides an explanation of the increased dielectric constant Zr<sub>x</sub>Si<sub>1-x</sub>O<sub>2</sub> mixed oxide systems for small amounts of Zr (x<0.3). An unusual sevenfold coordinated structure is described.

DTIC

*Coordination; Dielectric Properties; Joints (Junctions); Molecules; Oxides; Permittivity*

**20070026651** Oak Ridge National Lab., TN USA

**Adsorption and Desorption of Dinitrotoluene on Activated Carbon**

Ho, Patience C; Daw, C S; Aug 1987; 22 pp.; In English

Contract(s)/Grant(s): DE-AC05-84OR21400

Report No.(s): AD-A466647; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466647>

The adsorption and solvent extraction of aqueous 2,4-dinitro-toluene (DNT) were evaluated with two commercial activated carbons. Both carbons proved to be excellent adsorbents for aqueous DNT. The solvents tested for extracting the adsorbed DNT were water, acetone, and methanol, both individually and in mixtures with each other. Acetone and methanol were both found to be much more effective extraction solvents than water. Analysis of the extracts revealed the presence of at least six other chemical species besides DNT. Four of these other species were tentatively identified as 2,4-dinitro-benzyl alcohol, 2,4-dinitro-benzaldehyde, 2,4-dinitro-benzoic acid, and 2,4-dinitro-methylbenzoate. The presence of these derivative compounds suggests that some of the DNT undergoes chemical reactions while attached to the carbon surface.

DTIC

*Activated Carbon; Adsorption; Desorption; Explosives*

**20070026658** K Systems Corp., Beavercreek, OH USA

**Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint)**

Bray, Kevin R; Wu, Richard L; Fries-Carr, Sandra; Weimer, Joseph; Feb 2007; 11 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-2415; Proj-0605

Report No.(s): AD-A466667; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466667>

Capacitors are a pervasive technology in every military and commercial application. Increased performance and smaller size in capacitor devices have been the main focus of our research in the development of new dielectrics. A multilayer stacked rigid aluminum oxynitride (Ala<sub>x</sub>N) capacitor design concept has been developed to improve the energy density and high temperature capability of Ala<sub>x</sub>N capacitors. This method consists of depositing alternating layers of dielectric and metal on a rigid substrate. A rigid substrate can withstand the stresses of the dielectric being coated on only a single side which eliminates the wrinkling problem of depositing Ala<sub>x</sub>N on thin metal foil and metallized polymer substrates. The inherent surface roughness issue associated with commercially available polymers is no longer a concern as the surface finish of the substrate can be more easily controlled. Amorphous aluminum oxynitride films possess unique properties of high dielectric strength, high resistivity, low loss, high decomposition temperature, chemical inertness and good thermal conductivity. Dual DC pulsed magnetron reactive sputtering was employed to synthesize amorphous Ala<sub>x</sub>N films on various substrates. Dielectric properties were compared for films developed with different process conditions. The properties were optimized with respect to the following input parameters: DC power, pulse frequency, total pressure, substrate temperature and reactive gas ratio. The effects on the dielectric constant, frequency dependence of capacitance, dissipation factor, resistivity, and breakdown strength of these films were measured using simple parallel plate capacitor test structures. Temperature dependent dielectric properties were evaluated from -200 degrees C to 400 degrees C.

DTIC

*Aluminum; Capacitors; Flux Density; Oxynitrides; Thermodynamic Properties*

**20070026670** Pratt and Whitney Aircraft, East Hartford, CT USA

**Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes**

Ojard, G; Miller, R; Gowayed, Y; Chen, J; Santhosh, U; Ahmad, J; John, R; Jan 2007; 10 pp.; In English

Contract(s)/Grant(s): F33615-03-D-2354-0004; F33615-01-C-5234; Proj-4347

Report No.(s): AD-A466684; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466684>

Time-dependent response of samples with holes manufactured from MI SiC/SiC composites (01/01 material) was experimentally evaluated under creep and dwell fatigue loading. Forty specimens with a central hole with sizes 2.286, 4.572 and 6.35 mm were tested. All specimens showed primary and steady state creep responses. Environmental degradation was empirically related to material response at different stress levels utilizing information from samples without holes. ANSYS Finite Element Analysis was used to map the creep strain in the vicinity of the hole utilizing the empirical correlation.

DTIC

*Ceramic Matrix Composites; Responses; Silicon Carbides; Time Dependence*

**20070026681** Missouri Water Resources Research Center, Rolla, MO USA

**Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint)**

Adams, A G; Rahaman, M N; Dutton, Rollie E; Feb 2007; 34 pp.; In English

Contract(s)/Grant(s): F33615-01-D-5801-0032; Proj-4349

Report No.(s): AD-A466702; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466702>

A powder metallurgy route based on hot isostatic pressing (HIPing) of tape-cast monotapes was used for the direct fabrication of dense thin sheets of gamma titanium aluminide. Polarized light microscopy revealed a fine-grained microstructure but a few isolated larger grains were also present. The primarily metastable alpha2 microstructure of the rapidly solidified starting powder transformed to the equilibrium near-gamma microstructure during HIPing. Chemical analysis revealed that the dense sheet had a carbon content of 0.13 wt.%, which was only 0.04 wt.% higher than that of the starting powder, but the oxygen content was significantly higher, presumably introduced during the decanning step. The hardness measured using Vickers microindentation technique was 384 +/- 9 HV. Manipulation of the as-HIPed microstructure was performed by heating for up to 1 hour in flowing argon at temperatures below and above the alpha transus. Below 1250 deg C, limited grain growth and no discernable change in the as-HIPed (near-gamma) microstructure occurred.

DTIC

*Fabrication; Hot Isostatic Pressing; Microstructure; Powder Metallurgy; Titanium Aluminides*

**20070026713** Yale Univ., New Haven, CT USA

**Growth of a Single Freestanding Multiwall Carbon Nanotube on each Nanonickel Dot**

Ren, Z F; Huang, Z P; Wang, D Z; Wen, J G; Xu, J W; Wang, J H; Calvet, L E; Chen, J; Klemic, J F; Reed, M A; Aug 23, 1999; 4 pp.; In English

Contract(s)/Grant(s): DAAG55-97-1-0139

Report No.(s): AD-A466794; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466794>

Patterned growth of free-standing carbon nanotubes on submicron nickel dots on silicon was achieved using plasma-enhanced-hot-filament-chemical-vapor deposition (PE-HF-CVD). A thin film nickel grid was fabricated on a silicon wafer by standard microlithographic techniques, and the PE-HF-CVD was done using acetylene (C2H2) gas as the carbon source and ammonia (NH3) as a catalyst and dilution gas. Well separated, single carbon nanotubes were observed to grow on the grid. The structures had rounded base diameters of approximately 150 nm, heights ranging from 0.1 to 5 micrometers, and sharp pointed tips. A transmission electron microscopy (TEM) cross-sectional image clearly showed that the structures are indeed hollow nanotubes. The diameter and height depend on the nickel dot size and growth time, respectively. This nanotube growth process is compatible with silicon integrated circuit processing. Using this method, devices requiring free-standing vertical carbon nanotubes, such as scanning probe microscopy, field emission flat panel displays, etc., can be fabricated without difficulty.

DTIC

*Carbon Nanotubes; Fabrication; Nanotechnology; Nickel; Thin Films; Vapor Deposition*

**20070026727** California Inst. of Tech., Pasadena, CA USA

**Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination**

Hummel, Patrick; Osgaard, Jonas; Goddard, III, William A; Gray, Harry B; Jan 10, 2005; 6 pp.; In English

Report No.(s): AD-A466847; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466847>

Ligand field splittings were extracted from absorption spectra of metal hexacarbonyl and hexacyano complexes over 35 years ago by Gray and coworkers (J. Am. Chem. Soc., 85, 2922 (1963); *ibid.* 90, 4260, 5713 (1968)). Recent time-dependent density functional theory calculations by Baerends and coworkers (J. Am. Chem. Soc., 121, 10356 (1999)) on M(CO)6 with M=Cr, Mo, W raised questions about the magnitudes of these ligand field splittings. In order to reexamine such effects systematically, we report here the splittings for a series of 3d6 metal hexacarbonyl, hexaisocyno and hexacyano complexes: V(CO)6(-), Cr(CO)6, Mn(CO)6(+) and Fe(CO)6(2+); Co(CN)6(3) and Fe(CN)6(4); and V(CNH)(-6), Cr(CNH)6, Mn(CNH)6(+) and Fe(CNH)6(2+). This work demonstrates that the 3d splittings induced by the ligands in question generally fall in the order CO>CNH>CN-. We agree with Baerends and colleagues that CO exerts a much stronger ligand field than was originally thought.

DTIC

*Carbon Monoxide; Coordination; Cyanides; Field Strength; Ligands*

**20070026729** Naval Air Warfare Center, China Lake, CA USA

**Lessons Learned in Solid Rocket Combustion Instability**

Blomshield, Fred S; Nov 14, 2006; 20 pp.; In English

Report No.(s): AD-A466858; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466858>

Over the last 60 years, a considerable amount of time and money has been spent improving our understanding of combustion instability in solid rocket propulsion systems. Over this period, significant knowledge has been accumulated that can influence the acoustic stability of solid propulsive systems. Unfortunately, many of these lessons learned about combustion instability remain the knowledge of a select few in government and industry who work with combustion instability on a daily basis. This paper attempts to organize many of these rules of thumb that propellant formulators and motor designers need to be aware of in order to minimize the chances of combustion instability. In addition, several mathematical relationships are presented which can be used to predict the frequency of potential acoustic modes and determine resultant thrust oscillations produced by acoustic oscillations. Also included are some key fundamental equations which can be used to gain insight into combustion instability in rocket motor systems and there is a short section on motor instrumentation. This paper is not an attempt to be an exhaustive study into combustion instability, but rather, will attempt to list in a clear fashion some of the more important lessons learned and empirical observations of solid propellant combustion instability. This paper emphasizes composite propellants, but many observations apply to double base and composite modified double base propellants, as well.

DTIC

*Combustion Stability; Solid Propellant Rocket Engines*

**20070026739** Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD USA

**U.S. Army Toxic and Hazardous Materials Agency Quality Assurance Program**

Jan 1990; 363 pp.; In English

Report No.(s): AD-A466979; USATHAMA-PAM-11-41; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466979>

The quality Assurance Program has been prepared following the organizational guidelines contained in the U.S. Army Environmental Protection Agency QAMs - 005/80. This program, therefore, has been completely reorganized when compared to the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) Quality Assurance (QA) Program, 2nd Edition, March 1987. The user is cautioned not to assume that everything in this current Edition of the USATHAMA QA Program is exactly the same as it was in the March 1987 Edition. Numerous updates and changes have been made. The major changes are documented in the following tables.

DTIC

*Hazardous Materials; Quality Control; Toxic Hazards; Toxicity*

**20070026740** Weston (Roy F.), Inc., West Chester, PA USA

**Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture**

Williams, Richard T; MacGillivray, A R; Mar 1987; 341 pp.; In English

Contract(s)/Grant(s): DAAK11-85-D-0007

Report No.(s): AD-A466980; AMXTH-TE-CR-87106; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466980>

The degradation of nitroguanidine manufacture wastewater components was examined in order to predict the long-term feasibility of land farming. Continuous flow and soil perfusion columns, microbial enumeration, and batch mineralization studies were utilized for this investigation. After 271 days of operation for the continuous flow soil columns and 84 days of operation for the soil perfusion columns, only some components of nitroguanidine wastewater were completely or partially removed. Guanidine nitrate and sulfate were the most rapidly transformed. Nitroguanidine (NQ), however, was only partially removed.

DTIC

*Biodegradation; Degradation; Nitrates; Nitroguanidine; Soils; Waste Water*

**20070026748** Dames and Moore, Linthicum, MD USA

**Radon Screening of Buildings at the Umatilla Depot Activity, Hermiston, Oregon**

Lamont, S; Breyse, J; Jul 1990; 61 pp.; In English

Contract(s)/Grant(s): DAAA15-88-D-0008

Report No.(s): AD-A467014; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467014>

This document is the Standard Operating Procedure (SOP) for a radon screening of existing buildings at the Umatilla Depot Activity (UMDA), Hermiston, Oregon. The U.S. Army Toxic and Hazardous Materials Agency. (USATHAMA) has contracted with Dames & Moore--under Contract No. DAAA15-88-D-0008, Delivery Order No. 3--to conduct this survey in support of the U.S. Department of Defense (DOD) Base Realignment and Closure (BRAC) Program at UMDA. The Army wants to be aware of any potential or existing radon problems in buildings at UMDA that would be left in place at the time of base closure. It is noted that currently unoccupied or minimally occupied buildings may be heavily occupied under possible future use scenarios (such as use of the facility as an industrial park). The objective of the radon survey will be accomplished by conducting the following tasks. Note that a total of no more than 400 radon samples (including blank samples at a rate of 10 percent) is authorized. 1. Conduct of an initial building survey to collect information on and evaluate building characteristics for the determination of optimal locations for radon collector placement in each of the approximately 238 existing buildings at the installation. (Note that the 1,001 storage igloos are not included in this survey.) 2. Alpha track radon detector placement and retrieval and conduct of laboratory analyses for radon. 3. Conduct of a supplementary building survey--limited to buildings in which exceedance of the U.S. Environmental Protection Agency. (USEPA) 4-picocurie/liter (pCi/l) guideline for radon were noted-- which includes additional visual assessment and measurements, as appropriate, to provide information for the determination of additional surveys or remedial measures.

DTIC

*Buildings; Detectors; Radon; Surveys*

**20070026807** Loyola Coll., Baltimore, MD USA

**Applications of Molecular and Materials Modeling**

Westmoreland, Phillip R; Kollman, Peter A; Chaka, Anne M; Cummings, Peter T; Morokuma, Keiji; Neurock, Matthew; Stechel, Ellen B; Vashishta, Priya; Jan 2002; 453 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): ENG-9707092

Report No.(s): AD-A467500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467500>

This report reviews the development and applications of molecular and materials modeling in Europe and Japan in comparison to those in the USA. Topics covered include computational quantum chemistry, molecular simulations by molecular dynamics and Monte Carlo methods, mesoscale modeling of material domains, molecular-structure/mesoscale property correlations like QSARs and QSPRs, and related information technologies like informatics and special-purpose molecular-modeling computers. The panel's findings include the following: The USA leads this field in many scientific areas. However, Canada has particular strengths in DFT methods and homogeneous catalysis; Europe in heterogeneous catalysis, mesoscale, and materials modeling; and Japan in materials modeling and special-purpose computing. Major government-industry initiatives are underway in Europe and Japan, notably in multi-scale materials modeling and in development of chemistry-capable ab-initio molecular dynamics codes. In European and U.S. assessments of nanotechnology, it was also concluded that to advance the field most quickly and competitively the need is acute for applying new and existing methods of molecularly based modeling. Additional findings are outlined in the panel's executive summary.

DTIC

*Computational Chemistry; Molecular Dynamics; Monte Carlo Method; Quantum Chemistry*

**20070026843** ABB Environmental Services, Inc., Portland, ME USA

**No Further Action Decision Under CERCLA Study Area 43F Historic Gas Station Sites Fort Devens, Massachusetts**

Jan 1995; 36 pp.; In English

Contract(s)/Grant(s): DAAA15-91-D-0008

Report No.(s): AD-A467777; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467777>

This decision document has been prepared to support a no further action decision at Study Area 43F - Historic Gas Station Site (SA 43F) at Fort Devens, Massachusetts. The report was prepared as part of the U.S. Department of Defense (DoD) Base Realignment and Closure (BRAC) program to assess the nature and extent of contamination associated with site operations

at Fort Devens. In conjunction with the Army's Installation Restoration Program (IRP), Fort Devens and the U.S. Army Environmental Center (USAEC; formerly the U.S. Army Toxic and Hazardous Materials Agency) initiated a Master Environmental Plan (MEP) in 1988. The MEP consists of assessments of the environmental status of SAS, specifies necessary investigations, and provides recommendations for response actions with the objective of identifying priorities for environmental restoration at Fort Devens. The Historic Gas Station Sites were identified in the MEP as potential areas of contamination. On December 21, 1989, Fort Devens was placed on the National Priorities List under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act. An Enhanced Preliminary Assessment (PA) was also performed at Fort Devens to address areas not normally included in the CERCLA process, but requiring review prior to closure. A final version of the PA report was completed in April 1992. In 1992, DoD, through USAEC, also initiated a Site Investigation (SI) for SA 43A through S along with the other 12 SAs in SA Groups 2 and 7 at Fort Devens. The SI was conducted by ABB Environmental Services, Inc. (ABB-ES). Under Public Law 101-510, the Defense Base Realignment and Closure Act of 1990, Fort Devens has been selected for cessation of operations and closure.

DTIC

*Contamination; Decision Making; Ground Water*

**20070027250** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Multi-Wall Carbon Nanotubes for Flow-Induced Voltage Generation (Preprint)**

Liu, Jianwei; Dai, Liming; Baur, Jeff W; Aug 2006; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466863; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recently it has been reported that voltage can be generated by passing fluids over single-walled carbon nanotube (SWCNT) arrays with potential application to flow sensors with a large dynamic range. The present work investigates voltage generation properties of multi-walled carbon nanotubes (MWCNT) as a function of the relative orientation of the nanotube array with respect to the flow direction, flow velocity, and solution ionic strength. It was found that the flow-induced voltage can be significantly enhanced by aligning the nanotubes along the flow direction, increasing the flow velocity and/or the ionic strength of the flowing liquid. A flow-induced voltage of ~30mV, which is 15 times higher than the highest voltage reported for single-wall carbon nanotubes, has been generated from our perpendicularly-aligned MWCNT in an aqueous solution of 1 M NaCl at a relatively low flow velocity of 0.0005 m/s. The results are generally consistent with the pulsating asymmetric ratcheting mechanism proposed for SWCNT arrays, in which an asymmetrical spatial distributed strain forms from interactions with the polar and ionic species at the tube surface and is driven along the tube by the fluid flow.

DTIC

*Carbon Nanotubes; Electric Potential; Walls*

**20070027260** RFMD Infrastructure Product Group, Inc., Charlotte, NC USA

**Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint)**

Poulton, M J; Leverich, W K; Shealy, J B; Vetry, R; Brown, J; Green, D S; Gibb, S R; Jul 2006; 6 pp.; In English

Contract(s)/Grant(s): FA8650-05-C-5411; Proj-4348

Report No.(s): AD-A466895; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The linearity and efficiency performance was studied for large periphery AlGaIn/GaN HEMTs. Comparison was made between inherent linear device performance and device performance using Digital Pre-Distortion (DPD) correction. Additionally, both drain voltage and current were optimized to provide high efficiency for a specified linearity. Significant improvements in linear efficiency were achieved using the DPD correction with a best measured PAE of 43.5%, at a Vd of 28 V, using two carrier W-CDMA.

DTIC

*Broadband; Distortion; High Electron Mobility Transistors; Intermodulation; Linearity; Semiconductor Devices*

**20070027262** RFMD Infrastructure Product Group, Inc., Charlotte, NC USA

**GaN Wide Band Power Integrated Circuits (Preprint)**

Conlon, J P; Zhang, N; Poulton, M J; Shealy, J B; Vetry, R; Green, D S; Brown, J D; Gibb, S; Jul 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-C-5411; Proj-4348

Report No.(s): AD-A466897; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Gallium Nitride (GaN) amplifiers have demonstrated very high power density as well as wide band width in previous

research. This paper examines their use in supplying flat gain, power, and linearity across a large band width. It demonstrates two types of power amplifiers: a Ft Doubler (FT2) amplifier and a Cascode amplifier, both of which require a simple PCB tune. Both amplifiers show 0.2 to 4GHz bandwidth with 30 dBm P1dB output power. The 3GPP WCDMA output power is 20 dBm at -45 dBc ACLR.

DTIC

*Broadband; Gallium Nitrides; High Electron Mobility Transistors; Integrated Circuits; Leakage*

**20070027290** Naval Postgraduate School, Monterey, CA USA

**Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns**

Cleveland, Jr, William B; Mar 2007; 75 pp.; In English

Report No.(s): AD-A467073; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis had 2 objectives. The first purpose of this thesis was to develop an experimental procedure to study electric current induced flow of liquid metal, similar to that found at the armature-rail contact due to local melting, to determine the kinetics of liquid flow Ga under electric current conditions. For this, a model system comprising a bead of Ga on a Cu thin film track was devised in order to enable liquefaction and current induced movement of Ga to occur along the Cu track. Upon application of current, Ga underwent liquefaction due to Joule heating and once liquid, it rapidly migrated along the Cu track towards the negative terminal. The Ga liquid flow was attributed to electromigration of liquid Ga under the influence of direct electric field. The kinetics of Ga flow was determined. This method will be useful in calculating the kinetics of electromigration of molten Al along Cu rails in future railgun development. The second purpose of this thesis was to analyze debris left on Cu/24Ag rails following firing of 7075Al armatures, in order to understand the compositional evolution of the debris, and its role in creating surface damage to armature/rail interfacial surfaces. EDS analysis showed a majority of the debris was composed of oxidized aluminum with significant porosity. The analysis of the rail debris will benefit future studies on preventing rail debris from damaging railguns.

DTIC

*Current Density; Electric Current; Electromigration; Fluid Flow; Kinetics; Liquefaction; Railgun Accelerators*

**20070027474** Air Force Research Lab., Kirkland AFB, NM USA

**Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures**

Busani, T; Devine, R A; Jan 2004; 7 pp.; In English

Contract(s)/Grant(s): F29601-01-C-0241; Proj-4846

Report No.(s): AD-A467664; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Amorphous lanthanum aluminate films (LaAlO<sub>3</sub>) were deposited on Si substrates at room temperature using rf sputtering in pure Ar or an Ar/O<sub>2</sub> mixture with a stoichiometric target. The film composition was analyzed using XPS and EDX. The evolution of the material resulting from annealing at temperatures in excess of 900 degree C was studied using infrared spectroscopy, XPS profiling and AFM. We obtain clear evidence for in-diffusion of Si from the substrate into the dielectric film. FTIR analysis showed only one peak centered at 747 /cm with an FWHM of 185/cm for as-deposited samples indicating an amorphous structure. Annealed samples showed very narrow absorptions at 483-510, 607, 695-720 and 811 /cm. No evidence for SiO<sub>2</sub> peaks at ~1060 /cm was observed suggesting that the LaAlO<sub>3</sub> structure tends not to reduce into a mixture of SiO<sub>2</sub> and a silicide. Short time annealing at 1000 degrees C results in a broad band at 905 /cm which can be interpreted in terms of the formation of a layer rich in Si-O-La bonds. Nitridation of the substrate before oxide deposition and annealing slows the degradation process but does not suppress it. X-ray diffraction analysis of the annealed films indicates a very oriented crystalline structure, yet unidentified, whose direction depends upon the orientation of the Si substrate. The dielectric constant in both annealed and as-deposited films was measured to be less than 14 and the leakage current density was very low. Some mobile charge was detected. This dielectric constant is substantially less than the value ~25 anticipated from bulk, single crystal measurements.

DTIC

*Aluminates; Amorphous Materials; Dielectrics; Lanthanum; Oxides; Silicon; Stoichiometry; Substrates; Thin Films*

**20070027479** Technische Univ., Ilmenau, Germany

**Pyroelectric AlGaN/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors**

Ambacher, Oliver; Lebedev, Vadim; Kaiser, Ute; Eastman, L F; Aug 17, 2004; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0301; Proj-03PRO5145-00

Report No.(s): AD-A467686; NICOP-2-2003-APR; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The 18th month progress report includes the results on processing and investigations of (1) pyroelectric HEMT based

sensors for polar-liquid molecules detection; (2) Pt GaN Schottky diode hydrogen sensors; (3) AlGaIn/Si-based solar-blind UV photosensors. Summary of the results: (1) the AlGaIn/GaN HEMT sensors have been processed and tested with water and acetate pica-droplets. (2) Pt/GaN catalytic hydrogen sensors were processed and tested to operate at 350C and RT. (3) high-performance AlGaIn solar-blind UV photosensors with a spectral response of 240 - 300 nm and UV/visible contrast > 10e3 have been grown on Si substrates.

DTIC

*Aluminum Gallium Arsenides; Diodes; Gallium Nitrides; Gas Detectors; Gases; High Electron Mobility Transistors; Ionized Gases; Pyroelectricity; Schottky Diodes*

**20070027497**

**Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint)**

Turner, Andrew E; Leichner, Aaron; Oct 24, 2006; 5 pp.; In English

Contract(s)/Grant(s): FA9300-04-C-0008

Report No.(s): AD-A467734; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hydrogen safety has been an oxymoron in many circles since the catastrophic loss of the Hindenburg on May 6, 1937 due to a sudden fire consuming the huge 800 foot long, 100 foot diameter dirigible filled with hydrogen gas. Airship commercial service, enabled by relatively low-cost hydrogen, died along with the longest vehicle ever to fly, even though thousands of passengers had been transported without incident prior to that time. Since 1937 hydrogen has had a bad reputation, though less prominent applications such as launch vehicles, fuel cells and batteries have been safe and successful. But the passing of three generations and the maturation of certain technologies has advanced things sufficiently so that a hydrogen fuel transportation infrastructure and other uses can be discussed constructively. One beneficial application of hydrogen is pressurization of launch vehicle propellants, in other words forcing the liquid propellants out of their storage tanks and into the combustion chamber, overcoming combustion back-pressure and other resistance along the way. Hydrogen is the most mass-efficient way to do this. However, helium is more often used as the safer and more reliable solution, though it weighs twice as much. While the use of helium is a sensible approach for high-cost, high-reliability systems, hydrogen is attractive for systems that do not require high reliability. An example is Aquarius, a new low-cost, reduced-reliability launch vehicle for low-cost consumables, for which an occasional failure will be tolerated. This article discusses pressurization of liquid oxygen (LOX) with gaseous hydrogen, something most rocket scientists would not attempt but that has now been shown to be worthy of development.

DTIC

*Fuel Tank Pressurization; Hydrogen; Liquid Oxygen; Liquid Rocket Propellants; Pressurizing; Propellant Tanks; Risk*

**20070027505** Air Force Research Lab., Edwards AFB, CA USA

**Pentazole-Based Energetic Ionic Liquids: A Computational Study (Preprint)**

Pimienta, Ian S; Elzey, Sherrie; Gordon, Mark S; Boatz, Jerry; Aug 17, 2006; 61 pp.; In English

Contract(s)/Grant(s): Proj-23030423

Report No.(s): AD-A467750; AFRL-PR-ED-JA-2006-300; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The structures of protonated pentazole cations (RN5H+), oxygen-containing anions such as N(NO2)2-, NO3-, and ClO4-, and the corresponding ion pairs are investigated by ab initio quantum chemistry calculations. The stability of the pentazole cation is explored by examining the decomposition pathways of several monosubstituted cations (RN5H+) to yield N2 and the corresponding azidinium cation. The heats of formation of these cations, which are based onisodesmic (bond type conserving) reactions, are dependent on the nature of the substituents. The proton transfer reaction from the cation to the anion is investigated.

DTIC

*Ions; Liquids; Quantum Chemistry*

**20070027506** Michigan State Univ., East Lansing, MI USA

**Molecular Structure Analysis of Aminophenyl Silsesquioxane (Preprint)**

Lee, Andre; Haddad, Timothy S; Schwab, Joseph J; An, Yi Zhong; Oct 31, 2006; 22 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0084; FA9300-05-C-0022

Report No.(s): AD-A467753; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The molecular structures of aminophenyl substituted silsesquioxanes, prepared by two different approaches, have been



investigated using  $^{29}\text{Si}$  NMR spectroscopy. Aminophenyl silsesquioxane prepared by nitration/reduction of octaphenyl POSS(Registered), exhibits broad resonances in the  $^{29}\text{Si}$  NMR spectrum, whereas aminophenyl silsesquioxanes prepared directly from aminophenyltrimethoxysilane exhibit very narrow line widths. Wide-angle X-ray diffraction of the products from the direct synthesis show a diffraction peak with a d-spacing value similar to the 101 hkl reflection peak of the rhombohedral lattice seen in several other crystalline POSS(Registered) octamers, whereas the products from the nitration/reduction exhibit no diffraction peaks. Our analysis suggests that aminophenyl silsesquioxane prepared by the nitration/reduction of octaphenyl POSS(Registered) no longer retains the Si-O structure of the starting octaphenyl POSS(Registered), while the aminophenyl silsesquioxanes prepared by the direct synthesis have significant Si-O cage structure. Thermogravimetric analysis on both products indicates that the aminophenyl silsesquioxanes from the direct synthesis have better thermal and thermo-oxidative stability (TOS). Furthermore, this improved thermal stability is extended to highly crosslinked resins prepared from the phenylethynyl phthalimide derivatives of the aminophenyl silsesquioxanes. The thermal analysis suggests that the discrete Si-O frameworks found in POSS(Registered) monomers play an important role in maximizing the thermal and thermal-oxidative stability of the materials in which they are incorporated.

DTIC

*Molecular Structure; Thermogravimetry*

**20070027522** Politecnico di Milano, Milan, Italy

**Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapotic Self-complementary Tecton Tailored to Halogen Bonding**

Marras, Giovanni; Metrangolo, Pierangelo; Meyer, Franck; Resnati, Giuseppe; Pilati, Tullio; Vij, Ashwani; Jul 31, 2006; 7 pp.; In English

Report No.(s): AD-A467786; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe the synthesis and characterization, by single crystal X-ray analysis, of a 1D heteroditopic self-complementary tecton for halogen bonding. It was designed to also incorporate double bonds and to possess heteropolar pi-pi stacking groups in order to carefully control its supramolecular organization in the solid state. As a result of this supramolecular control, by UV irradiation in the solid state the compound dimerizes forming a 2D heterotetrapotic self-complementary tecton tailored to halogen bonding based self-assembly. This 2D tecton crystallizes clathrating chloroform molecules.

DTIC

*Bonding; Halogens; Solid State*

**20070027554** Air Force Research Lab., Edwards AFB, CA USA

**Numerical Analysis of Chamber Wall Heat Transfer in a GH<sub>2</sub>/GO<sub>2</sub> Sub-Scale Combustor**

Park, Tae; Coy, Edward; Mar 29, 2007; 15 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A467844; AFRL-PR-ED-TP-2007-169; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Chamber wall heat transfer is critical to lifetime and reliability goals in all engine cycles but design margins included to account for uncertainty of predictive methods and allow for system growth can have detrimental effects on performance. Ensuring that critical objectives will be achieved requires accurate predictive methods; however, in many cases, CFD tools used to predict chamber wall heat transfer have never been validated for rocket chamber conditions. AFRL has a program for assessing the current capability of CFD tools and as necessary, and where possible, making improvements. As a part of our ongoing efforts, a sensitivity analysis was performed to identify key parameters that dominate the overall uncertainty in hot-gas-side chamber wall heat transfer to guide decision making in the experimental effort. Numerical simulations of heat transfer in a sub-scale combustor were carried out using FLUENT over a range of boundary and initial conditions in order to determine sensitivity coefficients. These results were combined with estimates of the uncertainty in experimental measurements to determine an initial estimate for the uncertainty in heat flux prediction. The results indicate that the most critical parameters for chamber wall heat flux are surface roughness, turbulence intensity, and gas temperature.

DTIC

*Combustion Chambers; Heat Transfer; Liquid Propellant Rocket Engines; Numerical Analysis; Walls*

**20070027568** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint)**

Barnes, John; Champagne, Victor; Ballard, Donna; Eden, Timothy J; Shoffner, Brent; Potter, John K; Wolfe, Douglas E; Jan 2007; 20 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A467871; AFRL-ML-WP-TP-2007-431; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this study was to examine how the deposition of a thin layer of Commercially Pure (CP) Al on thin plates of Al-7075 T6 affects the tensile properties of the substrate. The CP Al was deposited using both Cold Spray and Kinetic Metallization. Cold Spray utilizes both He and N<sub>2</sub> as the carrier gas and a supersonic nozzle while Kinetic Metallization uses only He as the carrier gas and a sonic or friction compensated nozzle. A test matrix was established to evaluate the coatings applied by both methods. Characterization of the coatings included microstructural analysis, hardness measurements, and tensile, S-N fatigue and bend tests. Results of the characterization are presented.

DTIC

*Aluminum; Hardness; Kinetics; Mechanical Properties; Metallizing; Microstructure; Sprayers; Structural Analysis; Tensile Properties*

**20070027573** CFD Research Corp., Huntsville, AL USA

**Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species**

Thomas, Matthew; Deaconu, Stelu; Lewis, James; Coy, Edward; Mar 29, 2007; 30 pp.; In English

Contract(s)/Grant(s): FA9300-06-C-1002; Proj-300506JN

Report No.(s): AD-A467879; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Measurements of LIBS spectra in an atmospheric pressure laboratory burner and pressurized sub-scale rocket combustion chamber are reported. LIBS is being developed as diagnostic for near wall measurements in liquid rocket combustion chambers as part of an AFRL effort to experimentally determine relative concentrations of major combustion species in rocket chambers and reduce validation uncertainty of CFD heat transfer tools. The potential for simultaneous use as a health-monitoring diagnostic i.e. detection of wall and injector erosion is also discussed.

DTIC

*Combustion Chambers; Combustion Products; Detection; Laser-Induced Breakdown Spectroscopy; Liquid Propellant Rocket Engines*

**20070027591** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint)**

Ivasishin, Orest; Teliovich, Roman V; Ivanchenko, Volodymyr G; Tamirisakandala, Seshacharyulu; Miracle, Daniel B; Feb 2007; 41 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A467919; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Boron addition to conventional titanium (Ti) alloys instigates precipitation of intermetallic TiB whiskers that provide significant increases in strength and stiffness. The eutectic composition is the maximum boron concentration that provides these benefits via melt processing while maintaining reasonable ductility and damage tolerance. The eutectic point for the most widely used Ti alloy, Ti-6Al-4V (weight percent), modified by B addition, was determined to occur at 1.55+0.05B and 1545+5 °C. The microstructure, texture, and tensile properties of the eutectic alloy are sensitive to ingot solidification conditions and melt pool morphology. Several microstructural forms in the as-cast condition as well as their transformation during thermomechanical processing (TMP) were identified. Two types of eutectic structures, aligned and random, were obtained. Cast microstructures with random eutectic colony orientation had no marked crystallographic texture, while cast aligned microstructure had a strong [020] texture for the TiB phase and a <110> circular texture for the alpha-Ti phase.

DTIC

*Alloys; Eutectic Alloys; Eutectic Composites; Eutectics; Microstructure; Tensile Properties; Titanium Alloys*

**20070027594** Air Force Research Lab., Edwards AFB, CA USA

**Alkene- and Alkyne- Substituted Methylimidazolium Bromides: Structural Effects and Physical properties (Preprint)**  
Schneider, Stefan; Drake, Gregory; Hall, Leslie; Hawkiins, Tommy; Rosander, Michael; Smith, Dennis; Mar 8, 2007; 29 pp.; In English

Contract(s)/Grant(s): Proj-23030423

Report No.(s): AD-A467925; AFRL-PR-ED-JA-2007-097; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several bromide salts composed of methylimidazolium cations possessing unsaturated sidechains (allyl-, 3-butenyl-, propargyl-, 2-butynyl-, and 2-pentynyl-) have been synthesized and characterized by multinuclear NMR, vibrational spectroscopy, and DSC, X-ray and elemental analysis. X-ray structures of 1-(2-butynyl)-3-methylimidazolium bromide, 1-propargyl-3-methylimidazolium bromide as well as the X-ray structure of 1-allyl-3- methylimidazolium bromide which was previously identified as a room temperature ionic liquid, were all determined.

DTIC

*Alkenes; Alkynes; Bromides; Crystal Structure*

**20070027607** Air Force Research Lab., Edwards AFB, CA USA

**Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint)**

Iacono, Scott T; Perpall, Mark W; Hoffman, Wesley P; Wapner, Phillip G; Smith, Jr, Dennis W; Feb 26, 2007; 3 pp.; In English

Contract(s)/Grant(s): FA9300-06-C-0023; Proj-48470249

Report No.(s): AD-A467943; AFRL-PR-ED-JA-2007-068; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Co-monomera A and B were the focus of this investigation because they demonstrate accelerated cure times at lower temperatures compared with monomer precursors 1-3. We have demonstrated bis-ortho-diynylarene (BODA) monomers undergo Bergman cyclopolymerizations to form hyper-branched, rigid naphthalene networks that can be further carbonized at 1000 C to form glassy carbon in high yield (>80%).

DTIC

*Carbonization; Glassy Carbon; Monomers; Naphthalene*

**20070027629** Western Electrochemical Co., Cedar City, UT USA

**Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint)**

Richman, K W; Griffith, K N; Liotta, C L; Pollet, P; Apr 9, 2007; 11 pp.; In English

Contract(s)/Grant(s): FA9300-05-M-3013; Proj-300505KM

Report No.(s): AD-A467979; AFRL-PR-ED-TP-2007-212; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Extensive research has been directed at replacing hydrazine and its simple derivatives in liquid propellant fuel applications. While no specific replacement has been discovered, much has been learned about what types of compounds will make good fuels. One compound that has been investigated is 2-dimethylaminoethylazide (DMAZ). DMAZ is simple to prepare, and from a handling perspective is less toxic than hydrazine. Though DMAZ is hypergolic with IRFNA, there is a significant ignition delay. The explanation, based on ab-initio calculations is that the onset of ignition involves proton transfer from the acid to the amine nitrogen, and in the lowest energy conformer of DMAZ the azide group inhibits this proton transfer. This offers some insight into how one might design a fuel that overcomes these deficiencies. Either the electron distribution could be altered to allow for an enhanced interaction between the proton and the amine nitrogen, or the molecule could be altered to move the azide group away from the amine group. In either case, the chemistry would have to be done so that the advantages found with the DMAZ molecule (i.e. toxicity and energy) are not lost. While several molecules using either one approach or the other have been identified, this paper focuses on, a molecule that takes advantage of both approaches. The replacement of the tertiary amine nitrogen in DMAZ with 1,1-dimethyl hydrazine results in a molecule, 1,1-dimethyl-2-[2-azidoethyl]hydrazine (DMAEH) with a (calculated) lowest energy conformation in which the tertiary amine nitrogen is free to interact with the acidic proton at ignition. In addition to obvious steric improvements, a group with adjacent unshared electron pairs results in an enhancement of this group's nucleophilicity. Attempts at synthesizing DMAEH have ultimately failed.

DTIC

*Azides (Inorganic); Azides (Organic); Charge Transfer; Derivation; Ethylene; Fuels; Hydrazines; Ignition; Liquid Rocket Propellants*

**20070027661** Air Force Research Lab., Edwards AFB, CA USA

**Role of Thermochemical Decomposition in Energetic Material Initiation Sensitivity and Explosive Performance**

Shackelford, Scott A; Feb 5, 2007; 31 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A468050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Catastrophic initiation of an energetic material consists of a complex, interactive, sequential train of mechanistic mechanical, physical, and chemical processes which occur over a finite time period and proceed from macroscopic into sub-microscopic composition levels (bulk > crystalline > molecular > atomic). Initiation results when these processes proceed at a rate which generates sufficient energy (heat) to reach a threshold stage within this finite time period. Thus, the rate at which these mechanistic processes occur defines initiation sensitivity and affects performance. Thermochemical decomposition processes regulate the rate at which heat energy is released at the molecular level, and therefore to some extent, control energetic material initiation sensitivity and performance characteristics. Kinetic deuterium isotope effect (KDIE) data, obtained during ambient pressure thermochemical decomposition process, identifies the mechanistic rate-controlling bond rupture which ultimately regulates the energy release rate of a given energetic material. This same rate-controlling bond rupture also appears as a significant rate-limiting feature in higher order deflagration, combustion, and explosion phenomena. The effect the KDIE-determined rate-controlling bond rupture exerts on initiation sensitivity, and its potential influence in combustion and explosion performance is delineated.

DTIC

*Decomposition; Explosives; Sensitivity; Thermochemistry*

**20070027788** Applied Research Associates, Inc., Panama City, FL USA

**Perchlorate Removal, Destruction, and Field Monitoring Demonstration**

Coppola, Edward N; Davis, Andrea; Oct 2, 2006; 151 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-CU-0312

Report No.(s): AD-A468528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objectives of this demonstration were to evaluate and demonstrate a complete perchlorate ion exchange process for groundwater that included a unique, regenerable, perchlorate-selective ion exchange resin; an efficient regeneration technique that greatly minimized waste volume; methods for treating regeneration waste from this process that would reduce cost by enabling discharge or reuse; and to demonstrate a new perchlorate field monitor with ppb detection. In order to validate the performance and economics of the proposed processes compared to current perchlorate treatment processes, the following objectives were proposed: 1. Demonstrate perchlorate removal in groundwater from >50 ppb to < or = 5 ppb with a regenerable, perchlorate-selective ion exchange process. 2. Demonstrate an efficient regeneration technique of the perchlorate-selective ion exchange resin. Regenerant volume should be < 0.1% of treated groundwater stream. 3. Demonstrate removal or destruction of perchlorate (< or = 5 ppb) in the regenerant stream enabling discharge or reuse of the regenerant stream.

DTIC

*Destruction; Ground Water; Ion Exchange Resins; Perchlorates*

**20070027798** Oregon State Univ., Corvallis, OR USA

**Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons**

Semprini, Lew; Sep 2006; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468544; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Aerobic cometabolism is a promising technology for in situ remediation of chlorinated aliphatic hydrocarbons (CAH) at Department of Defense (DoD) sites. Low-cost methods are needed for generating the data required to design field-scale systems. This report describes a newly developed single-well technology for evaluating the feasibility of using in situ aerobic cometabolic processes to treat groundwater contaminated with chlorinated solvent mixtures. The Environmental Security Technology Certification Program (ESTCP) supported a 3-year field study to investigate single-well tests to evaluate the potential for aerobic cometabolism of CAHs. Tests were performed at McClellan Air Force Base (McAFB), California, using propane as the cometabolic substrate, and at Fort Lewis Logistics Center, Washington, using toluene as the cometabolic substrate. McAFB was selected as the demonstration site since it has significant CAH groundwater contamination, and it was the site of the ESTCP demonstration of cometabolic air sparging (CAS) with propane as a growth substrate. In the Fort Lewis demonstration, toluene was evaluated as a cometabolic growth substrate, and different surrogates and inhibitors were evaluated. The single-well test methods were developed and demonstrated to determine (1) the transport characteristics of nutrients, substrates, and CAHs and their transformation products; (2) the capability of indigenous microorganisms to utilize

selected substrates and transform targeted contaminants and surrogate compounds; (3) the rates of substrate utilization and contaminant transformation; and (4) the combinations of injected nutrients and substrates that maximize rates of contaminant transformation.

DTIC

*Aerobes; Aliphatic Hydrocarbons; Chlorocarbons; Contamination; Ground Water; Hydrocarbons*

**20070027799** Oregon State Univ., Corvallis, OR USA

**Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface**

Semprini, Lew; Istok, Jonathan; Nov 6, 2006; 98 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-9916

Report No.(s): AD-A468545; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Nonaqueous phase liquids (NAPL), including chlorinated solvents, aromatic hydrocarbons, and other volatile organic chemicals (VOC), are common contaminants at Department of Defense (DoD) and other federal and non-federal sites. Residual or pooled NAPL contamination provides a long-term source of contamination as it slowly dissolves into groundwater. A major obstacle preventing cost-effective soil and groundwater cleanup at many DoD sites is the current inability to accurately and inexpensively locate and quantify NAPL contamination. This final report describes the use of naturally occurring radon-222 (Rn) as a partitioning tracer for locating and quantifying NAPL contamination in the subsurface and for monitoring changes in NAPL quantities resulting from remediation activities. Radon-222 possesses unique physical properties that make it a useful natural partitioning tracer for detecting and quantifying NAPL. Rn is produced in the subsurface by the continuous decay of naturally occurring radium-226. In the absence of NAPL contamination, the aqueous Rn concentration quickly reaches a site-specific equilibrium value determined by the mineralogy and porosity of the geologic formation. In the presence of NAPL, however, the Rn concentration is substantially reduced due to partitioning of Rn into the organic NAPL phase. Moreover, the reduction in Rn concentration of groundwater in contact with a NAPL phase is quantitatively correlated with the quantity of NAPL present, as described by simple equilibrium models. Thus, the method is based on measuring Rn in groundwater samples from existing monitoring wells.

DTIC

*Contamination; Liquids; Radioactive Isotopes; Radon; Radon Isotopes; Soils*

**20070027802** Illinois Univ., Chicago, IL USA

**Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Nonparabolicity and the Urbach Tail**

Chang, Yong; Grein, Christoph H; Sivananthan, Sivalingam; Flatte, M E; Nathan, V; Guha, S; Aug 10, 2006; 4 pp.; In English  
Report No.(s): AD-A468548; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An analytical model describing the absorption behavior of HgCdTe is developed that simultaneously considers the contributions from nonparabolic conduction and light hole bands as calculated by a 14 X 14 matrix k-p method as well as the Urbach tail. This model is capable of smoothly fitting experimental absorption coefficient curves over energies ranging from the Urbach tail region to the intrinsic absorption region up to 300 meV above the band gap. Comparisons to the experimental results give good agreement.

DTIC

*Absorption Spectra; Absorptivity; Mercury Cadmium Tellurides; Photons*

**20070028474** Academy of Sciences (USSR), Saint Petersburg, Russian Federation

**Detonation Nanodiamonds and Related Materials. Bibliography Index, Issue 1**

Vul', Alexander; Dolmatov, Valerii; Shenderova, Olga; Jan 2003; 100 pp.; In English

Contract(s)/Grant(s): N00014-03-1-1070

Report No.(s): AD-A468237; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468237>

The Bibliography Index 'Nanodiamonds and Related Materials' was prepared for the First International Symposium on 'Detonation Nanodiamonds: Technology, Properties and Applications'. It seemed important to us to introduce the Symposium participants to most of the recent publications, since the studies in the area of nanotechnologies - nanoelectronics, nanobioengineering and nanomaterials - are gaining greater importance in the modern world. A key position among nanomaterials belongs to nanocarbon clusters, such as fullerenes, nanotubes and carbon onions discovered at the end of the 20th century. Most of the papers included in the Bibliography are on detonation nanodiamonds. Two papers published in the Russian journal 'Reports of the Academy of Sciences' and in 'Nature' in 1988 are the most widely cited ones, so they are

chosen as a zero point for the selection of publications. But we also included a short list of papers published before that date for the sake of historical reference. The publications on each topic are presented in a chronological sequence and in the alphabetic order within each year. The Index is concluded with a list of organizations and research groups involved in nanodiamond technologies, which may promote international cooperation within this community.

DTIC

*Bibliographies; Detonation; Diamonds; Nanotechnology*

**20070028525** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Effects of Temperature and Environment on Creep Behavior of an Oxide-Oxide Ceramic Matrix Composite**

Braun, Jason C; Mar 2007; 267 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468294; AFIT/GAE/ENY/07-M04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research investigated the creep behavior of an N720/Al2O3 composite. The composite consists of a porous alumina matrix reinforced with laminated, woven mullite/alumina fibers (Nextel™ 720). This ceramic matrix composite (CMC) has no fiber coating and relies on the porous matrix for flaw tolerance. The tensile stress-strain behavior was investigated and the tensile properties measured in the 800-1100 °C temperature range. Tensile creep behavior was examined at 1000 and 1100 °C in laboratory air and in steam environment. In air creep stress was 150 MPa. In steam creep stresses ranged from 100 to 160 MPa. Primary and secondary creep, but no tertiary creep, were observed in all tests. Minimum creep rate was reached in all tests. Creep rates accelerated with increasing temperature and creep stress. The presence of steam further increased creep rates. At 1000 °C creep run-out, defined as 100 hours at creep stress, was achieved in all tests. At 1100 °C run-out was achieved at 150 MPa in laboratory air, but only at 100 MPa in steam. The residual strength and modulus of all specimens that achieved run-out were characterized. At 1100 °C in the presence of steam, creep performance deteriorated rapidly with increasing creep stress. Composite microstructure, as well as damage and failure mechanisms, were explored.

DTIC

*Aluminum Oxides; Ceramic Matrix Composites; Creep Properties; Fiber Composites; Oxides; Temperature Effects*

**20070028561** North Carolina State Univ., Raleigh, NC USA

**Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules**

Smith, C. B., Inventor; Bilgen, M., Inventor; Hauser, P. J., Inventor; 28 Jan 05; 34 pp.; In English

Contract(s)/Grant(s): AG-533512

Patent Info.: Filed 28 Jan 05; US-Patent-Appl-SN-11-045-225

Report No.(s): PB2007-104040; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A process for producing an ionic crosslinked fibrous material, such as a cellulosic fabric, paper, or other substrate, wherein the ionic crosslinked fiber exhibits an increased wrinkle resistance angle. A process for producing a cationized chitosan, wherein the cationized chitosan exhibits cationization at the C(sub 6) and ring hydroxyl sites and the reactivity of the ring NH(sub 2) sites is preserved. A process for applying a polycation to an anionic fibrous material to form an ionic crosslinked fibrous material. A process for producing a cationized fibrous material, wherein the process is performed as a pad-batch process, an exhaust fixation process, a pad-steam process, or a pad-dry-cure process.

NTIS

*Anions; Cations; Cotton; Crosslinking; Ions; Molecular Weight; Molecules; Negative Ions*

**20070028664** CH2M/Hill Hanford Group, Inc., Richland, WA, USA

**Heat of Dilution Calculation for 19 Molar Sodium Hydroxide with Water for Use in 241-S-112**

Barton, W. B.; January 2007; 10 pp.; In English

Report No.(s): DE2007-899902; RPP-CALC-32668; No Copyright; Avail.: Department of Energy Information Bridge

High concentration caustic solutions are known to cause stress corrosion cracking in carbon steel at elevated temperature. This calculation establishes the conditions where heat of dilution will not cause the solution temperature - concentration to exceed the boundary for stress corrosion cracking as established by NACE International.

NTIS

*Alkalies; Carbon Steels; Dilution; Sodium Hydroxides; Water*

**20070028669** Swedish Univ. of Agricultural Sciences, Lund, Sweden

**Microbial Dynamics during Barley Tempeh Fermentation**

Feng, X. M.; January 2006; 52 pp.; In English

Report No.(s): PB2007-109954; Copyright; Avail.: National Technical Information Service (NTIS)

Tempeh is a traditional staple food in Indonesia mainly made from soybeans. Barley tempeh has been developed by adapting the soybean tempeh process. During soybean tempeh fermentation, the filamentous fungus *Rhizopus oligosporus* is dominant. However, other fungi and bacteria also occur, which may influence tempeh quality or even constitute a health risk. Introduction of food-grade lactic acid bacteria (LAB) and yeasts to tempeh fermentation may enhance tempeh nutritional and hygienic quality. The abilities of LAB and yeasts to grow together with *R. oligosporus* during barley tempeh fermentation and their possible effects on tempeh quality were studied.

NTIS

*Bacteria; Barley; Fermentation; Lactic Acid; Microorganisms; Yeast*

**20070028671** Swedish Univ. of Agricultural Sciences, Lund, Sweden

**Degradation of Polycyclic Aromatic Hydrocarbons by Actinomycetes**

Pizzul, L.; January 2006; 39 pp.; In English

Report No.(s): PB2007-109951; Copyright; Avail.: National Technical Information Service (NTIS)

The potential of some actinomycetes to degrade polycyclic aromatic hydrocarbons (PAH) and the effect of co-substrates, plants and other additives on their degradation and bioavailability was studied. A glass bead system for growth of PAH-degrading actinomycetes in liquid culture was developed and used for the screening of strains for biosurfactant activity and phenanthrene degradation in the presence of different co-substrates. Indication of biosurfactant production by all tested strains was obtained with hexadecane and rapeseed oil as co-substrates but not with glucose. *Rhodococcus* sp. DSM 44126 was identified as *R. wratislaviensis* and found to be able to degrade phenanthrene and anthracene. An actinomycete with a high capacity to degrade phenanthrene and pyrene was isolated from an agricultural soil and identified as *Mycobacterium* LP1. The catabolic activity of both strains was studied in liquid cultures and in soil. Several additives were also tested for their effect on PAH degradation in soils.

NTIS

*Actinomycetes; Degradation; Polycyclic Aromatic Hydrocarbons; Substrates*

**20070028702** Georgia Inst. of Tech., Atlanta, GA USA

**Synthesis, Structure, and Properties of PBO/SWNT Composites**

Kumar, Satish; Dang, Thuy D; Arnold, Fred E; Bhattacharyya, Arup R; Min, Byung G; Zhang, Xiefei; Vaia, Richard A; Park, Cheol; Adams, W W; Hauge, Robert H; Smalley, Richard E; Ramesh, Sivarajan; Willis, Peter A; Jan 2002; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466657; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466657>

Poly(p-phenylene benzobisoxazole) (PBO) has been synthesized in the presence of singlewall carbon nanotubes (SWNTs) in poly(phosphoric acid) (PPA) using typical PBO polymerization conditions. PBO and PBO/SWNT lyotropic liquid crystalline solutions in PPA have been spun into fibers using dry-jet wet spinning. The tensile strength of the PBO/SWNT fiber containing 10 wt % SWNTs is about 50% higher than that of the control PBO fibers containing no SWNTs. The structure and morphology of these fibers have been studied.

DTIC

*Carbon Nanotubes; Polymerization; Synthesis (Chemistry)*

**20070028739** Lawrence Livermore National Lab., Livermore, CA USA

**Corrosion Resistance of Structural Amorphous Metal**

Lian, T.; Day, S. D.; Farmer, J. C.; Apr. 10, 2006; 7 pp.; In English

Report No.(s): DE2007-895719; UCRL-TR-220476; No Copyright; Avail.: National Technical Information Service (NTIS)

This report focuses on the corrosion resistance of a yttrium-containing amorphous metal, SAM1651. SAM1651 has a glass transition temperature of approx. 584DGC, a recrystallization temperature of approx. 653DGC, and a melting point of approx. 1121DGC. The measured critical cooling rate for SAM1651 is = 80 K per second, respectively. The yttrium addition to SAM1651 enhances glass formation, as reported by Guo and Poon (2003). The corrosion behavior of SAM1651 was

compared with nickel-based Alloy 22 in electrochemical polarization measurements performed in several highly concentrated chloride solutions.

NTIS

*Amorphous Materials; Corrosion Resistance; Metals; Yttrium*

**20070028874** Lawrence Livermore National Lab., Livermore, CA USA

**Single Cell Chromatography, LDRD, Feasibility Study**

Knize, M. G.; Bailey, C. G.; Feb. 27, 2007; 8 pp.; In English

Report No.(s): DE2007-902253; UCRL-TR-228365; No Copyright; Avail.: Department of Energy Information Bridge

A limitation in the mass spectrometry of biological materials is the reduced ion formation caused by sample complexity. We proposed to develop an enabling technology, single cell planar chromatography, which will greatly increase the amount of chemical information that can be obtained from single biological cells when using imaging mass spectrometry or other surface analysis methods. The sample preparation methods were developed for the time-of-flight secondary mass spectrometer (ToF-SIMS) at LLNL. This instrument has a measured zeptomole (10<sup>-21</sup> mole, 600 atoms) limit-of-detection for a molecule with a mass to charge ratio of 225(1). Our goal was to use planar chromatographic separation to approach similar low limits of detection even with the chemically complex contents of a single cell. The process was proposed to reduce ion suppression and at the same time expose more of the cell contents to the ion beam. The method of work was to deposit biological cells on a silicon chip with suitable chromatographic and electrical properties, dissolve the cell with a droplet of solvent, allow the solvent to evaporate, and then allow the movement of cell contents laterally by immersing an edge of the chip in to a chromatographic solvent, that then moves through the chromatographic matrix allowing the components to interact with, and be separated by, the chromatographic substrate.

NTIS

*Chromatography; Feasibility; Cells (Biology)*

**20070028889** Wisconsin Univ., Madison, WI, USA; Brigham Young Univ., Provo, UT, USA

**Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report)**

Mavrikakis, M.; Dumesic, J. A.; Nabar, R. P.; Zou, H.; Paul, U.; Feb. 02, 2007; 41 pp.; In English

Report No.(s): DE2007-901151; No Copyright; Avail.: National Technical Information Service (NTIS)

Work continued on the development of a microkinetic model of Fischer-Tropsch synthesis (FTS) on supported and unsupported Fe catalysts. The following aspects of the FT mechanism on unsupported iron catalysts were investigated on during this third year: (1) the collection of rate data in a Berty CSTR reactor based on sequential design of experiments; (2) CO adsorption and CO-TPD for obtaining the heat of adsorption of CO on polycrystalline iron; and (3) isothermal hydrogenation (IH) after Fischer Tropsch reaction to identify and quantify surface carbonaceous species. Rates of C<sub>2</sub>+ formation on unsupported iron catalysts at 220oC and 20 atm correlated well to a Langmuir-Hinshelwood type expression, derived assuming carbon hydrogenation to CH and OH recombination to water to be rate-determining steps. From desorption of molecularly adsorbed CO at different temperatures the heat of adsorption of CO on polycrystalline iron was determined to be 100 kJ/mol. Amounts and types of carbonaceous species formed after FT reaction for 5-10 minutes at 150, 175, 200 and 285oC vary significantly with temperature.

NTIS

*Atoms; Catalysts; Computational Chemistry; Fischer-Tropsch Process; Iron*

**20070029222** Lawrence Livermore National Lab., Livermore, CA USA

**Controls of Fluid Chemistry on Fracture Growth**

Bruton, C. J.; Knauss, K. G.; Viani, B. E.; Bonner, B. P.; Feb. 27, 2007; 6 pp.; In English

Report No.(s): DE2007-902283; UCRL-TR-228397; No Copyright; Avail.: National Technical Information Service (NTIS)

During this two year project (the original proposal requested 3 years funding) we developed and tested a new design for a mini-bending jig for the hydrothermal atomic force microscope (HAFM) and a modified design for the HAFM itself. These new capabilities now permit study of the connection between stress and mineral dissolution and growth, as well as sub-critical crack growth (SCG). We demonstrated the successful design by imaging SCG of glass in situ, in real time in the HAFM, as a function of changing solution pH. We generated a movie of the SCG process. We successfully accomplished our project objectives through year 2. The role of water and its dissolved content in fracturing and rock deformation is poorly understood. However, new models describing the controls of surface chemistry on fracturing, and the relation between fracturing and the



breakage of bonds during mineral dissolution suggest new ways to quantify the impact of fluid chemistry on fracturing using the HAFM.

NTIS

*Chemical Reactions; Crack Propagation; Fluid Flow; Fractures (Materials); Fracturing; Surface Reactions*

**20070029238** Lawrence Livermore National Lab., Livermore, CA USA

**AFCI Storage and Disposal FY-06 Progress Report**

Halwey, W. G.; Wigeland, R.; Dixon, B.; Oct. 12, 2006; 31 pp.; In English

Report No.(s): DE2007-900865; UCRL-TR-225244; No Copyright; Avail.: National Technical Information Service (NTIS)

AFCI Storage and Disposal participants at LLNL, ANL and INL provide assessment of how AFCI technology can optimize the future evolution of the fuel cycle, including optimization of waste management. Evaluation of material storage and repository disposal technical issues provides feedback on criteria and metrics for AFCI, and evaluation of AFCI waste streams provides technical alternatives for future repository optimization. LLNL coordinates this effort that includes repository analysis at ANL and incorporation of repository impacts into AFCI criteria at INL. Cooperative evaluation with YMP staff is pursued to provide a mutually agreed technical base. Cooperation with select international programs is supported.

NTIS

*Cycles; Nuclear Transformations; Radioactive Wastes*

**20070029241** Lawrence Livermore National Lab., Livermore, CA USA

**Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc**

Kelley, K.; Hoffman, R. D.; Dietrich, F. S.; Mustafa, M.; Jun. 01, 2006; 42 pp.; In English

Report No.(s): DE2007-900873; UCRL-TR-221759; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors have developed a set of modeled neutron induced cross sections for use in radiochemical diagnostics. Local systematics for the input parameters required by the Hauser-Feshbach statistical model were developed and used to calculate neutron induced nuclear reaction cross sections for target isotopes of nickel, copper, and zinc (28 less than or equal to Z less than or equal to 30) for neutron numbers 30 less than or equal to N less than or equal to 40.

NTIS

*Copper; Diagnosis; Isotopes; Neutron Cross Sections; Nickel; Nuclear Reactions; Radiochemistry; Zinc*

**20070029257** Oklahoma State Univ., Stillwater, OK, USA

**Final Project Report for Terahertz Spectroscopy of Complex Matter**

January 2006; 15 pp.; In English

Contract(s)/Grant(s): DE-FG02-02ER45960

Report No.(s): DE2007-899163; DOE/FG-45960-4; No Copyright; Avail.: National Technical Information Service (NTIS)

This project designed characterization techniques for thin films of complex matter and other materials in the terahertz spectral region extending from approximately 100 GHz to 4000 GHz (4 THz) midway between radio waves and light. THz has traditionally been a difficult region of the spectrum in which to conduct spectroscopic measurements. The THz gap arises from the nature of the sources and detectors used in spectroscopy both at the optical (high frequency) side and electronic (low frequency) side of the gap. To deal with the extremely rapid oscillations of the electric field in this frequency region this research project adapted techniques from both the electronics and optics technologies by fabricating microscopic antennas and driving them with short optical pulses. This research technique creates nearly single cycle pulses with extremely broad spectral bandwidth that are able to cover the THz spectral range with a single measurement. The technique of THz time domain spectroscopy (THz-TDS) has seen increasing use and acceptance in laboratories over the past fifteen years. However significant technical challenges remain in order to allow THz-TDS to be applied to measurement of solid materials, particularly thin films and complex matter. This project focused on the development and adaptation of time domain THz measurement techniques to investigate the electronic properties of complex matter in the terahertz frequency region from 25 GHz to beyond 5 THz (<1 inv. cm to >165 inv. cm). This project pursued multiple tracks in adapting THz Time Domain Spectroscopy (THz-TDS) to measurement of complex matter.

NTIS

*Spectroscopy; Thin Films*

**20070029312** Tuskegee Univ., AL, USA

**Conversion of Hydrogen Sulfide in Coal Gases to Liquid Elemental Sulfur with Monolithic Catalysts. (Annual Report, October 1, 2005-September 30, 2006)**

Kwon, K. C.; Dec. 1, 2006; 31 pp.; In English

Contract(s)/Grant(s): DE-FG26-04NT42129

Report No.(s): DE2007-901077; No Copyright; Avail.: Department of Energy Information Bridge

Removal of hydrogen sulfide (H<sub>2</sub>S) from coal gasifier gas and sulfur recovery are key steps in the development of Department of Energys (DOEs) advanced power plants that produce electric power and clean transportation fuels with coal and natural gas. These plants will require highly clean coal gas with H<sub>2</sub>S below 1 ppmv and negligible amounts of trace contaminants such as hydrogen chloride, ammonia, alkali, heavy metals, and particulate. The conventional method of sulfur removal and recovery employing amine, Claus, and tail-gas treatment is very expensive. A second generation approach developed under DOEs sponsorship employs hot-gas desulfurization (HGD) using regenerable metal oxide sorbents followed by Direct Sulfur Recovery Process (DSRP). However, this process sequence does not remove trace contaminants and is targeted primarily towards the development of advanced integrated gasification combined cycle (IGCC) plants that produce electricity (not both electricity and transportation fuels).

NTIS

*Catalysts; Coal Derived Gases; Hydrogen Sulfide; Natural Gas; Sulfur*

**20070029326** Lawrence Livermore National Lab., Livermore, CA USA

**Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe<sub>48</sub>Mo<sub>14</sub>Cr<sub>15</sub>Y<sub>2</sub>C<sub>15</sub>B<sub>6</sub> and Variants**

Farmer, J.; Haslam, J.; Day, S.; Lian, T.; Saw, C.; Oct. 12, 2006; 41 pp.; In English

Report No.(s): DE2007-900129; UCRL-PROC-225260; No Copyright; Avail.: National Technical Information Service (NTIS)

This research has two primary long-term goals, all directed towards development of advanced amorphous-metal thermal-spray coatings with corrosion resistance superior to Type 316L stainless steel (UNS number S31603) and nickel-based Alloy C-22 (UNS number N06022). Computational materials science has been used to help guide the design these new materials.

NTIS

*Amorphous Materials; Brines; Calcium Chlorides; Corrosion Resistance; Iron; Metals; Sea Water; Tungsten; Yttrium*

**20070029356** Lawrence Livermore National Lab., Livermore, CA USA

**High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe<sub>49.7</sub>Cr<sub>17.7</sub>Mn<sub>1.9</sub>Mo<sub>7.4</sub>W<sub>1.6</sub>B<sub>15.2</sub>C<sub>3.8</sub>Si<sub>2.4</sub>**

Farmer, J.; Haslam, J.; Day, S.; Lian, T.; Saw, C.; Oct. 20, 2006; 49 pp.; In English

Report No.(s): DE2007-900130; UCRL-PROC-225433; No Copyright; Avail.: National Technical Information Service (NTIS)

This research has two primary long-term goals, all directed towards development of advanced amorphous-metal thermal-spray coatings with corrosion resistance superior to Type 316L stainless steel (UNS number S31603) and nickel-based Alloy C-22 (UNS number N06022). Computational materials science has been used to help guide the design these new materials.

NTIS

*Amorphous Materials; Composition (Property); Corrosion Resistance; Iron; Metals*

**20070029380** Lawrence Livermore National Lab., Livermore, CA USA

**Single-Cell Level Investigation of Cytoskeletal/Cellular Response to External Stimuli**

Hiddessen, A. L.; Bearinger, J. P.; Feb. 26, 2007; 11 pp.; In English

Report No.(s): DE2007-902301; UCRL-TR-228478; No Copyright; Avail.: National Technical Information Service (NTIS)

A detailed understanding of the molecular mechanisms by which chemical signals control cell behavior is needed if the complex biological processes of embryogenesis, development, health and disease are to be completely understood. Yet, if we are to fully understand the molecular mechanisms controlling cell behavior, measurements at the single cell level are needed to supplement information gained from population level studies. One of the major challenges to accomplishing studies at the single cell level has been a lack of physical tools to complement the powerful molecular biological assays which have provided

much of what we currently know about cell behavior. The goal of this exploratory project is the development of an experimental platform that facilitates integrated observation, tracking and analysis of the responses of many individual cells to controlled environmental factors. Toward this goal, we developed chemically-patterned microarrays of both adherent and suspension mammalian cell types. A novel chemical patterning methodology, based on photocatalytic lithography, was developed to construct biomolecule and cell arrays that facilitate analysis of biological function. Our patterning techniques rely on inexpensive stamp materials and visible light, and do not necessitate mass transport or specified substrates. Patterned silicon and glass substrates are modified such that there is a non-biofouling polymer matrix surrounding the adhesive regions that target biomolecules and cells. Fluorescence and reflectance microscopy reveal successful patterning of proteins and single to small clusters of mammalian cells. In vitro assays conducted upon cells on the patterned arrays demonstrate the viability of cells interfacing with this synthetic system. Hence, we have successfully established a versatile cell measurement platform which can be used to characterize the molecular regulators of cellular behavior in a variety of important biological processes. The achievements realized in this project have enabled presentations and publication within the international scientific community, new collaborations with researchers at the University of California, and successful competition for three additional, separate research grants on studies of stem cell fate commitment and pathogen-host cell interactions.

NTIS

*Molecular Biology; Cells (Biology)*

**20070029391** Greenlee Winner and Sullivan, P.C., Boulder, CA, USA

**Releaseable Corrosion Inhibitor Compositions**

Cook, R. L., Inventor; 11 Apr 03; 17 pp.; In English

Contract(s)/Grant(s): N000014-96-0147; F33615-99-C5013

Patent Info.: Filed Filed 11 Apr 03; US-Patent-Appl-SN-10-412 737

Report No.(s): PB2007-104631; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A new class of releasable corrosion inhibiting materials for protective coatings, methods of making the same, methods of using the same, and coatings containing the same are provided. The materials comprise one or more corrosion inhibitors that are chemically anchored to the surface of a particle having an aluminum oxyhydroxide surface through a carboxylate bond. The carboxylate/aluminum- oxyhydroxide-surface bond breaks under corrosion-causing conditions (for example the presence of high levels of hydroxide ions generated by the cathodic oxygen reduction reaction on metals such as iron and aluminum) thereby allowing the corrosion inhibitors to detach from the particle surface when corrosion is present.

NTIS

*Corrosion; Corrosion Prevention; Protective Coatings*

**20070029405** Lawrence Livermore National Lab., Livermore, CA USA

**Comparison of Isoconversional and Model Fitting Approaches to Kinetic Parameter Estimation and Application Predictions**

Burnham, A. K.; May 30, 2006; 12 pp.; In English

Report No.(s): DE2007-900446; UCRL-CONF-221685; No Copyright; Avail.: National Technical Information Service

(NTIS)

Chemical kinetic modeling has been used for many years in process optimization, estimating real-time material performance, and lifetime prediction. Chemists have tended towards developing detailed mechanistic models, while engineers have tended towards global or lumped models. Many, if not most, applications use global models by necessity, since it is impractical or impossible to develop a rigorous mechanistic model. Model fitting acquired a bad name in the thermal analysis community after that community realized a decade after other disciplines that deriving kinetic parameters for an assumed model from a single heating rate produced unreliable and sometimes nonsensical results. In its place, advanced isoconversional methods (1), which have their roots in the Friedman (2) and Ozawa-Flynn-Wall (3) methods of the 1960s, have become increasingly popular. In fact, as pointed out by the ICTAC kinetics project in 2000 (4), valid kinetic parameters can be derived by both isoconversional and model fitting methods as long as a diverse set of thermal histories are used to derive the kinetic parameters. The current paper extends the understanding from that project to give a better appreciation of the strengths and weaknesses of isoconversional and model-fitting approaches. Examples are given from a variety of sources, including the former and current ICTAC round-robin exercises, data sets for materials of interest, and simulated data sets.

NTIS

*Fitting; Kinetics; Parameter Identification; Models*

**20070029455** Swedish Environmental Protection Agency, Stockholm, Sweden

**Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation**

Tjus, K.; Bergstrom, R.; Fortkamp, U.; Forsberg, K.; Rasmuson, A.; Oct. 2006; 56 pp.; In English

Report No.(s): PB2007-110375; IVL-B-1692; No Copyright; Avail.: National Technical Information Service (NTIS)

Within the project a possible combination of techniques for recovery of metals and acids from stainless steel pickling has been investigated, as there is a lack of cost and energy efficient methods that allow recycling of both metals and acids today. Crystallisation and nanofiltration were combined in order to separate the metals as metal fluorides and recycle nitric and hydrofluoric acid to the pickling bath. A total treatment concept will also include the thermal treatment of the crystals, in order to gain metal oxides that can be reused. The fluorides will be recovered as HF from the exhaust gas. This thermal treatment has not been investigated in this project, but it should be possible to adapt existing techniques for that. Experiments in laboratory scale were performed in order to increase understanding of the processes and for design of a pilot plant. A Pilot plant was built within the project. Process liquids from two stainless steel companies in Sweden were investigated with the pilot plant. The experiments were used for recommendations on full-scale solutions as well as rough estimations on energy and cost savings. Tests for a longer period of time would be needed in order to be able to assess the life-time of the equipment and performance stability better, but the results show that the techniques could be used for metal separation to allow recycling of acids and prepare for metal recovery. The results also indicate possible energy savings when installing the system. Investigations from a parallel project show promising results regarding the on-line measurement of concentrations, which will allow a more efficient control of the process.

NTIS

*Baths; Crystallization; Metals; Pickling (Metallurgy)*

**20070029497** Savannah River National Lab., Aiken, SC, USA

**Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report**

Riha, B.; Looney, B.; Denham, M.; Bagwell, K.; Hall, R.; January 2006; 27 pp.; In English

Report No.(s): DE2007-900334; WSRC-TR-2006-00363; No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of these studies was to determine the feasibility of using edible oils for remediation of the low but persistent chlorinated solvent (cVOC) groundwater contamination at the SRS T-Area. This paper provides a summary and overview of the studies completed for the remediation of the T-Area groundwater plume using edible oils. This report begins with a summary of the results and a brief description of the preliminary oil deployment design followed by brief descriptions of T-Area and current groundwater conditions as related to edible oil deployment. This is followed by a review of the remediation processes using edible oils and specific results from modeling, field and laboratory studies. Finally, a description of the preliminary design for full scale oil deployment is presented.

NTIS

*Deployment; Oils; Solvents*

**20070029498** Westinghouse Savannah River Co., Aiken, SC, USA

**Hydrogen Technology Research at the Savannah River National Laboratory. Center for Hydrogen Research and the Hydrogen Technology Research Laboratory**

Danko, E. T.; Feb. 26, 2007; 15 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2007-900333; WSRC-STI-2007-00092; No Copyright; Avail.: National Technical Information Service (NTIS)

The Savannah River National Laboratory (SRNL) is a U.S. Department of Energy research and development laboratory located at the Savannah River Site (SRS) near Aiken, South Carolina. SRNL has over 50 years of experience in developing and applying hydrogen technology, both through its national defense activities as well as through its recent activities with the DOE Hydrogen Programs. The hydrogen technical staff at SRNL comprises over 90 scientists, engineers and technologists, and it is believed to be the largest such staff in the U.S. SRNL has ongoing R&D initiatives in a variety of hydrogen storage areas, including metal hydrides, complex hydrides, chemical hydrides and carbon nanotubes. SRNL has over 25 years of experience in metal hydrides and solid-state hydrogen storage research, development and demonstration. As part of its defense mission at SRS, SRNL developed, designed, demonstrated and provides ongoing technical support for the largest hydrogen processing facility in the world based on the integrated use of metal hydrides for hydrogen storage, separation and compression.

NTIS

*Hydrogen Production; Research and Development*

**20070029519** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid**

Baskin, Steven I; Petrikovics, Ilona; Platoff, Gennady E; Rockwood, Gary A; Logue, Brian A; Jan 2006; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468614; USAMRICD-P05-013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468614>

Methods of directly evaluating cyanide levels are limited by the volatility of cyanide and by the difficulty of establishing steady-state cyanide levels with time. We investigated the measurement of a stable, toxic metabolite, 2-aminothiazoline-4-carboxylic acid (ATCA), in an attempt to circumvent the challenge of directly determining cyanide concentrations in aqueous media. This study was focused on the spectrophotometric ATCA determination in the presence of cyanide, thiocyanate (SCN<sup>-</sup>), cysteine, rhodanese, thiosulfate, and other sulfur donors. The method involves a thiazolidine ring opening in the presence of p.(hydroxy.mercuri)- benzoate, followed by the reaction with diphenylthiocarbazone (dithizone). The product is spectrophotometrically analyzed at 625 nm in carbon tetrachloride. The calibration curve was linear with a regression line of  $Y = 0.0022x$  (R squared = 0.9971). Interference of cyanide antidotes with the method was determined. Cyanide, thiosulfate, butanethiosulfonate (BTS), and rhodanese did not appreciably interfere with the analysis, but SCN<sup>-</sup> and cysteine significantly shifted the standard curve. This sensitive spectrophotometric method has shown promise as a substitute for the measurement of the less stable cyanide.

DTIC

*Amino Acids; Carboxylic Acids; Cyanides; Metabolites; Spectrophotometry*

**20070029524** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor**

Anderson, Dana R; Holmes, Wesley W; Lee, Robyn B; Dalal, Stephen J; Hurst, Charles G; Maliner, Beverly I; Newmark, Jonathan; Smith, William J; Jan 2006; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468624; USAMRICD-P04-030; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468624>

Although best known as a blistering agent, sulfur mustard (HD) can also induce neutropenia in exposed individuals, increasing their susceptibility to infection. Granulocyte colony-stimulating factor (G-CSF) and pegylated G-CSF (peg-G-CSF) have been approved by the U.S. Food and Drug Administration as hematopoietic growth factors to treat chemotherapy-induced neutropenia. The goal of this study was to determine the effectiveness of G-CSF and peg-G-CSF in ameliorating HD-induced neutropenia. African green monkeys (*Chlorocebus aethiops*) were challenged with HD and, at 1, 3, 5, or 7 days after exposure, G-CSF therapy (10 microgram/kg per day for 21 days) was initiated. Peg-G-CSF (300 microgram/kg, single treatment) was similarly tested, with treatment given at 3 days after exposure. Untreated HD-exposed animals recovered from neutropenia 28 days after exposure, whereas G-CSF- or peg-G-CSF-treated animals recovered 8 to 19 days after exposure ( $p < 0.05$ ). These results indicate that G-CSF or peg-G-CSF may provide Food and Drug Administration-approved treatments that will reduce the duration of HD-induced neutropenia.

DTIC

*Colonies; Leukocytes; Stimulation; Sulfur*

**20070029529** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine**

Shih, Tsung-Ming; Rowland, Tami C; McDonough, John H; Jan 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468633; USAMRICD-P06-013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468633>

Two guinea pig models were used to study the anticonvulsant potency of diazepam, midazolam, and scopolamine against seizures induced by the nerve agents tabun, sarin, soman, cyclosarin, O-ethyl S-(2-(diisopropylamino)ethyl)methylphosphonothioate (VX), and O-isobutyl S-(2-diethylamino)ethyl-methyl phosphonothioate (VR). Animals instrumented for electroencephalogram recording were pretreated with pyridostigmine bromide (0.026 mg/kg i.m.) 30 min before challenge with 2 x LD50 (s.c.) of a nerve agent. In model A, atropine sulfate (2.0 mg/kg i.m.) and pyridine-2-aldoxime methylchloride (2-PAM; 25.0 mg/kg i.m.) were given 1 min after nerve agent challenge, and the tested anticonvulsant was given (i.m.) 5 min after seizure onset. In model B, a lower dose of atropine sulfate (0.1 mg/kg i.m.) was given along with 2-PAM 1 min after nerve agent challenge, and the anticonvulsant was given at seizure onset.

DTIC

*Anticonvulsants; Atropine; Dosage; Electroencephalography; Guinea Pigs; Nerves; Therapy*

**20070029533** Washington Univ., Seattle, WA USA

**Development of a 3-D Defocusing Liquid Crystal Particle Thermometry and Velocimetry (3DDLCPVT) System**

Schmitt, David R; May 2007; 144 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468644; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468644>

One of the most intriguing and perplexing problems in fluid mechanics today, as it was 50 years ago, is that of turbulence. The behavior of a fluid in turbulent regions around an object consists of chaotic flow phenomena made of unsteady vortices on many scales that can critically affect the ability of that object to pass through the fluid. Indeed, turbulent convective heat and mass transfer is one of the frequently encountered problems at all levels of applied engineering. While countless research efforts are devoted to understanding turbulent phenomena, this chaotic motion which also consists of random fluctuations in temperature, velocity, pressure, and fluid properties as well as advanced mixing (among other things), has yet to be solved analytically. As a result, understanding this flow requires the use of numerical methods. While turbulent behavior can be resolved through Direct Numerical Simulation (DNS) of the Navier-Stokes Equations, this method is extremely computationally intensive and cannot be practically implemented with today's computing power in flows with Reynolds numbers above approximately 10<sup>4</sup> or 10<sup>5</sup>. As a result, other methods must be used that can approximate turbulent behavior with flow modeling.

DTIC

*Defocusing; Liquid Crystals; Temperature Measurement; Thermometers; Velocity Measurement*

**20070029566** Wake Forest Coll., Winston-Salem, NC USA

**Charge Transfer Nanocomposites: The Effects of Scale-Hierarchy**

Carroll, David L; Dec 31, 2006; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0161

Report No.(s): AD-A468765; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468765>

In this work, we have accomplished the preparation and characterization of the optical properties of 280 nm silica nanospheres coated with a luminescent conjugated polyelectrolyte, sulfonated Poly(phenylene ethynylene) (PPE-SO<sub>3</sub><sup>-</sup>). The conjugated polymer is coated onto the nanospheres by the L-b-L method. Previous shell construction by means of a non-luminescent electrolytic polymer host, blended with luminescent semi-conducting nanocrystals is advanced in this work by constructing the shell from a luminescent polyelectrolyte. Furthermore, we have prepared fluorescent opal structures from these core-shell structures and investigated their optical properties.

DTIC

*Charge Transfer; Electrolytes; Hierarchies; Nanocomposites*

**20070029577** University of Southern California, Los Angeles, CA USA

**Energy Efficient Transient: Plasma Ignition: Physics and Technology**

Gundersen, M; Aug 30, 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0107; Proj-2308

Report No.(s): AD-A468806; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468806>

The project has conducted basic studies of flame ignition collaborative studies of pulse detonation ignition, and preliminary studies of fundamental issues relevant to the application of transient plasma as an ignition source for Air Force high-speed aircraft applications. Preliminary basic science experiments have been conducted at the Air Force Research Laboratory (AFRL) using planar laser-induced fluorescence (PLIF) for investigation of radical production and ignition delay. Very strong enhancement of radical species throughout the combustor volume using transient plasma for ignition (TPI) was demonstrated using PLIF, and the production of electronically excited species was well coordinated with TPI. In another study at AFRL systems were interfaced successfully with a pulse detonation engine (PDE), and data were taken for a variety of electrode lengths while burning aviation gasoline and ethylene. The project work also included development of appropriate ignition systems for these studies, comprised of pulse sources, transmission lines (cabling appropriate for nanosecond power pulses), and electrodes, and extending the work from laboratory pulse generation capabilities to considerable reduction in size and weight of the ignition pulse generation. This reduction is a critical issue in the application of this technology. The electrical engineering issues inherent in the application of the short pulses to fuel-air mixtures at various pressures and in a variety of geometries were addressed successfully in the project.

DTIC

*Ignition Systems; Plasma Physics; Pulsejet Engines*

**20070029582** Chicago Univ., Chicago, IL USA

**MURI Center for Materials Chemistry in the Space Environment**

Sibener, Steven J; Nov 30, 2006; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-01-1-0335

Report No.(s): AD-A468812; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468812>

MURI research activities, involving strong interactions between experiment and theory, including interactions with AFRL, NASA, and Boeing, have advanced knowledge of condensed-phase and gas-phase reactions relevant to materials reactivity in LEO. We have: elucidated the mechanism by which graphite is eroded by high-kinetic energy atomic oxygen; quantified the pathways by which organic molecules react with atomic oxygen in regimes not found in the terrestrial environment; explored hyperthermal O chemistry with gas-phase model organic compounds to delineate quantum chemical reaction dynamics appropriate to LEO; discovered a new gas-surface collisional energy-transfer mechanism in which atoms become embedded and re-emitted from thin organic films with specific directionality and excess momentum, contributing to a refined understanding of collisional energy transfer; developed new theoretical methodologies for treating rare events which can dominate the morphological evolution of eroding interfaces - including the first three-dimensional code that incorporates realistic interfacial chemical reactions with large surface area processes; explored synergistic effects in polymer degradation involving atomic oxygen and short-wavelength radiation commensurate with LEO solar illumination; collaborated with AFRLs to understand the efficacy of hybrid organic/inorganic POSS materials; and are important partners in orbital experiments, MISSE-5 and -6, which seek to better define materials degradation in LEO.

DTIC

*Aerospace Environments; Chemical Reactions; Energy Transfer; Multidisciplinary Research; Polymeric Films; Solar Radiation*

**20070029591** Nebraska Univ., Lincoln, NE USA

**Novel Continuous Carbon Nanofibers for the Next Generation Lightweight Structural Nanocomposites**

Dzenis, Y A; May 2007; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0142

Report No.(s): AD-A468823; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468823>

The goal of this research was to establish applicability and effectiveness of novel continuous carbon nanofibers as nanoreinforcement in advanced organic matrix composites. The specific objectives were: (1) demonstrate applicability of continuous carbon nanofibers for delamination suppression in advanced PMC laminates; (2) explore manufacturing and characterize mechanical behavior of carbon nanofiber reinforced epoxy matrix nanocomposites. Continuous carbon nanofibers were successfully manufactured and used to reinforce interfaces in specially designed aerospace grade carbon-epoxy laminates. Static and fatigue Mode I and II fracture mechanics and edge delamination testing were performed. Substantial improvements in delamination toughness, mechanical strength, and fatigue life were observed for the first time. Pioneering multilayered carbon nanofiber reinforced nanocomposites were manufactured and evaluated. It was demonstrated that continuous carbon nanofibers may provide unique advantages for structural nanocomposite applications.

DTIC

*Aerospace Vehicles; Carbon; Carbon Nanotubes; Mechanical Properties; Nanocomposites; Nanostructures (Devices)*

**20070029686** Illinois Univ., Urbana-Champaign, IL USA

**A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint)**

Bae, Byunghoon; Yeom, Junghoon; Radadia, Adarsh D; Masel, Richard I; Shannon, Mark A; Nov 2006; 6 pp.; In English

Contract(s)/Grant(s): FA8650-04-01-7121; Proj-4H20

Report No.(s): AD-A468430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468430>

A new type of fully integrated MEMS preconcentrator has been fabricated and tested as a front end for a flame ionization detector (FID). A 1 microliter preconcentrator filled with PEI-coated microposts is integrated with fast microvalves (response time < 50 microseconds) and a resistive microheater (ramping to 200C in 0.5 second). The integrated preconcentrator can sample a cubic centimeter of gas in 0.2 second at 50 kPa, adsorb targeted species, heat and desorb in 0.5 second, and inject concentrated gaseous species in as small as 50  $\mu$ s pulses into separation columns in a microscale gas chromatograph (GC), or directly into a detector. The unprecedented speed of this preconcentrator (< 1 second) is enabled by MEMS sizing and

fabrication, allowing sniffing of chemical warfare agents, toxic industrial compounds (TICs), and other volatile compounds in seconds, rather than tens of minutes with conventional systems.

DTIC

*Flames; Gas Chromatography; Gas Ionization; Gases; Microelectromechanical Systems; Sampling; Toxicity*

**20070029695** Pennsylvania State Univ., University Park, PA USA

**Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters**

Mohney, Suzanne E; May 21, 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0194

Report No.(s): AD-A468888; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468888>

Ohmic contacts to InAs and InGaAs have been investigated with the objective of providing low contact resistance, good thermal stability, and process compatibility for scaling InP-based heterojunction bipolar transistors to smaller sizes. For p-type InAs, the combination of modest contact resistance and good thermal stability at 250 °C was achieved with metallizations that had thin Pd layers deposited first, followed by W or Ti/Pt barrier layers, then Au. For n-type InAs, however, Pd as a first metal layer provided a higher resistance than conventional Ti/Pt/Au contacts. Ohmic contacts to p-type InGaAs were also investigated. An electron-beam evaporated Pd/Ru/Au contact developed at Penn State provided the minimum resistance of all contacts tested as well as good thermal stability at 250 °C, as demonstrated using contact resistances and cross-sectional transmission electron microscopy. However, Pt/Ti/Pt/Au contacts provided better thermal stability at 350 °C. Due to the possibility of electrochemically preparing Pd/Ru/Au contacts, they were selected for further study, and electroless deposition of successive Pd, Ru and Au layers on InGaAs was investigated.

DTIC

*Electron Beams; Electron Microscopy; Frequencies; Indium Phosphides; Thermal Stability; Transistors; Transmitters*

**20070029718** Tuskegee Inst., AL USA

**Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint)**

Zhou, Yuanxin; Pervin, Farhana; Lewis, Lance; Jeelani, Shaik; Mar 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-D-1912-0003; Proj-2302

Report No.(s): AD-A468958; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468958>

In this study, a high-intensity ultrasonic liquid processor was used to obtain a homogeneous mixture of epoxy resin and multi-walled carbon nanotubes (CNTs). The CNTs were infused into epon 862 epoxy resin through sonic cavitation and then mixed with a curing agent using a high-speed mechanical agitator. The trapped air and reaction volatiles were removed from the mixture using a high vacuum. Flexural tests and fracture toughness tests were performed on unfilled and CNT-filled epoxy to identify the effect of adding CNTs on the mechanical properties of epoxy. The highest improvement in strength and fracture toughness was obtained with 0.3 wt% CNT loading. The nanophased matrix filled with 0.3 wt% CNT was then used with weave carbon fabric in a vacuum-assisted resin transfer molding (VARTM) set up to fabricate composite panels. Flexural tests, Thermogravimetric Analysis (TGA), and Dynamic Mechanical Analysis (DMA) were performed to evaluate the effectiveness of adding CNTs on the mechanical and thermal properties of the composite. The glass transition temperature, decomposition temperature, and flexural strengths were improved by infusing CNTs.

DTIC

*Carbon Nanotubes; Epoxy Matrix Composites; Mechanical Properties; Temperature Effects; Thermodynamic Properties*

**20070029740** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Microbial Degradation of Fuel Oxygenates under Aerobic Conditions**

Dietz, John M; Mar 2007; 102 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469001; AFIT/GES/ENV/07-M1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469001>

This research determined the rate and extent of aerobic degradation of fuel oxygenates ethyl tert butyl ether (ETBE), tert amyl methyl ether (TAME) and ethyl alcohol (ethanol). Biodegradation was measured using gas chromatography (GC), respirometry, and biochemical oxygen demand (BOD) tests. Additionally, the research determined the effects of toluene on



degradation rates. This microcosm study used a microbial consortium obtained from a petroleum refinery wastewater treatment facility. Respirometry data were collected from chambers containing pure oxygenates, or oxygenate/toluene mixtures. Samples were withdrawn periodically for GC analysis. Aerobic conditions were maintained in the chambers at all times. Degradation of oxygenates was compared to degradation of toluene, assuming first order decay. Across all experiments TAME degraded at 8.65 % the rate of toluene, ETBE at 8.17% the rate of toluene and ethanol at 156.79 % the rate of toluene. GC and respirometry data were the most suitable methods for measuring degradation. BOD provided acceptable results for toluene and ethanol but not for the slower degrading oxygenates. Finally, the presence of toluene slowed the degradation of both ETBE and TAME.

DTIC

*Aerobes; Alcohols; Biodegradation; Butenes; Degradation; Ethers; Ethyl Compounds; Gas Chromatography; Methyl Compounds; Microorganisms; Radicals; Rubber*

**20070029753** Army Research Development and Engineering Command, Warren, MI USA

**Complex Processes in Electrochemical Systems**

Catherino, Henry A; Aug 1, 2006; 9 pp.; In English

Report No.(s): AD-A469039; TACOM-16086; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469039>

The study of the individual components comprising a physical system is a necessary first step for understanding the behavior of the system. However, when the individual components are brought together, unexpected consequences have a way of taking place that were not anticipated by the studies on the individual components. This is usually the consequence of the union of components that comprise a non-linear system. The term 'non-linear' is understood within the usual analytical definition: [4] (1)  $f(a+b)=f(a)+f(b)$  and (2)  $cf(b)= f(cb)$  or present purposes, it is equation (1) that is of interest. In it lies a fundamental facet of human thinking. Simply put, equation (1) states that if a problem is divided into its parts and the parts are studied independently, then the parts can be reassembled and the response of the union can be predicted. This sometimes works. One name that characterizes this kind of behavior is the Principle of Superposition which is found in the analysis of electrical circuits. The nice thing about linearity is that the problems tend to have computable solutions. Another nice thing is that the systems being described can be easily categorized into discrete and unique parts and the mathematics is simpler and solutions exist. Non-linearity requires terms not included in equation (1) that suggest the existence of interactions between the components. The feedback between the components has a way of making the cause and effect presumption to become fuzzy. This is what characterizes a complex process.

DTIC

*Complex Systems; Electric Batteries; Electrochemistry*

**20070029827** Army Research Lab., Aberdeen Proving Ground, MD USA

**Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites**

Schuster, Brian E; Magness, Lee S; Kecskes, Laszlo J; Wei, Qiuming; Miller, Michael K; Ervin, Matthew F; Hruszkewycz, Stephan; Minagel, Todd C; Ramesh, Kalliat T; May 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-68T2G1

Report No.(s): AD-A469175; ARL-RP-178; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469175>

Recently, there has been tremendous interest in the size-dependent mechanical properties of materials, in particular, using various applications of the micrometer-scale uniaxial compression technique. In this technique, site-specific focused ion beam (FIB) milling is employed to fabricate micrometer sized compression specimens (micro-posts) from otherwise bulk material. These micro-posts are then tested in uniaxial compression using a flat punch indenter in a conventional nanoindenter. We apply this technique to examine the mechanical properties of bulk metallic glass (BMG) systems from two perspectives; micro-electro-mechanical systems, and tungsten (W)-BMG composite kinetic energy penetrators (KEP). The mechanical properties of Pd40Ni40P20 are found to be relatively free from scale effects approaching the micron size scale. There are, however, moderate increases in strength for micrometer sized, likely resulting from extrinsic factors such as local heterogeneities, pores, and/or other defects are able to act as points of stress concentrations. While the mechanical properties of monolithic amorphous alloys are well understood, local heterogeneities in W-BMG composites may affect the response of

the composite. With this motivation, the micro-posts of the BMG are machined from the composite material using site-specific FIB milling. The mechanical properties of the BMG matrix are examined, and thus microcompression is used as a tool to relate local mechanical properties to the expected bulk response in these composites.

DTIC

*Metallic Glasses; Tungsten; Tungsten Alloys*

**20070029985** Birch Stewart Kolasch and Birch, Falls Church, VA, USA

**Determination of Metal Ions in Solution by Photoluminescence Anisotropy**

Thompson, R. B., Inventor; Elbaum, D., Inventor; Feliccia, V. L., Inventor; Christianson, D., Inventor; Patchan, M. W., Inventor; 8 Nov 04; 20 pp.; In English

Contract(s)/Grant(s): ONR-N00014-91-1572; ONR-BES-9613556

Patent Info.: Filed 8 Nov 04; US-Patent-Appl-SN-10-982 956

Report No.(s): PB2007-108656; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The invention relates to compositions and kits for homogeneous fluorescence polarization (anisotropy) assays for detecting and quantifying metal ions in solution. Metal-dependent binding of a fluorescent ligand to an unlabeled macromolecule effects a measurable change in anisotropy as will the binding of metal ions to a fluorescent labeled macromolecule. Binding of the fluorescent ligand to the unlabeled macromolecule is metal dependent with the change in anisotropy being proportional to the concentration of bound metal ions. Conversely, if the fluorescent label is first conjugated to a macromolecule and the macromolecule is subsequently stripped of metal ion, it may then be used to signal binding of metal ions. The covalently bound fluorescent label exhibits changes in anisotropy proportional to the concentration of bound metal ions. Kits comprise a fluorescent molecule and a macromolecule.

NTIS

*Anisotropy; Complex Compounds; Ions; Metal Ions; Patent Applications; Photoluminescence*

## 26

### METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

**20070026411** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Probabilistic Analysis for the Mechanical Properties of Cross-Ply Fiber-Reinforced Composite Laminate (Postprint)**

Chuang, Shui-Nan; Mar 2006; 15 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A466114; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466114>

A probabilistic micromechanics model has been developed for the unidirectional fiber-reinforced composite material design screening. This model provides a design-screening tool to help material producers eliminate the unnecessary time-consuming and costly material fabrications and to reduce the numbers of testing to a minimum, but enough to verify the model prediction. Consequently, it provides a means to accelerate the insertion of materials into AF productions. To include the material design in the structural design process, we extended the probabilistic analysis to predict the probability density functions for the off-axis transformed reduced stiffness, Young's modulus, transverse Young's modulus, shear modulus and Poisson's ratio. In this report we will focus on the probabilistic analysis of symmetric and anti-symmetric regular cross-ply laminates of IM-7/520-4 fiber-reinforced composite with odd-number plies parallel to and even-number plies perpendicular to the laminate principal axes.

DTIC

*Fiber Composites; Laminates; Mechanical Properties; Models; Ply Orientation*

**20070026525** Virginia Univ., Charlottesville, VA USA

**The Effect of Inhomogeneous Plastic Deformation on the Ductility and Fracture Behavior of Age Hardenable Aluminum Alloys**

Csontos, Aladar A; Starke, Edgar A; Jan 5, 2005; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-97-1-1034

Report No.(s): AD-A466374; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466374>

The role of alloy composition, grain structure, precipitate microstructure, and precipitate dislocation interactions on the

plastic deformation characteristics and the resulting fracture behavior of two isotropic Al Li Cu X alloys designated AF/C-458 (1.8 w/o Li) and AF/C- 489 (2.1 w/o Li) was examined. Inhomogeneous deformation due to strain localization from the shearing of the delta (Al<sub>3</sub>Li), theta (Al<sub>2</sub>Cu), and Tau (sub 1) (Al<sub>2</sub>CuLi) precipitates lead to fine and coarse planar slip for the AF/C-458 and AF/C-489 alloys, respectively. The intensity of this planar slip was predicted through slip intensity calculations using precipitate density measurements, dislocation particle interactions, and grain boundary misorientation-slip continuity statistics. The slip intensity predictions were corroborated through atomic force microscopy (AFM) measured slip height offsets on the polished surface of single aged and 2% plastically strained tensile samples. Our results suggest that the low ductility of AF/C-489 in comparison to AF/C-458 is primarily due to the much larger slip lengths, i.e. grain size, which increased the strain localization and stress concentrations on grain boundaries, thus promoting low-energy intergranular fracture.

DTIC

*Aluminum Alloys; Ductility; Fracture Mechanics; Plastic Deformation; Precipitation Hardening*

**20070026577** Indian Inst. of Science, Bangalore, India

**Topological Close Packing in Structurally Complex Intermetallics (Crystalline, Quasicrystalline and Noncrystalline)**

Ranganathan, Srinivasa; Jun 2006; 6 pp.; In English

Report No.(s): AD-A466501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466501>

Atomic Cluster Configurations in Metallic Glasses: In connection with the model for metallic glasses proposed by D. B..Miracle [A structural model for metallic glasses. Nature Materials 3 (2004) 697-702], the structures consisting of a single solute atom surrounded by a coordination shell of solvent atoms has been examined. The possible coordination number (CN) depends, of course, on the ratio of radii of the two kinds of atom. Atomic Size Factor Criterion in Designing Bulk Metallic Glasses: In the heuristic formulations for glass forming ability by Inoue, atomic size, negative enthalpy of mixing and multicomponent criteria are used. A study of related crystalline and quasicrystalline intermetallics lends weight to the atomic size being the dominant factor. The largest size atom plays a key role in all topologically close-packed phases, even when it happens to be a minority constituent. The supertetrahedron: The various structures that can arise from supertetrahedral clusters serve to illustrate the interplay between the different approaches to visualising the geometry underlying complex material structures - sphere packing models, clusters describable as sets of nested polyhedra, network structures, and network-type configurations of polyhedra. A concise description and visualization of atomic structures is fundamental to a clear understanding of a broad range of phenomena in the expansive class of intermetallic alloys. Geometrical models based on polytetrahedral units have been adopted in order to rationalize a number of important intermetallic structures: the family of gamma-phases, the Laves phases and the so-called 'anti-Laves' phases. An icosahedral cluster consisting of a 13 equal-sized spheres is a simple polytetrahedral unit of relevance in many crystalline, quasicrystalline and amorphous structures. A more complicated polytetrahedral unit has been emphasized; the supertetrahedron, consisting of four interpenetrating icosahedra.

DTIC

*Crystallinity; Intermetallics; Topology*

**20070026578** Hanyang Univ., Seoul, Korea, Republic of

**Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion**

Shin, Dong H; Dec 8, 2006; 3 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0175

Report No.(s): AD-A466503; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466503>

This project focused on deformation processing, microstructural development, and mechanical properties of Ti and Ti-6Al-4V alloys. Specific tasks included: (1) Study superplastic deformation of a Ti-6Al-4V alloy that have been processed by equal channel angular extrusion and relate the deformation mechanism to the enhancement of superplasticity, and (2) Examine the effect of strain path for Ti fabricated by equal channel angular extrusion and uniaxial compression, with a special focus on the improved mechanical properties of the deformed Ti. As a part of the report, two papers were published in Materials Science and Engineering A (vol.A410-411, 2005, 156-159) and Metallurgical and Materials Transactions A (vol.37, 2006, 381-391). The work was begun under AOARD 034023, 'Microstructure development of ultrafine grained Ti and superplasticity of Ti-6Al-4V alloy.' Most of that effort was devoted to Ti-6Al-4V alloy. Much progress has been made over the more than two years of effort. We propose to complete our studies by studying, in detail, deformation mechanisms for the

enhanced superplasticity in the ultrafine grained Ti-6Al-4V alloy with a special focus on the role of non-equilibrium grain boundaries.

DTIC

*Aluminum Alloys; Extruding; Microstructure; Purity; Superplasticity; Titanium Alloys; Vanadium Alloys*

**20070026632** Dayton Univ. Research Inst., OH USA

**The Effect of As-Large-As (ALA) Grains on the High-Temperature Fatigue Life of Waspaloy**

Brogdon, Mandy L; Dec 2006; 120 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5200; Proj-4347

Report No.(s): AD-A466607; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466607>

Waspaloy is a nickel superalloy that, when processed, may contain as-large-as (ALA) grains in the outer surface of the billet. Many components were manufactured containing this ALA region. The common practice now is to remove the ALA-affected region; however, the effect of these ALA grains in Waspaloy has not directly been studied. To characterize the material and determine the effects of the ALA grains, tensile tests and fatigue tests were performed at 538 degrees C to emulate the operating conditions of Waspaloy aerospace components. Half of the specimens tested were ALA containing specimens and the other half of the specimens were from the mid radius of the billet and did not contain ALA grains. Replicas were taken of several of each group to track crack initiation and growth. The fracture surfaces were also examined in a scanning electron microscope (SEM) where stereo pair photographs were taken so the surface geography could be viewed in a program called MeX by creating digital elevation maps (DEM). The tensile tests revealed yield strength variability in the ALA material. The fatigue data showed three types of behavior in the ALA material and two types in the non-ALA material. Based on the average material in both groups, the ALA material had a shorter average life. The short life specimens in each group, however, had almost the same number of cycles to failure, implying that the ALA grains had no specific bearing on the minimum bound of specimen life.

DTIC

*Fatigue Life; Grain Size; Heat Resistant Alloys; High Temperature; Nickel Alloys; Waspaloy*

**20070027246** Army Research Lab., Aberdeen Proving Ground, MD USA

**Ballistic Evaluation of Magnesium Alloy AZ31B**

Jones, Tyrone L; DeLorme, Richard D; Burkins, Matthew S; Gooch, William A; Apr 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A466839; ARL-TR-4077; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wrought magnesium alloys, which maintain various niche market applications because of their unique properties, have been the subject of a heightened level of research and development for potential application in the automotive market; however, few data are available about their ballistic properties. In order to fill this gap, the U.S. Army Research Laboratory (ARL) and Magnesium Elektron North America (MENA), Inc., conducted a cooperative effort to evaluate magnesium alloy AZ31B, which was commercially available in a wrought form. MENA produced the rolled product and conducted the mechanical testing, and ARL performed the ballistic testing. Some limited ballistic data are provided for this alloy in both the H24 and O tempers.

DTIC

*Ballistics; Magnesium Alloys*

**20070027295** Air Force Research Lab., Eglin AFB, FL USA

**Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Text**

Plunkett, B; Cazacu, O; Lebensohn, R A; Barlat, F; Nov 21, 2006; 23 pp.; In English

Contract(s)/Grant(s): FA8651-05-1-0005; Proj-2502

Report No.(s): AD-A467081; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An elastic-viscoplastic model for describing the anisotropic high-strain rate behavior of both low-symmetry and high symmetry textured materials is proposed. Yielding is described using a recently developed criterion which can capture simultaneously anisotropy and compression-tension asymmetry associated with deformation twinning. The anisotropy coefficients as well as the size of the elastic domain are considered to be functions of the accumulated plastic strain. The specific expressions for the evolution laws are determined using a multi-scale methodology, i.e. experimental measurements

of crystallographic texture and uniaxial stress/strain curves, poly-crystalline calculations, and macroscopic scale interpolation techniques. An over stress approach is used to incorporate rate effects in the formulation. Applications of the model to the description of the high strain-rate response of low-symmetry (hexagonal-close-packed zirconium) and high-symmetry (body-centered-cubic tantalum) pre-textured metals are presented. The very good agreement between the simulated and experimental post-test geometries of the Taylor impact specimens in terms of major and minor side profiles and impact interface foot prints shows the ability of the model to describe with fidelity the differences in the evolution of an isotropy between zirconium and tantalum.

DTIC

*Anisotropy; Elastic Properties; Impact Tests; Isotropy; Metals; Models; Texts; Viscoplasticity*

**20070027518** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Recrystallization and Grain-Growth Behavior of a Nickel-Base Superalloy During Multi-Hit Deformation (Preprint)**

Weaver, D S; Semiatin, S L; Feb 2007; 20 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A467780; AFRL-ML-WP-TP-2007-432; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The initial breakdown behavior of Waspaloy-ingot material with coarse, columnar grain structure was established via isothermal hot compression of double-cone samples. Temperature (1177 degrees C), strain rate (0.1 s<sup>-1</sup>), dwell time between increments of deformation (30 or 60 seconds), and forging direction relative to the columnar structure were typical of industrial practice. Recrystallization kinetics were more rapid during multi-hit testing than monotonic testing. The recrystallization and grain-growth behavior showed a complex dependence on imposed strain, test orientation, and dwell time.

DTIC

*Deformation; Heat Resistant Alloys; Nickel; Nickel Alloys; Recrystallization*

**20070027521** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint)**

Mahaffey, D W; Semiatin, S L; Schaab, A E; Rollett, A D; Feb 2007; 8 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A467784; AFRL-ML-WP-TP-2007-433; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Columnar-grained samples of commercial-purity nickel were analyzed to establish the relative energy of <001> tilt boundaries as a function of misorientation. For this purpose, an electron-backscatter-diffraction (EBSD) technique was used to determine the grain-boundary geometry and misorientations across grain boundaries at triple-junction locations in two-dimensional sections perpendicular to the sample fiber texture. Analysis of the triple-junction dihedral angles and misorientations revealed that the relative boundary energy followed a classical Read-Shockley dependence.

DTIC

*Grain Boundaries; Misalignment; Nickel; Purity*

**20070027576** Dayton Univ. Research Inst., OH USA

**Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring**

Hartman, George A; Jan 2007; 9 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5200; Proj-4347

Report No.(s): AD-A467885; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Macroscopic damage and final failure of components subjected to repeated loading is preceded by microscopic damage accumulation in localized areas of the component material. The microscopic damage accumulation phase often comprises the majority of the life of the component. Thus, a detailed understanding of the processes involved would be invaluable for material design and life prediction. In metals, these localized damage accumulation areas are usually on the scale of the microstructure and the damage is not readily apparent. An infrared camera system has been developed to detect the radiant energy associated with local damage accumulation. This system pinpoints the location of the damage accumulation site and allows the loading to be stopped early in the damage accumulation process. The first goal is to use the system to stop mechanical testing as soon as a local damage area can be detected. This goal has been achieved and the IDDS has been used to support a number of research programs studying crack initiation. The second goal is to develop an understanding of the

various phenomena that produce infrared radiation signatures and correlate them with damage accumulation mechanisms. This work is just beginning and this paper discusses our plan to meet this goal.

DTIC

*Cameras; Damage; Detection; Infrared Detectors; Infrared Radiation; Microcracks; Photometers; Real Time Operation*

**20070027771** Academy of Sciences of the Ukraine, Kiev, Ukraine

**High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor**

Glavatska, Nadiia I; Jan 2005; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468509; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report results from a contract tasking Institute for Metal Physics as follows: This project will conduct a fundamental study of Ni-Mn-Ga-X alloys exhibiting large and stable values of magnetic-field-induced strain at temperatures above 320 K. The objective is to establish the factors determining the values and stability of magnetic shape memory behavior in order to feed the design of a new class of magnetic shape memory actuators and sensors. Specifics of the project are: (i) the complex theoretical and experimental study of a correlation between electronic, magnetic, and crystalline structure and the phase transformation temperatures with occurrence of magnetic shape memory effect (MSME) using various experimental techniques and theoretical calculations in an attempt to determine the physical grounds for design of MSME alloys; (ii) a study of phase, thermal, and mechanical stability of martensite and the corresponding magnetic-field-induced strain in studied Ni-Mn-Ga and Ni-Mn-Ga-X high temperature magnetic shape memory alloys.

DTIC

*Actuators; Detectors; High Temperature; Magnetic Storage; Manganese Alloys; Shape Memory Alloys; Shapes*

**20070028666** Case Western Reserve Univ., Cleveland, OH USA

**Modeling the Effects of Crevice Former, Particulates, and the Evolving Surface Profile In Crevice Corrosion**

Agarwal, A. S.; Landau, U.; Shan, X.; Payer, J. H.; January 2006; 13 pp.; In English

Report No.(s): DE2007-899321; No Copyright; Avail.: National Technical Information Service (NTIS)

Crevice corrosion may initiate in confined regions due to transport limitations, followed by an accumulation of a highly corrosive chemistry, capable of dissolving the metal. The metal and the crevice former surface roughness, the presence of particulates under the crevice former and the accumulation of solid corrosion products at the corroding site would significantly affect the current and potential distribution at the anode by increasing the ohmic potential drop. Most crevice corrosion models focus on a smooth walled crevice of uniform gap and do not account for the changing profile after crevice corrosion has been initiated. In this work we analyze the crevice (anodic) region and apply current and potential distribution models to examine the effects of the perturbed surface topography. The analysis focuses on three related issues: (i) the effects of surface roughness of the metal and the crevice former, (ii) the effects of particulates under the crevice former, and (iii) the evolution of the crevice profile with corrosion product accumulation at the active, anodic region.

NTIS

*Corrosion; Cracks; Particulates*

**20070028876** Lawrence Livermore National Lab., Livermore, CA USA

**Crevice Repassivation Potentials for Alloy 22 in Simulated Concentrated Ground Waters**

Rebak, R. B.; Evans, K. J.; Ilevbare, G. O.; 13 Nov. 2006; 19 pp.; In English

Report No.(s): DE2007-902250; UCRL-CONF-226066; No Copyright; Avail.: Department of Energy Information Bridge

The resistance of Alloy 22 (N06022) to localized corrosion, mainly crevice corrosion, has been extensively investigated in the last few years. However, the behavior of Alloy 22 in concentrated aqueous solutions that may simulate concentrated ground waters was not fully understood. Systematic electrochemical tests using cyclic potentiodynamic polarization as well as the Tsujikawa-Hisamatsu electrochemical method were performed to determine the crevice corrosion susceptibility of Alloy 22 in simulated concentrated water (SCW), simulated acidified water (SAW) and basic saturated water (BSW). Results show that Alloy 22 is immune to crevice corrosion in SCW and SAW but may suffer crevice corrosion initiation in BSW. Results also show that in a naturally aerated environment, the corrosion potential would never reach the critical potential for crevice corrosion initiation.

NTIS

*Corrosion; Cracks; Ground Water*

**20070028904** Lawrence Livermore National Lab., Livermore, CA USA

**Changes in Delta-Plutonium Due to Self-Irradiation Aging Observed by Continuous In-Situ X-ray Scattering**

Saw, C. K.; Chung, B. W.; Wall, M. A.; Jan. 08, 2007; 8 pp.; In English

Report No.(s): DE2007-902280; UCRL-CONF-227115; No Copyright; Avail.: Department of Energy Information Bridge

The aging in plutonium is predominantly caused by its internal self-irradiation. The self-irradiation in Pu-239 is by the decay process of transmuted the Pu atom into uranium atom and emitting an  $\alpha$ -particle. Most of the lattice damage comes from the uranium recoil resulting in Frenkel-type defects consisting of vacancies and self-interstitial atoms, helium in-growth and defect clusters and possibly even though it is not yet observed, the generation of voids. As part of the stockpile stewardship, it is important to understand the changes in the structure and microstructures and their correlations to the physical properties. Changes in the physical properties have a direct relationship to the quality of the structure, in terms of formation of defects and defect clustering, accumulation of voids, grain boundaries, phase changes and etc. which can adversely affect the stability of the material. These changes are very difficult to monitor because of the high activity of the sample, high atomic number making x-ray and synchrotron probe into the bulk very difficult (neutron probe is not feasible) and the long life time which normally requires decades to measure. In this paper we describe the development of an in-situ in-house transmission x-ray diffraction (XRD) experimental technique used to monitor the structural changes in these materials. This technique calls for a very thin sample of less than 2 mm and to accelerate the aging process due to self-irradiation, spiked alloy of 7.5 weight percent of Pu-238 is used. This is equivalent to roughly 17 times the normal rate of aging.

NTIS

*Irradiation; Plutonium; X Ray Scattering*

**20070029726** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Modeling JP-8 Fuel Effects on Diesel Combustion Systems**

Schihl, Peter; Hoogterp, Laura; Pangilinan, Harold; Schwarz, Ernest; Bryzik, Walter; Nov 30, 2006; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468974; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468974>

Agenda: 1) Introduction/Background; 2) JP-8 Evaporation Rate Modeling; 3) JP-8 Ignition Modeling; 4) Engine Predictions Results; and 5) Conclusions.

DTIC

*Combustion; Corrosion Prevention; Diesel Fuels; Fuel Combustion; Fuels; JP-8 Jet Fuel*

**20070029829** Army Research Lab., Aberdeen Proving Ground, MD USA

**Titanium Brazing for Structures and Survivability**

Doherty, Kevin J; Tice, Jason R; Szewczyk, Steven T; Glide, Gary A; May 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-622105.AH84

Report No.(s): AD-A469178; ARL-RP-177; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469178>

Titanium is a candidate as a structural material for all new tactical and armored ground vehicles, because of its high strength-to-weight ratio, excellent corrosion resistance, and inherent ballistic resistance. However, titanium as a structural material is much less mature than both steel and aluminum alloys, especially in the area of joining. While welding is the typical joining method for titanium, vacuum brazing is an option in areas that are difficult to access for welding as well as areas near other nonmetallic materials, such as ceramics. This work focuses on vacuum brazing of titanium (both Ti-6Al-4V and commercially pure titanium) and the effect of processing changes (alloy, temperature, pressure), including post-braze hot isostatic pressing, on mechanical properties and microstructure. This study will examine the joining of both plate materials as well as lightweight, periodic pyramidal core structures. Shear and tensile testing is performed to determine the strength/ductility relationship to the various processing routes. Microscopy (optical and SEM) is employed to quantify the degree of bonding and to examine the microstructural changes, both within the base materials and at the bond line, associated with the process variations.

DTIC

*Brazing; Composite Structures; Titanium; Titanium Alloys*

## NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

**20070026367** United Technologies Corp., Wright-Patterson AFB, OH USA

**Oxygen Plasma Treatment and Deposition of CN<sub>x</sub> on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint)**

Muratore, C; Korenyi-Both, A; Bultman, J E; Waite, A R; Jones, J G; Voevodin, A A; Storage, T M; Dec 2006; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-03-D-5801; Proj-4349

Report No.(s): AD-A466031; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466031>

High-performance polymer matrix composites (PMCs) are an appealing choice for materials in aerospace applications due to their high strength-to-weight ratio and stability over a broad temperature range for thousands of service hours. The use of PMCs in propulsion applications is currently limited only by insufficient resistance to erosion by abrasive media. Erosion-resistant coatings may provide the necessary protection, however their application is not straightforward, as surface preparation is a challenge. Specifically, it is because of the resin-rich outer plies, mold release agents, and fluorinated high-temperature polymer matrices that treatment prior to deposition is required. A low pressure oxygen plasma treatment process was developed to improve adhesion of CN<sub>x</sub> coatings to a polymer matrix composite. CN<sub>x</sub> was selected as a protective coating for its high hardness-to-elastic ratio, coupled with elastic resilience. In situ x-ray photoelectron spectroscopy was used to evaluate the effect of the plasma treatment on surface chemistry, and electron microscopy was used to identify changes in the surface morphology of the PMC substrate after plasma exposure. CN<sub>x</sub> coatings were then deposited on treated PMC substrates. The effect of the plasma predeposition treatment on coating adhesion and erosion resistance was evaluated. The combination of PMC pretreatment and coating with CN<sub>x</sub> reduced the erosion rate by an order of magnitude.

DTIC

*Carbon; Corrosion Resistance; Deposition; Erosion; Fluoropolymers; Oxygen Plasma; Polymer Matrix Composites; Protective Coatings*

**20070026522** Yale Univ., New Haven, CT USA

**Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography**

Chen, C; Reed, M A; Asplund, C L; Cassell, A M; Myrick, M L; Rawlett, A M; Tour, J M; Van Patten, P G; Aug 2, 1999; 4 pp.; In English

Report No.(s): AD-A466370; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466370>

We report the in situ replacement of conjugated molecules in an insulating matrix by scanned probe microscope lithography. High yield, programmable patterning of a self-assembled monolayer of dodecanethiol was performed by applying voltage pulses from a scanning tunneling microscope. Conjugated oligomers were observed to be subsequently chemisorbed onto the patterned sites.

DTIC

*Conjugation; Extremely Low Frequencies; Lithography; Microscopes; Oligomers; Scanning Electron Microscopy*

**20070026567** Army Research Lab., Aberdeen Proving Ground, MD USA

**Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness**

Robinette, Jason; Bujanda, Andres; DeSchepper, Daniel; Dibelka, Jessica; Costanzo, Philip; Jensen, Robert; McKnight, Steven; Apr 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-AH84

Report No.(s): AD-A466485; ARL-TR-4084; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466485>

Recent publications have reported a synergy between rubber and silica in modified epoxy resins that results in significantly improved fracture toughness without reductions in other material properties. In this work, we seek to achieve the same type of synergy in commercial vacuum-assisted resin transfer molding (VARTM) epoxy resins, SC15 and SC79, produced by Applied Polymeric, Inc. Nanopox F400 (Hanse Chemie) containing 40 weight-percent epoxy-functional silica in a diglycidyl bisphenol-F (DGEBF) epoxy was blended with the VARTM resins to add various silica loadings in the systems.



It was found that the presence of DGEGBF influenced resin properties more than silica. This monomer impacted crosslink density and other material properties. The crosslink density of SC15 was increased and resulted in reductions in resin fracture toughness, mode II composite fracture toughness, and increased damage area in impact performance. The crosslink density of SC79 was reduced upon the addition of DGEGBF contained in the Nanopox. At 10 weight-percent silica, resin fracture toughness, mode II composite toughness, and impact properties were improved due to decreased matrix crosslink density and the presence of silica. Finally, morphological studies showed that silica influences the rubber phase separation in a model epoxy system and VARTM epoxies. Further research will investigate the effects of epoxy-functional silica addition to phase separation mechanisms in rubber-toughened epoxies.

DTIC

*Elastomers; Epoxy Resins; Resin Transfer Molding; Resins; Toughness; Vacuum*

**20070026571** Army Research Lab., Aberdeen Proving Ground, MD USA

**Modeling Damage and Fragmentation in Concrete**

Clayton, John D; Apr 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-WHPR01E

Report No.(s): AD-A466490; ARL-RP-169; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466490>

A theory combining nonlinear continuum elasticity, inelasticity, thermodynamics, damage mechanics, and fragmentation is formulated. The model is applied to study concrete subjected to high rate loading as occurs during ballistic impact. Two thermodynamically motivated methods are postulated within this theoretical framework for quantitatively characterizing the mass and velocity distributions of the post-impact debris field, one based upon a local energy balance and a second following global entropy maximization. Here the concrete, a composite mixture of mortar and granite aggregate, is regarded as a homogeneous continuum prior to fragmentation. However, the composite nature of the microstructure directly influences model parameters dictating the mean fragment dimension, here specifically related to the coarse aggregate size. Standard continuum elements represent the intact solid and particles describe eroded material in numerical implementation of the model. The impact of a metal sphere on a thin concrete target, and the subsequent motion of the resulting cloud of concrete fragment debris, are simulated. Fragment size, speed, and kinetic energy statistics predicted by the two methods are compared.

DTIC

*Concretes; Damage; Fragmentation; Thermodynamics*

**20070026663** Pratt and Whitney Aircraft Group, East Hartford, CT USA

**Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint)**

Ojard, G; Miller, R; Gowayed, Y; Chen, J; Santhosh, U; Ahmad, J; John, R; Jan 2007; 11 pp.; In English

Contract(s)/Grant(s): F33615-03-D-2354-0004; Proj-4347

Report No.(s): AD-A466675; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466675>

With the increased interest in using high performance ceramic matrix composites for advanced applications, long-term property behavior is of interest. In this work, time-dependent response of MI SiC/SiC composites (01/01 material) was experimentally evaluated under creep and dwell fatigue loading. A series of standard samples were tested at 815 degrees Celsius and 1204 degrees Celsius at various stress levels and multiple durations. All specimens showed primary and steady state creep responses. There were also some samples that showed tertiary creep response. Environmental degradation was empirically related to material response at different stress levels. Micrographic images of failed specimens revealed the existence of cavitations that were possibly caused by the creep strain at high stress areas.

DTIC

*Ceramic Matrix Composites; Creep Properties; Degradation; Dwell; Steady State; Time Dependence*

**20070026712** Dayton Univ. Research Inst., OH USA

**Off-Axis Creep Behavior of Oxide/Oxide Nextel(Trademark)720/AS-0 (Preprint)**

Buchanan, Dennis J; John, Reji; Zawada, Larry P; Nov 2006; 23 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5200; Proj-4347

Report No.(s): AD-A466791; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466791>

Oxide/Oxide Ceramic Matrix Composites (CMC) are currently being demonstrated in high-temperature aerospace

applications where their oxidation resistance is critical to a successful design. Many applications are engine components that are axisymmetric in shape and subject to axisymmetric thermal and mechanical loadings. Traditionally woven CMC materials used in these components are typically made from 0 deg/90 deg fiber architectures. In many cases the highest stresses are not always coincident with the orientation of the reinforcing fibers. Therefore, these components may experience stress states that approach the off-axis tensile and creep strengths of the material. The oxide/oxide CMC investigated in this study was Nextel(trademark)720/AS. Nextel(trademark)720/AS is composed of an Alumina-Silica matrix reinforced with an eight-harness stain weave (8HSW) of Nextel(trademark)720 fibers. Tensile and creeps tests at 1100 C on +/- 45 deg Nextel(trademark)720/AS were performed to characterize the off-axis material behavior. The +/- 45 deg orientation has approximately two thirds the ultimate tensile strength of the 0 deg/90 deg orientation. However, the tensile toughness of the + or - 45 deg orientation was higher than the 0 deg /90 deg orientation by a factor of 2X. The creep rupture strength at 100 hrs for the + or - 45 deg orientation was approximately one third that of the 0 deg/90 deg orientation.

DTIC

*Ceramic Matrix Composites; Creep Properties; Oxides; Tensile Strength*

**20070026864** Texas A&M Univ., College Station, TX USA

**Development of Nanocomposite Reinforced Polymeric Materials to be Used for Racks for Retorting Polymeric Trays**

Sue, Hung-Jue; Aug 22, 2003; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468220; SPO103-02-D-0003/0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468220>

The Combat Rations Network (COPANET) is a Defense Logistic Agency (DLA) sponsored manufacturing technology program to improve the quality, reduce the cost, and increase the productivity of operational rations while increasing DLA's surge capability in the area of military rations. This report summarizes activity under Short Term Project 2007. The ultimate goal of this project was to develop a material to improve the performance and cost effectiveness of polymeric trays used for retorting Polytray rations. Initially, many candidate materials were gathered based on recommendation and research. Materials selection was limited to Polypropylene-based systems due to cost constraints and their prior proven performance during CORANET I and STP 1016.

DTIC

*Composite Materials; Manufacturing; Nanocomposites; Polypropylene; Rations; Trays*

**20070027313** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint)**

Snyder, Jr , Carl E; Gschwender, Lois J; Gunderson, Stephen L; Fultz, George W; Nov 2006; 18 pp.; In English

Contract(s)/Grant(s): FA8650-05-D-5050; Proj-4347

Report No.(s): AD-A467114; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The amount of hydraulic fluid used by all branches of the military is significant both in terms of volume and cost. The disposal of used hydraulic fluid is a cost, time, and logistical component that can be greatly reduced by the purification and reuse of used hydraulic fluid. This report describes a project that evaluated the effectiveness of various hydraulic fluid purification process configurations on the removal of water and particulate contaminants from MIL-PRF-83282 hydraulic fluid in 55-gallon drums.

DTIC

*Contaminants; Contamination; Hydraulic Fluids; Particulates; Purification*

**20070027429** Paul Scherrer Inst., Villigen, Switzerland

**Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites**

Lippert, Thomas K; Urech, Lukas; Sep 12, 2006; 96 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-03-1-03058

Report No.(s): AD-A467554; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report results from a contract tasking Paul Scherrer Institut as follows: Three different polymers (GAP, PVN and PVC) with two different absorbers (carbon nanoparticles and an IR-dye (Epolite 2057)) have been investigated as fuel for the micro laser plasma thruster. GAP and PVN are energetic polymers with a high decomposition enthalpy of -3829 J/g (PVN) and -2053 J/g (GAP). PVC was used as a less energetic (the decomposition enthalpy of -418 J/g is much lower than for the

other two polymers) commercially available reference. The best overall performance was observed for GAP. In the ms thrust measurements a efficiency of 370% was obtained for GAP+C, which means that chemically stored energy was transferred into thrust. In the fs measurements, higher thrust values were obtained for GAP+IR than for GAP+C. This is also in good correlation with the fs plasma emission measurements. The IR-dye lead to a higher fragmentation in the shadowgraphy measurements, which were performed at low fluences. The metal- and metal-oxidenanoparticles had no positive influence on the plasma and shockwave properties of GAP+IR. In the ns mass spectrometry measurements, GAP showed the highest fragmentation and the fastest C<sup>+</sup> ions. The highest energetic polymer PVN, showed the worst performance in all experiments at high fluences, and only a efficiency of 21% was obtained in the thrust measurements. In the mass spectrometry measurements, strong signals could be assigned to the solvent, which was used to produce the PVN film. Also strong thermal effects, like the formation of fibers and melting were observed. In the shadowgraphy measurements, which were performed in air and at low fluences, the fastest shockwave was observed for PVN+IR. Additional doping with CuO slowed down the shockwave, but also reduced the thermal features. For PVC a efficiency of 50% was determined in the thrust measurements. At high laser fluences, PVC performed worse than GAP, but better than PVN.

DTIC

*Artificial Satellites; Laser Plasmas; Lasers; Mass Spectroscopy; Plasma Engines; Polymers*

**20070027503** Air Force Research Lab., Edwards AFB, CA USA

**Processing of Multifunctional Epoxy Resins Modified with Silicon Based Nanomaterials (POSTPRINT)**

Spero, Amy R; Marchant, D; Mabry, J; Viculis, Lisa; Feb 7, 2006; 16 pp.; In English

Contract(s)/Grant(s): Proj-48470249

Report No.(s): AD-A467748; AFRL-PR-ED-TP-2006-039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Improvements in thermal and physical properties of epoxy resin systems have been demonstrated in the past through the influence of fillers. However, these improvements often come with a significant cost to processability. This paper examines the influence of nanofillers on a multifunctional epoxy resin system in terms of processability and thermal properties. The nanocomposites explored included nanosilica, linear calcium silicate (wollastonite), and polyhedral oligomeric silsesquioxane (POSS) in CYCOM(Registered) 977-3 resin. Composites with three to five weight percent of nanofillers were produced using IKA high shear mixers. The thermal and flow properties of the composites were evaluated using Dynamic Mechanical Thermal Analysis (DMTA) and parallel plate rheology. The microstructure of the composite was explored using Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM). Each of the nanofillers used in this study showed a small improvement in T<sub>g</sub> over the neat epoxy. However, the addition of nanosilica dramatically increased the viscosity of the neat resin in contrast to the addition of wollastonite or POSS. The wollastonite showed no degradation in clarity and did not significantly increase the viscosity of the resin.

DTIC

*Epoxy Resins; Silicates; Silicon*

**20070027519** Nebraska Univ., Lincoln, NE USA

**Organic Polymers with Magneto-Dielectric Properties**

Rajca, Andrzej; Mar 28, 2007; 7 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0056

Report No.(s): AD-A467781; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Organic diradicals, in which the atomic orbitals carrying spin density, have near-perfect alignment for strong ferromagnetic exchange coupling, were designed, synthesized, and characterized by magnetic studies. These include novel triplet (S = 1) ground state aminyl diradicals, in which spin density is centered at nitrogen atoms, and S = 1 ground state nitroxide diradicals, in which spin density is primarily located at nitrogen and oxygen atoms. The nitroxide diradicals are stable at ambient conditions. These diradicals were intended as ligands (monomers) in ferrimagnetic coordination polymers magneto-dielectric properties.

DTIC

*Dielectric Properties; Magnetic Properties; Organic Materials; Polymers*

**20070027641** Air Force Research Lab., Eglin AFB, FL USA

**High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint)**

Jordan, Jennifer L; Richards, Wayne; White, Brad; Spowart, Jonathan E; May 2007; 13 pp.; In English

Contract(s)/Grant(s): Proj-2306

Report No.(s): AD-A468014; AFRL-MN-EG-TP-2007-7403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Polymers and polymer-based particulate composites are becoming increasingly used in aerospace structural applications, where they experience complex, non-static loads. Correspondingly, the high strain rate mechanical properties are of increasing importance. This paper investigates the properties of epoxy - bisphenol-A/diethanolamine epoxy (Epon 826/DEA) - and epoxy-based particulate composites across strain rates from  $10(\text{exp } -3)$  to  $10(\text{exp } 5)$  /s. The samples were tested using Instron, traditional split Hopkinson pressure bars (SHPBs) and a miniaturized SHPB for ultra-high strain rates. Additionally, the epoxy samples are tested with dynamic mechanical analysis to look at the effects of time-temperature superposition on the strain rate effects in the samples. The results of the testing are compared to the Hasan-Boyce model for polymers, which has shown good agreement with other epoxy studies, to develop constitutive equations for these materials.

DTIC

*Aluminum Oxides; Epoxy Matrix Composites; Epoxy Resins; Mechanical Properties; Particulates; Strain Rate*

**20070027669** Naval Air Warfare Center, China Lake, CA USA

**A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance**

Guenther, Andrew J; Yandek, Gregory R; Wright, Michael E; Petteys, Brian J; Quintana, Roxanne; Connor, Dan; Gilardi, Richard D; Marchant, Darrell; May 23, 2006; 35 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A468069; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new cyanate ester monomer was prepared from bis(4-cyanatophenyl)-dimethylsilane (SiMCy) and fully characterized by analytical and spectroscopic techniques. The monomer was found to have a melting point about 20 deg C lower than that of the commercial bis(4-cyanatophenyl)dimethylmethane (BADCy) with similar melt viscosity, curing kinetics, and post-cure glass transition temperature. Analysis of the single-crystal molecular structure by x-ray diffraction showed that intermolecular packing was dominated by weak hydrogen-bonding attractions between the aromatic rings and the -OCN nitrogen atoms. In contrast, the packing interactions found in BADCy are dominated by dipole-dipole interactions of the OCN groups. These differences may explain the 50% reduction in moisture uptake observed in SiMCy as compared to BADCy during exposure to boiling water. In addition, thermogravimetric analysis revealed that SiMCy exhibited a significantly higher char yield in air than BADCy, presumably due to the formation of silicates at high temperature. The combination of improved thermo-oxidative stability and reduced moisture absorption without significant loss in ease of processing or mechanical properties makes SiMCy an important potential 'drop in' replacement for BADCy, and demonstrates the power of the molecular level approach to designing new high-temperature polymer materials.

DTIC

*Cyanates; Esters; Moisture Resistance; Oxidation Resistance; Plastics; Resins; Silicon; Thermal Resistance; Thermosetting Resins*

**20070027741** Air Force Research Lab., Kirkland AFB, NM USA

**A Test Method to Assess the Foldability of Flexible Structural Materials**

Murphey, Thomas W; Sanford, Gregory E; Apr 2007; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468441; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A coupon level comparative test method was developed to assess the foldability of thin flexible materials used in deployable structures. The subject materials support tensile and compressive loads; they are not cloth-like. The non-destructive method consists of a tensile stiffness test and a compressive buckling test and reveals changes in coupon properties that could result from locally extreme strains incurred during folding. The test is intended to provide a standardized means to compare changes in material systems or fabrication processes as flexible material development efforts continue. The method was applied to nine identical rigidizable composite coupons folded ten times. Five of the coupons were folded to a 4 mm radius and four were folded to a 2 mm radius. The results did not reveal a measurable change in coupon behavior from the pre-folded state.

DTIC

*Nondestructive Tests; Protocol (Computers)*

**20070028890** SRI International Corp., Menlo Park, CA, USA

**Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.)**

Krishnan, G. N.; Malhotra, R.; Alvarez, E.; Lau, K. H.; Sanjurjo, A.; Feb. 2007; 17 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT41616

Report No.(s): DE2007-901148; No Copyright; Avail.: Department of Energy Information Bridge

Heat-exchangers, particle filters, turbines, and other components in integrated coal gasification combined cycle system must withstand the highly sulfiding conditions of the high temperature coal gas over an extended period of time. The performance of components degrades significantly with time unless expensive high alloy materials are used. Deposition of a suitable coating on a low-cost alloy may improve its resistance to such sulfidation attack, and decrease capital and operating costs. The alloys used in the gasifier service include austenitic and ferritic stainless steels, nickel-chromium-iron alloys, and expensive nickel-cobalt alloys.

NTIS

*Coal Gasification; Corrosion Resistance; Diffusion*

**20070029386** Senterfitt (Akerman), West Palm Beach, FL, USA

**Dynamically Modifiable Polymer Coatings and Devices**

Bohn, C. C., Inventor; Brennan, A. B., Inventor; Baney, R. H., Inventor; 17 Feb 04; 20 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0325

Patent Info.: Filed Filed 17 Feb 04; US-Patent-Appl-SN-10-780 424

Report No.(s): PB2007-104653; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A dynamic coating includes at least one polymeric layer for attachment to a surface. The polymeric layer includes at least one electrically conducting polymer including layer, wherein under influence of a dynamic signal applied to the polymeric layer, a contact angle of the polymeric layer dynamically and substantially increases or decreases upon oxidation or reduction of the polymer. The polymeric layer can also expand or contract upon oxidation or reduction. The coating can be used for a variety of applications including a non-toxic biofouling preventative system and for forming low voltage electrowetting pumps.

NTIS

*Devices; Conducting Polymers*

**20070029396** Alaska Univ. Fairbanks, Nome, AK, USA

**Oxygen Transport Ceramic Membranes. Quarterly Report from October 2006 through December 2006**

Bandopadhyay, S.; Nithyanantham, T.; Dec. 31, 2006; 45 pp.; In English

Contract(s)/Grant(s): DE-FC26-99FT40054

Report No.(s): DE2007-900473; No Copyright; Avail.: National Technical Information Service (NTIS)

Contents: Introduction; Executive Summary: Task 1: Preparation and Characterization of Dense Ceramic oxygen Permeable Membranes; Task 2: Determine material mechanical properties under conditions of high temperature and reactive atmosphere; Task 3: Measurement of Surface Activation/Reaction rates in Ion Transport Membranes using Isotope Tracer and Transient Kinetic Techniques; Conclusions; Lists of Acronyms and Abbreviations; and References.

NTIS

*Ceramics; Membranes; Oxygen*

**20070029589** Case Western Reserve Univ., Cleveland, OH USA

**Hyperbranched Polymers for Resin Transfer Molding**

Mather, Patrick T; Mar 1, 2005; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0274

Report No.(s): AD-A468819; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468819>

The purpose of this proposal study new low viscosity thermoset additives - hyperbranched polymers (HBPs) - as processing aids and toughening additives for high performance resin transfer molding (RTM) resins. The proposed research

project will culminate with a detailed understanding of the trends in performance properties with materials characteristics, including hyperbranched architecture, blend composition, and processing protocol.

DTIC

*Dendrimers; Polymers; Resin Transfer Molding*

**20070029738** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Decomposition Kinetic of Greases by Thermal Analysis**

Rhee, In-Sik; Apr 27, 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468999; TARDEC-17086; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468999>

Pressure Differential Scanning Calorimeter (PDSC) is a thermal analytical technique for evaluating oxidation-thermal stability of polymer materials including lubricating greases using the differential heat flow between sample reference thermocouples under various temperatures and pressures. The ASTM D 5483 test method is one of acceptable PDSC techniques to evaluate the grease oxidation stability. In a research effort, a decomposition kinetic model was developed to predict grease high temperature life using ASTM D 5483 PDSC technique. This kinetic model can predict grease oxidation life at the various temperatures and the degree of oxidation using their activation energy. Also, it was found that this kinetic model has a limited correlation to the results from ASTM D 3527 grease life test. This kinetic model can therefore be used to predict the high temperature grease life within certain constraints.

DTIC

*Decomposition; Greases; Thermal Analysis*

**20070029739** Dayton Univ. Research Inst., OH USA

**Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint)**

Zabinski, J S; Hu, J J; Bultman, J E; Pierce, N A; Voevodin, A A; Jan 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-D-5050; Proj-4347

Report No.(s): AD-A469000; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469000>

Oxides are inherently stable in air at elevated temperatures and may serve as wear resistant matrices for solid lubricants. Aluminum oxide is a particularly good candidate for a matrix because it has good diffusion barrier properties and modest hardness. Most thin film deposition techniques that are used to grow alumina require high temperatures to impart crystallinity. Crystalline films are about twice as hard as amorphous ones. Unfortunately, the mechanical properties of most engineering steels are degraded at temperatures above 250-350 degrees C. This work is focused on using energetic reactive ion bombardment during simultaneous pulsed laser deposition to enhance film crystallization at low temperature. Alumina films were grown at several background gas pressures and temperatures, with and without Ar ion bombardment. The films were nearly stoichiometric except for depositions in vacuum. Using nitrogen ion bombardment, nitrogen was incorporated into the films and formed the Al-O-N matrix. Nitrogen concentration could be controlled through selection of gas pressure and ion energy. Crystalline Al-O-N films were grown at 330 degrees C with a negative bias voltage to the substrate, and showed improved hardness in comparison to amorphous films. Film deposition methodology and characterization of chemical and mechanical properties are reported in detail.

DTIC

*Aluminum; Aluminum Oxides; Ion Beams; Metal Films; Oxynitrides; Pulsed Laser Deposition; Pulsed Lasers; Stoichiometry; Thin Films*

**20070029769** Dayton Univ. Research Inst., OH USA

**Image Reconstruction Based Modeling of 3D Textile Composite (Postprint)**

Zhou, Eric; Mollenhauer, David; Iarve, Endel; Apr 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-D-5052; Proj-4347

Report No.(s): AD-A469066; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469066>

Innovative weaving and braiding processes open up a new opportunity for making 3-D textile composites that give significantly damage-tolerant structural response with design flexibility for durable joints, near-net shape processing, etc. To

fully understand the mechanical behavior of 3-D textile composites, it is essential to perform analyses to predict effective material properties and damage initiation and growth. In this paper we present a new approach to generating 3-D textile composite geometric models based on image processing techniques. The main objectives are to visualize, manipulate, and reconstruct textile internal structures based on multidimensional image data for the purpose of further mechanics analysis. A software code called the ImageScan is developed to generate geometry models from a set of image slices of a textile composite based on image reconstruction technology. The images from an optical microscope or other source can be segmented into objective constituents and reconstructed into 3-D geometry, which can be input into an appropriate mechanics model to predict the material properties and mechanical deformation under a specific boundary condition and loadings.

DTIC

*Composite Materials; Image Reconstruction; Mechanical Properties; Textiles*

## 28

### PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*; and *44 Energy Production and Conversion*.

**20070026692** RAND Corp., Santa Monica, CA USA

#### **Constraints on JP-900 Jet Fuel Production Concepts**

Bartis, James T; Flint Jr, G T; Jan 2007; 21 pp.; In English

Contract(s)/Grant(s): FA7014-06-C-0001

Report No.(s): AD-A466729; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466729>

Researchers at the Energy Institute of Pennsylvania State University (Penn State) are conducting research on producing jet fuel by coprocessing coal or coal-derived products with low-value liquid intermediates produced during petroleum refining. To date, most of this research effort has focused on a coal-tar blending process. Penn State currently plans to build a one-barrel per-day pilot plant and produce 100 barrels of product to be delivered to and tested by the Air Force Research Laboratory. Recognizing the limited availability of the coal-tar derived liquids used in the coal-tar blending process, the Penn State research team has recently shifted its attention to a co-coking process, in which a mixture of solid coal and a refinery intermediate, decant oil, is used to produce a combination of liquid fuels and coke.

DTIC

*Fuel Production; Jet Engine Fuels*

**20070026744** ABB Environmental Services, Inc., Portland, ME USA

#### **No Further Action Decision Under CERCLA, Fort Devens Study Area 58, Buildings 2648 and 2650 Fuel Oil Spills**

Nov 1995; 52 pp.; In English

Contract(s)/Grant(s): DAAA15-91-D-0008; Proj-7053-12

Report No.(s): AD-A467004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467004>

This decision document has been prepared to support a no further action decision at Study Area 58 - Buildings 2648 and 2650 Fuel Oil Spills (SA 58) at Fort Devens, Massachusetts. The report was prepared as part of the U.S. Department of Defense (DOD) Base Realignment and Closure (BRAC) program to assess the nature and extent of contamination associated with site operations at Fort Devens. In conjunction with the Army's Installation Restoration Program (IRP), Fort Devens and the U.S. Army Environmental Center (USAEC; formerly the U.S. Army Toxic and Hazardous Materials Agency) initiated a Master Environmental Plan (MEP) in 1988. The MEP consists of assessments of the environmental status of SAS, specifies necessary investigations, and provides recommendations for response actions with the objective of identifying priorities for environmental restoration at Fort Devens. SA 58 was identified in the MEP as a potential source of contamination. On December 21, 1989, Fort Devens was placed on the National Priorities List under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act.

DTIC

*Buildings; Fuel Oils; Fuels; Oil Slicks*

**20070026795** Army Tank-Automotive Research and Development Command, Warren, MI USA  
**Tank Automotive Research, Development, and Engineering Center**

Prokurat-Franks, Lisa; Mar 18, 2002; 13 pp.; In English

Report No.(s): AD-A467460; TARDEC-TR-16142; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467460>

TARDEC's Mission: To research, develop, engineer, leverage, and provide advanced systems integration of technology into ground systems and support equipment throughout the life cycle.

DTIC

*Automobiles*

**20070026867** Library of Congress, Washington, DC USA

**Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety and Regulation**

Parfomak, Paul W; Flynn, Aaron M; May 27, 2004; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468225; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468225>

Liquefied natural gas (LNG) is a hazardous fuel frequently shipped in large tankers to U.S. ports from overseas. While LNG has historically made up a small part of U.S. natural gas supplies, rising gas prices, current price volatility and the possibility of domestic shortages are sharply increasing LNG demand. To meet this demand energy companies have proposed building dozens of new LNG import terminals throughout the coastal USA. But many of these terminals would be built onshore near populated areas, so local communities fear the terminals would expose them to unacceptable safety and security hazards. Potentially catastrophic pool fires or vapor cloud fires could arise from a serious accident or attack on LNG infrastructure. Faced with the widely perceived need for greater LNG imports, and persistent public concerns about LNG safety, Congress is examining the adequacy of safety provisions in federal LNG siting regulation.

DTIC

*Liquefied Natural Gas; Safety*

**20070027256** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Army Fuels: Policies, Regulations, and Executive Orders**

Villahermosa, Luis A; Nov 8, 2006; 26 pp.; In English

Report No.(s): AD-A466879; TARDEC-16679; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Discussion of the executive orders and policies related to the type of fuels used by the Army and the efforts to reduce fuel consumption.

DTIC

*Charts; Fuel Consumption; Fuels; Policies; Regulations*

**20070027368** Army War Coll., Carlisle Barracks, PA USA

**America's Energy Security Policy: Goals for 2025**

Chesley, Gary; Feb 1, 2007; 23 pp.; In English

Report No.(s): AD-A467292; No Copyright; Avail.: Defense Technical Information Center (DTIC)

President Bush declared in his 2006 State of the Union address that America is addicted to oil, which is often imported from unstable parts of the world. He set a goal to replace more than 75 percent of the oil imported from the Middle East by 2025. However, nearly every recent president since the Nixon administration has had energy goals; few have been achieved. This paper assesses the failure to meet past energy goals, analyzes energy trends, and recommends actions to meet the goal of replacing 75 percent of Middle East imported oil by 2025.

DTIC

*International Trade; Oils; Security*

**20070027392** Naval Postgraduate School, Monterey, CA USA

**Improving the Resiliency of the Natural Gas Supply and Distribution Network**

Nadeau, John; Mar 2007; 88 pp.; In English

Report No.(s): AD-A467387; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To accommodate the nation's escalating demand for natural gas, which is expected to increase 700% by 2030, the natural gas industry will likely build several new liquefied natural gas (LNG) import terminals. The location of these new terminals



is an important strategic decision that significantly impacts the resiliency of the nation's natural gas supply and distribution network. Due to public opposition in many communities and shortcomings in the current licensing process, any additional LNG import terminals are apt to be concentrated along the Gulf Coast. Unfortunately, this impending concentration will increase the vulnerability and diminish the resiliency of this critical infrastructure. This thesis uses network theory to forecast how the location of new terminals will impact the risk, vulnerability, and resiliency of the natural gas supply and distribution network. To enhance the resiliency and reduce the vulnerability of this critical infrastructure, we argue network analysis methodology should be applied during the terminal siting process. The Federal government must act quickly to facilitate siting of terminals in locations that reduce the vulnerability and improve the resiliency of the natural gas network. Failure to act will squander an unprecedented opportunity to shape and intelligently design this portion of the nation's critical infrastructure.

DTIC

*Liquefied Natural Gas; Natural Gas*

**20070027491** Engineering Research and Consulting, Inc., Edwards AFB, CA USA

**Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint)**

Venner, Marty; Parker, James; McKeon, William; Jun 16, 2006; 11 pp.; In English

Report No.(s): AD-A467721; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On 23 August 2005 the Air Force Research Laboratory (AFRL) Propulsion Directorate at Edwards AFB conducted an open air burn of over 2000 kg of Titan IV solid rocket motor propellant. Multiple remote sensors were deployed to measure the heat flux and spectral emissions during the burn. The heat flux data was utilized to help determine the hazard classification for the propellant. An average normalized irradiance of 1.62 kW/m<sup>2</sup> was obtained during a nominal portion of the burn and supports a classification of 1.4. A Fourier Transform Infrared (FTIR) spectrometer collected data over a spectral range of 1.4 - 14  $\mu$ m. Those data show strong gaseous emissions from carbon dioxide, water, and hydrogen chloride as well as a continuum emission component due to the aluminum oxide particulates.

DTIC

*Combustion; Heat Flux; Infrared Radiation; Propellants; Solid Rocket Propellants; Spectrum Analysis*

**20070027549** Air Force Research Lab., Edwards AFB, CA USA

**Experimental and Numerical Investigations of RP-2 Under High Heat Fluxes**

Billingsley, M C; Lyu, H Y; Bates, R W; May 2007; 32 pp.; In English

Contract(s)/Grant(s): Proj-4847

Report No.(s): AD-A467838; AFRL-PR-ED-TP-2007-150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Interest in developing reusable, long-life, liquid hydrocarbon fueled rocket engines has continued to grow in recent years. Of critical importance in designing and developing an engine with these characteristics is of course the fuel and its impact on potential cooling schemes. For several years now, the Air Force Research Laboratory Propulsion Directorate has been developing the capability to examine the thermal performance of newly emerging petroleum distillate fuels such as RP-2, an advanced grade of ultra-low sulfur rocket kerosene. This paper reports recent experiments and numerical simulations of RP-2 cooled thermal stability tests conducted in the AFRL High Heat Flux Facility located at Edwards AFB, CA. Heat transfer measurements and simulations of those experiments using Metacomp's CFD++ conjugate heat transfer capability were conducted over heat fluxes ranging from 2-10 BTU/in<sup>2</sup>/s, channel velocities from 26-165 ft/s, and wall temperatures from 840-1135 deg F. A Nusselt number correlation comparison of experimental results to well-known Dittus-Boelter and Sieder-Tate correlations and the NASA/GRC correlation of Stiegemeier et. al is presented for Reynolds numbers between 5,000-35,000. Computational comparisons with experimental measurements are made and represent the first steps in producing a validated predictive computational capability.

DTIC

*Heat Flux; Kerosene; Liquid Fuels; Liquid Propellant Rocket Engines*

**20070029330** Lawrence Livermore National Lab., Livermore, CA USA

**Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls**

Choi, J.; Lee, C.; Day, D.; Wall, M.; Saw, C.; Nov. 15, 2006; 25 pp.; In English

Report No.(s): DE2007-900175; UCRL-CONF-226122; No Copyright; Avail.: National Technical Information Service (NTIS)

Spent nuclear fuel contains fissionable materials (235U, 239Pu, 241Pu, etc.). Neutron multiplication and the potential for

criticality are enhanced by the presence of a moderator during cask loading in water, water incursion in accidents conditions during spent fuel storage or transport. To prevent nuclear criticality in spent fuel storage, transportation, and during disposal, neutron-absorbing materials (or neutron poisons, such as borated stainless steel, Boral™, Metamic™, Ni-Gd, and others) would have to be applied. The success in demonstrating that the High-Performance Corrosion-Resistant material (HPCRM) can be thermally applied as coating onto base metal to provide for corrosion resistance for many naval applications raises the interest in applying the HPCRM to USDOE/OCRWM spent fuel management program. The fact that the HPCRM relies on the high content of boron to make the material amorphous an essential property for corrosion resistance and that the boron has to be homogeneously distributed in the HPCRM qualify the material to be a neutron poison.

NTIS

*Amorphous Materials; Corrosion Resistance; Metal Coatings; Metals; Neutrons; Nuclear Fuels; Safety; Spent Fuels*

**20070029393** National Nuclear Security Administration, Las Vegas, NV, USA

**Annual Transportation Report for Radioactive Waste Shipments to and from the Nevada Test Site. (Fiscal Year 2006)**

Jan. 2007; 20 pp.; In English

Report No.(s): DE2007-900566; DOE/NV-1187; No Copyright; Avail.: Department of Energy Information Bridge

In February 1997, the U.S. Department of Energy, Nevada Operations Office issued the 'Mitigation Action Plan which addressed potential impacts described in the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada' (DOE/EIS 0243). The U.S. Department of Energy, Nevada Operations Office committed to several actions, including the preparation of an annual report, which summarizes waste shipments to and from the Nevada Test Site (NTS) Radioactive Waste Management Sites (RWMS) at Area 3 and Area 5. This document satisfies requirements with regard to low-level radioactive waste (LLW) and mixed low-level radioactive waste (MLLW) transported to or from the NTS during fiscal year (FY) 2006.

NTIS

*Radioactive Wastes; Transportation; Nevada*

**20070029394** Savannah River National Lab., Aiken, SC, USA

**Improving Thermal Performance of Radioactive Material Drum Type Packages by Using Heat Pipes**

Gupta, N. K.; Mar. 06, 2007; 7 pp.; In English

Report No.(s): DE2007-900560; WSRC-STI-2007-00101; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper presents a feasibility study to improve thermal loading of existing radioactive material packages by using heat pipes. The concept could be used to channel heat in certain directions and dissipate to the environment. The concept is applied to a drum type package because the drum type packages are stored and transported in an upright position. This orientation is suitable for heat pipe operation that could facilitate the heat pipe implementation in the existing well proven package designs or in new designs where thermal loading is high. In this position, heat pipes utilize gravity very effectively to enhance heat flow in the upward direction. Heat pipes have extremely high effective thermal conductivity that is several magnitudes higher than the most heat conducting metals. In addition, heat pipes are highly unidirectional so that the effective conductivity for heat transfer in the reverse direction is greatly reduced. The concept is applied to the 9977 package that is currently going through the DOE certification review. The paper presents computer simulations using typical of-the-shelf heat pipe available configurations and performance data for the 9977 package.

NTIS

*Drums (Containers); Heat Pipes; Packaging; Radioactive Materials; Temperature Effects; Thermal Analysis*

**20070029461** Government Accountability Office, Washington, DC, USA

**Nuclear Safety: DOE's Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened**

May 2007; 41 pp.; In English

Report No.(s): PB2007-110246; GAO-07-712; No Copyright; Avail.: CASI: [A03](#), Hardcopy

More than 700,000 tons of uranium are stored at two Department of Energy (DOE) sites where uranium enrichment took place and where two facilities are being constructed to treat depleted uranium. Some of the storage cylinders for uranium came from the Army more than 50 years ago and may originally have contained phosgene, a toxic gas used as a chemical weapon in World War I. In September 2005, DOE's Inspector General issued an alert warning that residual phosgene, if present, could threaten the safety of people and the treatment facilities. GAO was directed to review DOE's investigation of possible

phosgene contamination of uranium storage cylinders. GAO consulted a panel of experts to assess the adequacy of DOE's investigation and whether possible phosgene contamination could threaten the new treatment facilities under construction. According to members of GAO's expert panel, although DOE adequately demonstrated that the public would not be harmed if small amounts of phosgene escaped from the storage cylinders, it neglected to explicitly document its analysis of worker safety in its investigation of possible phosgene contamination.

NTIS

*Contamination; Hazards; Health; Phosgene; Public Health; Radiation Protection; Safety; Uranium*

**20070029556** Southwest Research Inst., San Antonio, TX USA

**Fuel Property Effects on T700 Exhaust Particulates**

Moses, Clifford A; Jun 2004; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAE07-99-C-L053

Report No.(s): AD-A468740; TFLRF-373; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468740>

T700 engine and combustor-rig tests were conducted to evaluate fuel and additive effects on exhaust particulates. Six base fuels were used ranging from a zero-aromatics synthetic fuel to diesel fuel. The effect of copper contamination on particulates was evaluated as was the effect of the additive Spec\*Aid 8Q462, which has been shown to reduce particulates in some other testing. Particulates were characterized by both mass and size distribution. Particulate mass correlated equally well with the fuel aromatic content, hydrogen content, and smoke point. More importantly, in the engine tests, an excellent correlation was found between the particulate mass on the filters and the integrated particulate volume calculated from the particulate-size distribution. The presence of copper contamination did not affect the concentration or size of particulates. Limited results on two fuels without replication showed a 10 to 15% reduction in particulates at the cruise condition with the 8Q462 additive. The results indicate that a zero-aromatics fuel will reduce particulate mass about 25% compared to an average JP-5. Alternately, F-76 diesel fuel would be expected to double the particulate mass.

DTIC

*Additives; Exhaust Gases; Jet Engines; Particulates; Turbine Engines*

**20070029774** Army Tank-Automotive Research and Development Command, Warren, MI USA

**TARDEC National Automotive Center - Selfridge Air National Guard Base**

Sanborn, Harold R; Hart, Aaron; Apr 25, 2007; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469076; TARDEC-17055; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469076>

The U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC)-National Automotive Center (NAC) is the DoD/Army focal point for collaborative ground vehicle research and development and serves as a catalyst linking industry, academia and government agencies in the development, exchange, and commercialization of automotive technologies. The NAC accelerates the commercialization of advanced vehicle technologies by demonstrating new technologies in a safe, controlled environment and recognizes the inherent linkage between mobility platforms and the energy infrastructure necessary to support these platforms.

DTIC

*Airports; Armed Forces (United States); Automobiles*

### 31

## ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

**20070026356** BAE Systems, UK

**Quantitative Analysis of Situational Awareness (QUASA): Applying Signal Detection Theory to True/False Probes and Self-Ratings**

McGuinness, Barry; Jun 2004; 86 pp.; In English; Original contains color illustrations

Report No.(s): AD-A465817; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA465817>

This paper describes a technique for assessing the situational awareness of individuals such as warfighters participating

in C2 experiments and exercises. Known as QUASA (quantitative analysis of situational awareness), the technique combines both objective queries (true/false probes) and subjective self-ratings of confidence for each probe response. The data so obtained are then analyzed and interpreted using the mathematical framework of Signal Detection Theory (SDT). The rationale behind the technique is described, followed by an example of its implementation and the results obtained. Further refinements of the technique based on recent research in experimental psychology are also considered.

DTIC

*Psychological Tests; Quantitative Analysis; Ratings; Signal Detection; Situational Awareness*

**20070026477** Academia Sinica, Taipei, Taiwan, Province of China

**High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale**

Wu, M K; Hwu, Y K; Chen, C D; Chae, W H; Sep 5, 2006; 18 pp.; In English

Contract(s)/Grant(s): MIPR-AOARD-044008

Report No.(s): AD-A466234; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466234>

Investigation of achieving direct imaging of fluid hydrodynamics in the microfluidic devices using a newly developed X-ray phase contrast radiology technique. The capability of direct imaging in real time of this new technique allows us to study the internal dynamics of the formation of the bubbles in respond to the localized heat or vibration in a microfluidic device. With such information, one can tie the images of the internal bubble formation with the external formation of the sprays to support the numerical simulation, which can be used to improve the functionality of ink-jet printer head. Apart from the ink flow study, one can also study mechanism of nano-particle flow in micro-scaled fluidic channels, which may eventually lead to the better understanding of the mechanism of drug delivery.

DTIC

*High Resolution; Hydrodynamics; Micrometers; Phase Contrast; Radiology; Real Time Operation; X Rays*

**20070026478** Synergistic Research, Inc., Springfield, VA USA

**Net-Centric Test & Evaluation**

Buchheister, John B; Jun 2004; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466235; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466235>

This paper and associated presentation describes an approach for test and evaluation in a net-centric environment. A short term effort is planned in February to September 2004 to develop and apply appropriate measures of effectiveness (MOEs), metrics, and methods of data collection, analysis and evaluation for a representative test item's performance within a networked system of systems environment. A net-centric T&E approach is prepared for the Rosetta STONE Single Integrated Picture Enabling Technology Demonstration (ETD). The Department of Defense has issued guidance and criteria in the form of joint concepts, net-centric checklists, and interoperability and supportability instructions for use in program assessments, capability analyses, and experimentation. The finding of this research so far are that these criteria, comprised of attributes derived largely from network-centric warfare concepts and commercial standards, are not yet in a form suitable for immediate and widespread use for test and evaluation (T&E). However, progress is being made. Status of the effort will be reported at the Symposium to include lessons learned for planning future net-centric T&E.

DTIC

*Computer Networks; Warfare*

**20070026494** Florida Univ., Gainesville, FL USA

**Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor**

Sheplak, Mark; Chandrasekaran, Venkataraman; Cain, Anthony; Nishida, Toshikazu; Cattafesta, Louis N; Jun 2002; 7 pp.; In English

Contract(s)/Grant(s): F4962-97-1-0507

Report No.(s): AD-A466321; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466321>

A detailed characterization is presented of a silicon-micromachined thermal shear-stress sensor employing a thin-film platinum-sensing element on top of a silicon-nitride membrane that is stretched over a vacuum cavity. The sensor was operated in a constant current mode and characterized using a four-point probe configuration to isolate the sensor response from the effects of external compensation circuitry. The characterization results consist of static sensitivity data at multiple overheat

ratios (maximum of 11 mV/Pa at an overheat of 1.0), pressure sensitivity spectra (<1 microvolt/Pa), noise floor spectra (100 nV/square root of Hz), and direct dynamic calibration data (up to 7 kHz). Noise floor measurements reveal a minimum detectable shear stress of 9 microPa/Hz, thus resulting in a sensor dynamic range of over 100 dB (9 microPa 1.7 Pa).

DTIC

*Microelectromechanical Systems; Micromachining; Shear Stress; Silicon*

**20070026495** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Shakedown & Determination of Tunnel Control Settings for Refurbished Trisonic Gasdynamic Facility (TGF)**

Saladin, Julie E; Sep 2006; 95 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-A01B

Report No.(s): AD-A466325; AFRL-VA-WP-TR-2007-3015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466325>

The Trisonic Gasdynamic Facility (TGF) had refurbishment completed in 2005 after being put into mothball status ten years prior. Upgrades during refurbishment to the tunnel and the loss of the old operations staff required the need for an initial set of tunnels runs to determine how to operate the facility, rediscover the limitations of the facility, and determine the correlation between the old documented control settings and the new systems. This control calibration also served as the initial shakedown of the refurbished tunnel, allowing technicians and engineers to cycle the systems and discover the best practices for operation and unresolved or unknown problems with the system. The shakedown initiated the reliable and successful operation of the TGF for future ground testing experiments.

DTIC

*Calibrating; Trisonic Wind Tunnels; Wind Tunnels*

**20070026509** Air Warfare Centre RAF, Lincoln, UK

**The Effects of Wind Turbine Farms on ATC Radar**

May 10, 2005; 45 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466350; AWC/WAD/72/665/TRIALS; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466350>

The UK Government supports the introduction of wind turbine farms as part of its alternative energy strategy. However, Ministry of Defense (MoD) guidelines restrict planning consent for wind turbine farms within line of sight (LoS) from Primary Surveillance Radars and in close proximity to Royal Air Force (RAF) Airfields. The validity of these guidelines has been the subject of close scrutiny by the wind farm developers. Consequently, a trial was conducted by the Air Command and Control Operational Evaluation Unit (Air C2 OEU) in response to a tasking from Headquarters No 3 Group (HQ 3 Gp), to determine the effects of wind turbine farms on Air Traffic Control (ATC) Primary Surveillance Radars. Stage 1 of the Trial was a scoping exercise over the period 3-4 Nov 04, utilizing the Watchman radar at RAF Valley and the Trysglwyn and Rhyd-y-Groes wind turbine farms. Stage 2, the start of the main trial, was conducted in the period 23-25 Nov 04 utilizing the Llandinam (P&L) wind turbine farm in South Wales. A Watchman Radar was deployed to a privately owned site in Shropshire, slightly south of the National Air Traffic Services (NATS) Radar Site at Clee Hill. This deployment provided medium-range data from within the main beam of the radar. Stage 3 was conducted during the period 13-14 Dec 04, again utilizing the P&L wind turbine farm but with the Watchman Radar on a soft-field site at Llanbister. This provided short-range data from within the auxiliary beam of the radar.

DTIC

*Air Traffic Control; Search Radar; Turbines; Wind Effects; Wind Turbines; Windpower Utilization*

**20070026731** Naval Air Warfare Center, China Lake, CA USA

**Development of Subscale Fast Cookoff Test**

Atwood, Alice I; Wilson, Kenneth J; Laker, Travis S; Washburn, Ephraim B; Nov 14, 2006; 11 pp.; In English

Report No.(s): AD-A466874; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466874>

A propane-fueled combustor was built to support the development of an alternate to the external fire test currently required for final Hazards Classification (HC). The device has the capability to provide a controlled heat flux environment of 40-400

kW/sq m (12,600- 126,000 Btu/hr/sq ft). This results in a repeatable and quantifiable environment for the evaluation of the fast cook-off response of an ordnance item.

DTIC

*Combustion Chambers; Firing (Igniting); Heat Flux; Test Equipment*

**20070026743** Naval Explosive Ordnance Disposal Facility, Indian Head, MD USA

**Unexploded Ordnance Site Investigation of US Military Ranges in Panama: Empire, Balboa West and Pina Ranges**

Sperka, Jonathan; Black, Heather; Burr, Arnold; Jul 1998; 178 pp.; In English

Report No.(s): AD-A467000; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467000>

This report covers the UXO sampling and clearance activities conducted on site in Panama on the Empire, Balboa West and Pina Ranges. The data collected was used to refine and/or confirm the initial UXO Assessment Report published in 1997 entitled 'Unexploded Ordnance Assessment of U.S. Military Ranges in Panama: Empire, Balboa West and Pina Ranges'. This report provides a snapshot of the conditions of the ranges and training areas with respect to UXO concentrations.

DTIC

*Ammunition; Ordnance*

**20070026778** Dynamics Research Corp., Arlington, VA USA

**Case Study of a Prototype Set of Behaviorally Anchored Rating Scales (BARS) for C2 Assessment**

Murphy, Jim; Grynovicki, Jock O; Kysor, Kragg P; Jun 2003; 53 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467406>

The Command and Control Research Program's (CCRP) recent publication of the 'Code of Best Practice for Experimentation' highlights once again the potential of behaviorally anchored rating scales (BARS) as an assessment tool for command-staff team performance in the execution of battle command. Interest in BARS as a performance appraisal technique has grown steadily since first proposed in 1963 (Smith and Kendall). The BARS methodology was originally proposed as an appraisal instrument for individuals but has since been applied to team environments. In 1991, the U.S. Army funded research for the development of BARS to support aircrew training (Grubb et al.). In 1999, a comprehensive framework was developed for assessing C4ISR performance in which commander and staff proficiencies would be observed and assessed using carefully developed BARS (Leedom). The intention was to link the assessments to other force effectiveness measures to determine the overall effectiveness of the human-technical system. That proposal led to an ARL funded effort and the development of a prototype set of BARS designed to assess the team proficiencies of a commander and staff in the execution of 'battle command.' This paper describes the use of the prototype BARS in a recent battle lab experiment, and sheds light on future efforts to develop BARS within the context of Joint services experimentation.

DTIC

*Command and Control; Prototypes; Ratings*

**20070027266** New Mexico State Univ., Las Cruces, NM USA

**Parametric Dynamic Load Prediction of a Narrow Gauge Rocket Sled**

Furlow, John S; Dec 2006; 261 pp.; In English

Report No.(s): AD-A466902; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Dynamic load prediction of rocket sleds has been of interest to sled designers and analysts since the inception of the Holloman High Speed Test Track, (HHSTT). Dynamic loading along with thrust and aerodynamic loading is a primary contributor to sled design load cases. Dynamic loading comes directly from the rocket sled traversing the gap between the slipper and rail and the resulting sliding impacts. The current study investigates the prediction of narrow gauge sled dynamic loads by applying a systematic process of modeling validation, design parameter variation and dynamic load correlation.

DTIC

*Dynamic Loads; Measuring Instruments; Sleds*

**20070027317** Naval Postgraduate School, Monterey, CA USA

**Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters**

Adams, Barry D; Mar 2007; 109 pp.; In English

Report No.(s): AD-A467122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Currently, the Air Force is developing the Space Radar (SR) system, the Navy the DD(X) 21st Century Destroyer, and

the Army the Future Combat Systems (FCS). While technologies developed by the Research, Development, Test, and Evaluation (RDT&E) organizations affiliated with each military service often have pervasive utility among the services, the structures of these RDT&E organizations currently do not provide for or permit any substantial degree of synergistic teaming, integration, or technology leveraging. As a result, technology development for each of the SR, DD(X), and FCS programs has failed to achieve schedule efficiency, cost effectiveness, and technical proficiency. To enable a successful development of these systems in particular and to prevent DoD system acquisition programs from failing to achieve the aforementioned parameters, a leveraged technology development strategy is needed. This thesis examined the potential for inter-service technology development and identified opportunities to leverage the development of common, critical technologies across the three services within the DoD in general and across the SR, DD(X), and FCS programs in particular. The findings of this study show that through careful planning and coordinated technology transition, DoD acquisition programs can indeed leverage the technology development efforts of the three services within the DoD. The identified technology leveraging opportunities will enable significant cost savings and schedule efficiency to the Space Radar, DD(X), and Future Combat Systems programs and help ensure deployment of these critical defense capabilities.

DTIC

*Abilities; Cost Effectiveness; Costs; Defense Program; Interoperability; Military Operations; Military Technology*

**20070027421** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Corporate Entrepreneurship Assessment Instrument (CEAI): Refinement and Validation of a Survey Measure**

Cates, Michael S; Mar 2007; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467545; AFIT/GIR/ENV/07-M7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The study of corporate entrepreneurship has established itself as a valuable area of research for both public and private-sector organizations. The measurement instrument known as the Corporate Entrepreneurship Assessment Index (CEAI) has been designed to tap the climate-related organizational factors that represent and potentially encourage corporate entrepreneurship. This study is an attempt to refine the CEAI. The core constructs of the CEAI are redefined, the items are tested for content validity, the factor structure is analyzed, and the CEAI is correlated to other known measures to validate the CEAI. Through this testing, the CEAI was refined and found to be a useful measure for predicting an innovative, entrepreneurial environment.

DTIC

*Organizations; Refining; Surveys*

**20070027470** Defence Science and Technology Organisation, Canberra, Australia

**Joint Essential Tasks and a Framework for Evaluation**

Kingston, Gina; Johns, Kevin; Sep 2002; 11 pp.; In English

Report No.(s): AD-A467653; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In Jan 2000, DSTO embarked on a task to develop a list of Australian Joint Essential Tasks (ASJETs) to support the planning and evaluation of exercises. This process has been very successful and has seen ASJETs incorporated into the planning for the next major Australian-led exercise -- Crocodile 03. Evaluation may be used for a variety of purposes: to monitor progress; to determine whether or not objectives can be achieved; to assess the suitability of new processes, systems, or structures; and to identify deficiencies or dependencies. Each of these purposes has different evaluation requirements. Also, evaluation may be limited to determining which activities have been conducted, or be based on subjective opinions, repeatable subjective measures, or objective measures. While rigorous objective evaluation is often considered the most desirable and reliable method, it may prove to be impractical or too expensive. A risk-managed approach may be a good alternative. The evaluation approach selected needs to take into account a number of factors, such as the purpose of the evaluation and the time and results of the last evaluation, to determine which measures should be used. With experience, it should be possible to identify a suite of reliable measures, both subjective and objective. This evaluation approach is discussed in the context of planned evaluations for future military exercises.

DTIC

*Australia; Evaluation; Measurement; Military Operations; System Effectiveness*

**20070027645** Executive Office of the President, Washington, DC USA

**American Competitiveness Initiative: Leading the World in Innovation**

Feb 2006; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Keeping our competitive edge in the world economy requires focused policies that lay the groundwork for continued

leadership in innovation, exploration, and ingenuity. America's economic strength and global leadership depend in large measure on our Nation's ability to generate and harness the latest in scientific and technological developments and to apply these developments to real world applications. These applications are fueled by: scientific research, which produces new ideas and new tools that can become the foundation for tomorrow's products, services, and ways of doing business; a strong education system that equips our workforce with the skills necessary to transform those ideas into goods and services that improve our lives and provide our Nation with the researchers of the future; and an environment that encourages entrepreneurship, risk taking, and innovative thinking. By giving citizens the tools necessary to realize their greatest potential, the American Competitiveness Initiative (ACI) will help ensure future generations have an even brighter future.

DTIC

*Education; United States*

**20070027696** Aerospace Corp., El Segundo, CA USA

**X-Ray Dose in Microfocus Radiographic Inspections**

Stupian, G W; Mar 15, 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A468142; TR-2007(8555)-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The radiation dose accumulated by specimens during real-time microfocus radiographic examination is of interest to program office customers and their contractors because of possible damage to certain sensitive types of electronic components. The real-time X-ray facility in The Aerospace Corporation's Laboratory Operations has two microfocus radiography systems. This report characterizes the radiation levels in both our Feinfocus model 160.52 system and our Phoenix X-ray 'PCBA/Analyzer.' These instruments are representative of the state-of-the-art in X-ray inspection. The variables involved in the determination of total dose include the voltage and current of the X-ray tube; the amount and type of shielding material (incidental and deliberate) between the sample and the X-ray source; the distance from the source to the sample; and the time spent looking at the sample. Some general principles of X-ray dosimetry are discussed along with strategies for dose minimization when required. Most of the considerable body of published work on the characterization of kilovolt X-ray sources has been done by the medical physics community. This report aims at ensuring that similar information is brought to the attention of people in the aerospace industry.

DTIC

*Dosage; Dosimeters; Inspection; Radiography; X Rays*

**20070027714** Veridian Engineering, Inc., Dayton, OH USA

**Experimentation with Evolving C2 Operation Centers - Implications for the Human Element**

Goodman, Michael; Garrabone, Michael; Rolek, Evan; McCormick, Ed; Jun 2001; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468354; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In spite of the surge in new technologies, complex operational processes, and high operations tempos, the selection, education, training, and team functions of the modern C2 operators has not been given comparable attention. In order to properly staff future C2 operations centers with capable individuals and operational teams, attention needs to be directed to the analysis of the evolving C2 operator training requirements and team dynamics that are being driven by modern technology and changing concepts of operations. This paper will describe the assessment approach and methodology employed by the Air Force Research Laboratory's Warfighter Training Research Division, Information Systems Training Branch, Brooks AFB, TX (AFRL/HEAI) researchers as they observed the C2 operators in the Time Critical Targeting Cell (TCTC) during Joint Expeditionary Force eXperiment 2000 (JEFX 00). The AFRL/HEAI researchers followed a human factors oriented approach in developing a data collection methodology to gain insight into the scope of issues confronting personnel in modern C2 operation centers. This approach stressed the importance of C2 functions and processes related to time critical targeting that depended on the interactions among individuals and teams of C2 operators. These insights may ultimately assist in the specification of C2 operator training requirements and help characterize the individual and team desired performance capabilities.

DTIC

*Command and Control; Education; Human Factors Engineering; Personnel Development*



**20070027807** Florida Univ., Gainesville, FL USA

**Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE**

Hatfield, Kirk; Annable, Michael D; Rao, P S; Feb 2006; 173 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-0114

Report No.(s): AD-A468559; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The use of contaminant flux and contaminant mass discharge as robust metrics for assessment of risks at contaminated sites and for evaluating the performance of site remediation efforts has gained increasing acceptance within the scientific, regulatory and user communities. The Passive Flux Meter (PFM) is a new technology that directly addresses the DoD need for cost-effective long-term monitoring, because flux measurements can be used for process control, for remedial action performance assessments, and for compliance purposes. However, the use of innovative technologies such as the PFM can be slow to gain acceptance in the environmental community. Thus, to gain acceptance it must be shown that the PFM technology possesses a sound theoretical basis accepted widely in the technical circles and that it be field-scale demonstrated at diverse sites. Under ESTCP project No ER-0114, the PFM is demonstrated and validated at several locations including Hill AFB in Layton, Utah; NASA Launch Complex 34 in Cape Canaveral, Florida; a Canadian Forces Base in Ontario, Canada; Naval Base Construction Base in Port Hueneme, California; and the Naval Surface Warfare Center at Indian head, Maryland. The projects at Hill, NASA, and Borden include the objectives of evaluating the flux meter as an innovative technology for direct in situ measurement of cumulative water and contaminant flux for DNAPLs and compiling field data to transition the technology from the innovative testing phase to regulatory/end user acceptance and stimulated commercialization. The Port Hueneme project evaluated MTBE flux with similar objectives while the Indian Head project demonstrated the borehole flux meter to measure water and perchlorate contaminant flux.

DTIC

*Contaminants; Ground Water; Magnetic Measurement; Risk; Solutes; Water*

**20070027808** Florida Univ., Gainesville, FL USA

**Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA**

Hatfield, Kirk; Annable, Michael D; Rao, P S; Jul 2006; 113 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-0114

Report No.(s): AD-A468560; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The use of contaminant flux and contaminant mass discharge as robust metrics for assessment of risks at contaminated sites and for evaluating the performance of site remediation efforts has gained increasing acceptance within the scientific, regulatory and user communities. The Passive Flux Meter (PFM) is a new technology that directly addresses the DoD need for cost-effective long-term monitoring, because flux measurements can be used for process control, for remedial action performance assessments, and for compliance purposes. However, the use of innovative technologies can be slow to gain acceptance in the environmental community; this is because an innovative technology requires a sound theoretical basis accepted widely in the technical circles and field-scale demonstration at diverse sites. Under ESTCP project No ER-0114, the PFM is demonstrated and validated at several locations including Hill AFB in Layton, Utah; NASA Launch Complex 34 in Cape Canaveral, Florida; a Canadian Forces Base in Ontario, Canada; Naval Base Ventura County (NBVC) at Port Hueneme, California; and the Naval Surface Warfare Center at Indian Head, Maryland. The projects at Hill and Borden included the objectives of evaluating the flux meter as an innovative technology for direct in situ measurement of cumulative water and contaminant flux for DNAPLs and compiling field data to transition the technology from the innovative testing phase to regulatory/end user acceptance and stimulate commercialization. The Indian head project demonstrated the PFM could measure water and perchlorate contaminant flux. The focus of the NASA site was to demonstrate and validate the PFM, as a tool for measuring groundwater and contaminant fluxes at the Launch Complex 34 site (LC 34) where NASA was demonstrating bioaugmentation to enhance the removal of trichloroethylene (TCE) using an engineered microbial culture, KB-1(TradeMark).

DTIC

*Contaminants; Ground Water; Magnetic Measurement; Risk; Solutes; Water*

**20070027809** Florida Univ., Gainesville, FL USA

**Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD**

Hatfield, Kirk; Annable, Michael D; Rao, P S; Jul 2006; 138 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-0114

Report No.(s): AD-A468561; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The use of contaminant flux and contaminant mass discharge as robust metrics for assessment of risks at contaminated sites and for evaluating the performance of site remediation efforts has gained increasing acceptance within the scientific, regulatory and user communities. The Passive Flux Meter (PFM) is a new technology that directly addresses the DoD need for cost-effective long-term monitoring, because flux measurements can be used for process control, for remedial action performance assessments, and for compliance purposes. However, the use of innovative technologies can be slow to gain acceptance in the environmental community; this is because an innovative technology requires a sound theoretical basis accepted widely in the technical circles and field-scale demonstration at diverse sites. Under ESTCP project No ER-0114, the PFM is demonstrated and validated at several locations including Hill AFB in Layton, Utah; NASA Launch Complex 34 in Cape Canaveral, Florida; a Canadian Forces Base in Ontario, Canada; Naval Base Ventura County (NBVC) at Port Hueneme, California; and the Indian Head Naval Surface Warfare Center (IHDIV-NSWC) in Maryland.

DTIC

*Contaminants; Ground Water; Magnetic Measurement; Perchlorates; Risk*

**20070027817** Army Tank-Automotive Research and Development Command, Warren, MI USA

**NAC Off-Vehicle Brake Testing Project**

Miller, Leo; May 1, 2007; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468577; TACOM/TARDEC-17036; No Copyright; Avail.: Defense Technical Information Center

(DTIC)

The inclusive term 'ESA' (Engineering Support Activity) shall be defined as the responsible Army vehicle system engineering authority, equivalent non-Army governmental vehicle design authority, or non-US Governmental civilian engineering activity's designated vehicle or brake program engineer when used solely as a commercial/civilian undertaking.

DTIC

*Evaluation; System Effectiveness*

**20070028520** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Design, Construction, and Validation of the AFIT Small Scale Combustion Facility and Sectional Model of the Ultra-Compact Combustor**

Anderson, Wesley S; Mar 2007; 114 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468367; AFIT/GAE/ENY/07-M01; No Copyright; Avail.: Defense Technical Information Center

(DTIC)

The AFIT small-scale combustion facility is complete and its first experiment designed and built. Beginning with the partially built facility, detailed designs have been developed to complete the laboratory in order to run small-scale combustion experiments at atmospheric pressure. A sectional model of the Ultra-Compact Combustor has also been designed and built. Although the lab's specific design intent was to study the UCC's cavity-vane interaction, facility flexibility has also been maintained for future work. The design enabled the completion of liquid fuel and air delivery systems, power and control systems, and test equipment. The design includes failsafe operation, remote control, and adherence to SAE ARP 1256 testing standards. Construction of the laboratory has forced design changes as new obstacles arose. As system construction has been completed validation and troubleshooting have been undertaken. The AFIT facility can now deliver air in two separately controlled air lines at up to 530 K (500 deg F), at delivery rates of 0.12 kg/s (200 SCFM) for the main line and 0.03 kg/s (60 SCFM) for the secondary. A continuous dual syringe pump can deliver liquid fuel at up to 5.67 mL/s for JP-8 equivalence ratios up to 4. Safe, remote ignition and shutdown are in place and all test equipment fundamental to combustion is installed. The addition of an advanced laser combustion diagnostics system adds more unique capability to the laboratory. The laser system will provide instantaneous Raman and Raman spectroscopy, Coherent Anti-Stokes Raman Scattering, Planar Laser-Induced Fluorescence, Laser-Induced Incandescence and Planar Imaging Velocimetry diagnostic techniques.

DTIC

*Combustion; Combustion Chambers; Construction; Research Facilities*

**20070028537** Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA  
**Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container**

Lam, Y H; Granuzzo, J; Kirshteyn, D; Yang, X M; Oct 2006; 10 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467928; ARASI-TR-06002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Rubber pad expanded neoprene is currently positioned in the container body assembly. It is fastened with adhesive to the metal end, which is crimped to the outer body portion of the fiber container. Extensive testing was performed on the cartridge support during design, pre-production, and FAT testing on past and current contracts by U.S. Army Armament Research, Development and Engineering Center personnel. The cartridge support has shown excellent strength at both elevated and negative temperatures. The container itself is designed and manufactured in a way as to add additional strength to the support. The fiber container, by forming an exterior barrier around the cartridge support also helps in controlling the amount of expansion the cartridge support can achieve. By removing the rubber pad, an initial cost savings of \$0.32 per container would be achieved.

DTIC

*Ammunition; Evaluation; Rubber; System Effectiveness; Value Engineering*

**20070028684** Florida Univ., Gainesville, FL USA  
**Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope**

Xie, Huikai; Fedder, Gary K; Oct 2003; 11 pp.; In English

Contract(s)/Grant(s): F30602-97-2-0323

Report No.(s): AD-A466436; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466436>

A gyroscope with a measured noise floor of 0.02 degrees /s/Hz<sup>1/2</sup> at 5 Hz is fabricated by post-CMOS micromachining that uses interconnect metal layers to mask the structural etch steps. The 1x1 mm lateral-axis angular rate sensor employs in-plane vibration and out-of-plane Coriolis acceleration detection with on-chip CMOS circuitry. The resultant device incorporates a combination of 1.8- micrometers-thick thin-film structures for springs with out-of-plane compliance and 60-micrometers-thick bulk silicon structures defined by deep reactive-ion etching for the proof mass and springs with out-of-plane stiffness. The microstructure is flat and avoids excessive curling, which exists in prior thin-film CMOS-microelectromechanical systems gyroscopes. Complete etch removal of selective silicon regions provides electrical isolation of bulk silicon to obtain individually controllable comb fingers. Direct motion coupling is observed and analyzed.

DTIC

*CMOS; Etching; Fabrication; Gyroscopes; Microelectromechanical Systems; Reactivity*

**20070028745** Naval Postgraduate School, Monterey, CA USA  
**Computational Experimentation in C2**

Nissen, Mark E; Buettner, Raymond R; Jun 2004; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466012; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466012>

No abstract available

*Command and Control; Computation*

**20070028805** Aptima, Inc., Woburn, MA USA  
**When Do Organizations Need to Change (Part II)? Incongruence in Action**

Entin, Elliot E; Diedrich, Frederick J; Kleinman, David L; Kemple, William G; Hocevar, Susan P; Rubineau, Brian; Serfaty, Daniel; Apr 25, 2003; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-C-0233

Report No.(s): AD-A467094; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467094>

Organizations that adapt to changes in their environment have a much better chance at achieving their mission and performing well. When organizations do adapt they usually alter their strategies, but rarely do they change their organizational structure even when that structure no longer fits the mission. To identify the conditions that will be salient enough to cause organizations to alter not only their strategies, but also their current structures, we used a model-based design process to create mission scenarios that were either matched (congruent) or mismatched (incongruent) with two organizational structures

(functional, divisional). We then examined measures over time to identify ones that discriminated between congruent and incongruent conditions early in the mission scenarios. Several measures of communications, performance and workload appeared to be good candidates for leading indicators of the need for organizational change.

DTIC

*Organizations; Workloads (Psychophysiology); Military Technology*

**20070028806** Aptima, Inc., Woburn, MA USA

**When Do Organizations Need to Change (Part I)? Coping with Incongruence**

Diedrich, Frederick J; Entin, Elliot E; Hutchins, Susan G; Hocevar, Susan P; Rubineau, Brian; MacMillan, Jean; Apr 25, 2003; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-C-0233

Report No.(s): AD-A467093; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467093>

Different organizational structures are better matched to certain mission types than others (organizational congruence). Consequently, one way to achieve superior mission effectiveness is to switch between organizational structures when circumstances dictate. However, little is known about the variables that signal the need for such structural adaptation. To explore this issue, we used a model-based design process to create mission scenarios that were either matched (congruent) or mismatched (incongruent) with two organizational structures (Functional, Divisional). Results indicated that, as predicted on the basis of the coordination requirements imposed by the model-based design process, performance in the incongruent cases was characterized by increased communication, increased perceived workload, and degraded performance. Given these overall results, we explored these data further by analyzing communication patterns to identify how the organizations attempted to cope with the congruence problem. Our results indicated that the communication strategies employed in the face of incongruence depended on organizational structure/mission scenario pairings, suggesting that the specific signals of the need for structural adaptation will likely depend on context.

DTIC

*Organizations; Military Technology; Military Personnel*

**20070029544** UXB International, Inc., Blacksburg, VA USA

**Non-Thermal, On-Site Decontamination and Destruction of Practice Bombs**

Heaton, Harley L; Jun 12, 2006; 204 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-DACA87-02-C-0014

Report No.(s): AD-A468687; MM-0211; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468687>

The U. S. Armed Forces have been exploring alternative methods of dealing with unexploded ordnance (UXO) practice bombs (such as the BDU-33) that contain spotting charges (such as the CXU-5, MK-4, or KC-4). There are hundreds of thousands of these bombs at bombing ranges throughout the U.S. The explosive ordnance disposal (EOD) community estimates the dud rate of these bombs to be upwards of 20%. This means that when removing these items from a range, every bomb has to be examined. If it has not functioned, the item must be rendered inert. UXBase, a new process under development by UXB International, Inc. (UXB), uses base hydrolysis (a non-thermal, environmentally safe, cost effective alternative to the 3X and thermal 5X methods) to treat and destroy propellant and explosive residues on range-derived scrap and other materials. UXB feels this technology can also be applied to practice bombs. The process was evaluated to determine required process variables. Following treatment the clean scrap was evaluated to determine its value. After neutralization, the liquid by-products were analyzed for explosive content, metals, and pH. During operations, gasses evolved were analyzed for hydrogen, carbon monoxide, carbon dioxide, and phosphine. Overall the process failed to achieve its objectives. The failure was due to the inability of the caustic fluid to penetrate certain blockages of some dropped, but still live, BDU's so that the propellant was not always destroyed. The fact that propellant does remain in some cases means that inspection would be required to verify that the process has worked as intended for each and every BDU treated, which largely negates the projected cost savings from the process, and does not decrease the hazards associated with recycling BDU's over the present practice.

DTIC

*Ammunition; Decontamination; Destruction; Ordnance*

**20070029578** University of Southern California, Los Angeles, CA USA

**A Study of Communicating Science and Engineering**

Gundersen, Martin A; Aug 2006; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0306

Report No.(s): AD-A468807; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468807>

During the last year the major activity of the 'Communicating Science and Engineering' project involved the third workshop (Catalyst Workshop) planned through the American Film Institute with the participation of colleagues in the industry, and with assistance from media experts at the National Academy. This workshop had the goals of 1) providing scientists and engineers with an opportunity to learn about the film industry and to enhance their science-oriented script writing skills (in order to involve more scientists and engineers in the creative process), and 2) providing data and learning for the project about approaches to professional activities in this area of research (the unique nature of the project presents planning difficulties because of the lack of a knowledge base or established research community to draw from). The Catalyst Workshop was held in August. Studies of the educational aspects of the project, in terms of impact, are reported.

DTIC

*Communicating; Education; Motion Pictures*

**20070029826** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**An Evaluation of High Velocity Wear**

Cameron, Gregory J; Mar 2007; 143 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469174; AFIT/GAE/ENY/07-M06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469174>

The Holloman High Speed Test Track (HHSTT) is a rocket-powered sled track facility used for testing a variety of hypervelocity aerospace applications. The current speed record is 6,453 miles per hour. While this seems fast there are customers at the track that have requirements demanding even faster speeds. Significant research has been conducted in the area of rail gouging as it relates to the test track, and efforts are under way to reduce and even eliminate this phenomenon. Any steps taken in this effort may eliminate catastrophic sled failures caused by gouging, however wear is another damaging issue that needs to be understood. This research evaluates wear in two fashions. First, data from the Dynamic Analysis and Design System (DADS) software, used by the HHSTT to model sled loading and vibration, is evaluated in a theoretical model originating from 'high-speed' pin-on-disk experimentation. The second method evaluates wear by conducting a series of simulations in which temperature, rail geometry in the form of an asperity, speed and rail coating are varied. These short duration simulations are performed with CTH, a hydrocode designed for analyzing hypervelocity impact problems. A validated CTH model, used in previous gouging research, was used to estimate wear by examining local areas of failure and melting. DADS provides forces related to frictional heating and vertical velocity information that will be incorporated as input into CTH.

DTIC

*Aerospace Systems; High Speed; Hypersonic Speed; Sleds; Wear*

**32**

**COMMUNICATIONS AND RADAR**

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 *Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see 03 *Air Transportation and Safety*, and 16 *Space Transportation and Safety*.

**20070026364** Texas A&M Univ., College Station, TX USA

**Distributed Command and Organizational Situation Awareness**

Ma, Norman K; Ioerger, Thomas R; Jun 2004; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466017>

Situation awareness is an essential cognitive-domain object of the command and control decision process. This paper places an organization's SA in the context of OODA (Observe, Orient, Decide, Act) interaction between opposing teams. In addition, a hierarchical SA structure is used to organize SA generated from the physical entities in the corresponding physical

domain. A rich Modal Logic-based language (SALMA) is proposed to represent and also to communicate awareness within an organization to form the Organizational Situation Awareness. An example of increase of knowledge due to Organizational SA is given. An additional example of strategic maneuver based on Organization SA is also given. The paper concludes with an assessment of technology-led innovation and the significance of measurement in situation awareness.

DTIC

*Organizations; Situational Awareness*

**20070026366** Space and Naval Warfare Systems Center, San Diego, CA USA

**Modeling and Simulation in Support of Network Centric Warfare Analysis**

Alspaugh, Chris; Dave, Nikhil; Hepner, Tom; Leidy, Andy; Stell, Mark; Tran, Cam; Woods, Heather; Youm, Wonita; Legaspi, Albert; Weatherly, Jim; Jun 2004; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466029>

The Space and Naval Warfare Systems Center San Diego (SSC San Diego) Code 2822, Network Centric Warfare Analysis Branch, has been developing and integrating models of Navy communications systems. These models are used for assessing communications performance in networked operations and the accompanying impact of communications on C4ISR operations. This paper provides an overview and highlights some of our recently completed tasks and ongoing efforts.

DTIC

*Communication Networks; Navy; Network Analysis; Simulation; Telecommunication; Warfare*

**20070026391** Arizona Univ., Tucson, AZ USA

**Network Centric Warfare in the U.S. Navy's Fifth Fleet. Network-Supported Operational Level Command and Control in Operation Enduring Freedom**

Adkins, Mark; Kruse, John; Jun 2004; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466072; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466072>

Outline of presentation: Environment; Theory; Investigation; Findings; Other Lessons; Implications; Questions.

DTIC

*Command and Control; Warfare*

**20070026393** Defence Science and Technology Agency, Singapore

**Command Control and Information Systems in the Age of Knowledge-Centricity**

Cheah, Mervyn; Lock Pin, Chew; Chee Ping, Tan; Jun 2004; 51 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466076; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466076>

We are in the age of Knowledge Centricity (we will call it Knowledge in short). The age of Knowledge is an age of revolutionary change for businesses and military alike brought about by advancements in networking. These advancements are founded on rapid advancements in Telecommunications and Information Technology. Command Control and Information Systems (C2IS) is a medium by which military organizations exercise command and control. In the Knowledge era, C2IS design must also undergo a revolution to help the information users harness the right information, help them make a deeper appreciation of the situation, and enable them to make better and faster responses. This paper articulates an architecture for a C2IS build for the Knowledge Age, called Command Control Knowledge System (C2KS). The approach moves away from the traditional approach for C2IS design, which is based on C2 processes, to one centered on the human's knowledge creation, and sharing processes. This paper will also present a system currently under development at the SAF Center of Military Experimentation called Mission Mate, which is SAF's prototype of a C2KS.

DTIC

*Command and Control; Information Management; Information Systems*

**20070026397** Army Communications-Electronics Command, Fort Monmouth, NJ USA

**Experimenting with C2 Applications and Federated Infrastructures for Integrated Full-Spectrum Operational Environments in Support of Collaborative Planning and Interoperable Execution**

Mayk, Israel; Klose, Dirk; Jun 2004; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466094; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466094>

In this paper, we describe the design, implementation, and execution of and the results obtained from the SINCE

experiment 1a (SINCEx1a). The goals of this experiment were (a) to test and verify the information exchange among all of the US and German systems connected in the experimentation environment, and (b) to demonstrate and validate with military user participation that the C2 functionality implemented was adequate to support future planned operational experiment, SINCEx1b. SINCEx1a implementation followed, adopted and adapted a code of best practice approach for experimentation. Both adopted features and adapted elements are summarized herein. Clearly, many compromises had to be made considering the limited resources and budget available. Many trade-offs were made in establishing a balance between (a) developing the infrastructure not only for SINCEx1a but for the planned follow-on experiments and (b) developing the SINCEx1a experimental configuration that was finally used in the conduct of the actual experiment.

DTIC

*Command and Control; Experimentation; Spectra*

**20070026399** RAND Corp., Santa Monica, CA USA

**Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation**

Porche, Isaac; Jamison, Lewis; Herbert, Tom; Jun 2004; 80 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466098; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466098>

A C4ISR architecture for future forces is a major concern to the Army. This report describes progress of an on-going project to develop a framework for assessing individual communication technologies and concepts by accounting for technological and operational detail. Assessments of communication performance (e.g., message delay and message completion rate) factor terrain, mobility, and other scenario specific details via high-resolution simulations. For such measurements, excessive run-times can be a problem. This is usually the case for high-resolution simulation of communication networks. However, in this paper, it is shown that high-resolution communication network simulation runs (using Qualnet(copyrighted), although time consuming, can be used to capture the dynamics of communication performance in closed form expressions or meta-models. The meta-models can then be embedded into force-on-force simulation (JANUS) to get perhaps the most important performance measure, e.g., warfighter effectiveness. This forms a framework that supports detailed, scenario specific examination of the impact of C4ISR on warfighter effectiveness.

DTIC

*Architecture (Computers); Combat; Command and Control; High Resolution; Intelligence; Reconnaissance; Simulation; Surveillance*

**20070026422** Department of National Defence, Ottawa, Ontario Canada

**Canadian Network Enabled Operations Initiatives**

Babcock, Sandy; Jun 2004; 51 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466127; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466127>

This paper provides an overview of network enabled operations (NEOps) issues and initiatives within the Department of National Defense/Canadian Forces and how it has or will facilitate transformation. This includes discussion on the results of efforts to decompose NEOps to identify areas of fruitful research and development, and the status of efforts to address such areas. Moreover, this paper seeks to map the impact of NEOps to the department's PRICIE construct (equivalent to the US DOTMLP framework) and discuss concept development and experimentation related to this theory. Moreover, information is provided on departmental efforts in relation to C4ISR developments and their implications for NEOps within the context of the 2002 Exercise Robust Ram and the Pacific Littoral ISR Experiment (PLIX) conducted during the summer of 2003. The paper also describes the planning and expectations for an Atlantic Littoral ISR Experiment (ALIX) during August 2004, which will integrate and exploit multiple sensors in an integrated intelligence, surveillance and reconnaissance architecture (IISRA), including the employment of an uninhabited airborne vehicle (UAV), and concludes with discussion on future intentions in this area.

DTIC

*Canada; Command and Control*

**20070026428** Army Communications Research and Development Command, Fort Monmouth, NJ USA

**Battle Command on the Move**

Morley, Rebecca; Kobsar, Joseph; Jun 2004; 49 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466138; XA-CERDEC/C2/NJ; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466138>

Battle Command on the Move (BCOTM) is a revolutionary capability that provides current and future combined arms commanders all of the information resident in their command posts, and the required communications necessary to command and control their combined arms team on the move, or at a short halt, from any vantage point on the joint battlefield. The purpose of the BCOTM effort was to convert five M-7 Bradley Fire Support Team (BFIST) vehicles into BCOTM systems. Three operator workstations and an extensive Mission Equipment Package (MEP) were integrated into the five BFIST platforms to provide a common operational picture and enable Situational Understanding (SU) while on the move. The integration team consisted of three groups who worked together for 2 months to complete the system from the concept until the final hand off to the 4th Infantry Division (ID), Fort Hood, TX. The program was extremely successful and has led to further advancements in battle command on the move.

DTIC

*Command and Control; Military Vehicles*

**20070026520** Management and Technical Services Inc., Virginia Beach, VA USA

**Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC)**

Street, Thomas T; Williams, Frederick W; Cooper, L S; Holloway, III, Kenneth E; Rininger, Michael; Miller, Charles; Shirley, Bradley; Genovese, Samuel; Showalter, David; Zak, Stephen; Apr 18, 2007; 87 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-C-0332; Proj-61-9134-0-7-5

Report No.(s): AD-A466368; NRL/MR/6180-07-9040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466368>

The object of the Damage Control (DC) Triad program was to develop a Damage Control Communications system, which would be damage tolerant and remain operable in casualty situations where DC communications are vital. The current state of the art in communications technologies (WLAN, enhanced VoIP Power Line Communications, and Sound-Powered Phone implementations) should allow the implementation of the system without a costly R&D program. This report details the communications technologies and their application and testing in a shipboard environment to implement and demonstrate a true uninterrupted and survivable DC Communications system.

DTIC

*Communication Networks; Damage*

**20070026538** Naval War Coll., Newport, RI USA

**Using Wargames for Command and Control Experimentation**

Rubel, Robert C; Jun 2003; 11 pp.; In English

Report No.(s): AD-A466408; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466408>

Wargames are a staple technique of military research, but various inherent characteristics have prevented their use as rigorous analytic tools. Traditional gaming has long employed C2 among players, however, C2 has been generally regarded as a necessary adjunct to generating player moves, not as an element of independent scrutiny or play. Games that explore network-centric warfare necessarily focus precisely on player C2. Beyond their traditional exploratory function, wargames can constitute the basis for valid C2 experimentation. Harnessing wargames for C2 experimentation is possible if we conceptually divide them into two layers: the simulation layer and the command and control layer. Traditional wargames have consisted solely of the simulation layer, whose limitations with respect to experimentation are well documented. By separating out player C2 we have a different situation. C2 in a wargame can be real, not simulated, because it is what players actually do to each other and therefore is subject to valid experimental treatments. Such conceptual separation also allows the C2 experiment to ride on a relatively simple game that can be iterated more easily than traditional wargames. An example of a recent joint Naval War College / Center for Naval Analyses C2 experiment using a wargame is provided.

DTIC

*Command and Control; War Games*



**20070026593** Defence Science and Technology Organisation, Edinburgh, Australia

**Evaluation of Organisational Interoperability in a Network Centric Warfare Environment**

Fewell, Suzanne; Richer, Warren; Clark, Thea; Warne, Leoni; Kingston, Gina; Sep 2004; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466532; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466532>

Recent trends and developments in operations mean that military organizations are increasingly being required to interoperate with a larger number, and wider range, of non-traditional partners. These include military, government and non-government agencies both national and international. At the same time, some military organizations are examining how they might best use the recent advances in information communications technology including the adoption of different approaches to warfare such as network centric warfare (NCW). The Organizational Interoperability Model (OIM) was developed for the evaluation of interoperability at the human-activity or organizational level. The opportunity has been taken to re-examine the model in light of the changes outlined above. In particular, this paper examines the suitability of the OIM for conducting evaluations in this wider context, and introduces a new version of the model. This paper also discusses the analysis of interoperability in individual organizations, starts to identify some potential stand-alone indicators and foreshadows the development of additional models based on the OIM.

DTIC

*Interoperability; Military Operations; Warfare*

**20070026599** Defense Information Systems Agency, Falls Church, VA USA

**C3X: Correlation, Causation and Controlled Experimentation for C2**

Hiniker, Paul J; Sep 2004; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466544; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466544>

This paper examines the key role of controlled experimentation in testing causal hypotheses on the warfighting effectiveness of C2 technologies and procedures. Through the years many hypotheses have been advanced regarding the factors making for effective warfighting. More troops, more firepower, higher speed of maneuver, superior doctrine, better training and superior C4I (Command, Control, Communications and Intelligence) are all factors hypothesized to make for more effective warfighting. Warfighting, itself is adjudged more effective when enemy combat losses appreciably exceed own force losses. How does one go about testing the many hypotheses on the causes of warfighting effectiveness against observational evidence? For example, what difference does it make to warfighting effectiveness if we put in a particular new C2 technology? We don't need to know simply what's the difference between military units with and without the new C2 technology; we need to know what actually happens with the new C2 technology compared with what would have happened without it. We shall prove that controlled experiments provide the only unequivocal tests of such causal hypotheses; otherwise the observed results are open to rival explanation in terms of causation by some of the uncontrolled factors. We introduce causal hypothesis testing with observations on a single group and then move to the method of using simple correlational data for two groups. This forces us to confront the open ended issue of control groups and control variables in testing causal hypotheses which in turn leads us to consider the most conclusive method, controlled experimentation.

DTIC

*Combat; Command and Control; Hypotheses; Planning*

**20070026633** Naval Postgraduate School, Monterey, CA USA

**Operational Trust: A New Look at the Human Requirement in Network Centric Warfare**

Blatt, Nicole; May 21, 2004; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466612; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466612>

Everyone agrees that the new information technology systems affect the way we fight wars. Advocates from the President of the USA to NATO leaders even recognize the information revolution in military affairs (RMA) and prescribe the need for major operational changes. However, the opinions of how the command and control operations should change are often diametrically opposed. Leading civilian authorities in network centric warfare profess a decentralized control system called self-synchronization. Meanwhile, the U.S. military leadership sponsors new technology experiments that often centralize control and increase micromanagement. Could these differences stem from a different assessment of operational trust? An enduring principle for increasing efficiency and effectiveness of command and control has always been centralized command, decentralized execution. In network centric warfare, this can be optimized through an approach called self-synchronization.

However, certain necessary conditions must first be met for self-synchronization to succeed. The authors of the book, *Power To The Edge*, state that these conditions include ‘Trust in the information, subordinates, superiors, peers, and equipment’ Can this condition be met? This paper tackles the requirement to trust in network centric warfare.

DTIC

*Command and Control; Decision Theory; Warfare*

**20070026655** QinetiQ Ltd., Farnborough, UK

**Modular Structures in a Multinational Force Headquarters**

Stewart, K; Christie, M; Sep 2004; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466661; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466661>

When organizations operate in an environment that is dynamic, complex and unpredictable they need to develop more flexible structures if they are to increase their chances of surviving. Organizational complexity increases when the constituent elements involved belong to different nationalities. Advances in information and communication technology (ICT) implemented with the appropriate process and structural changes offer the prospect of improving the flexibility of organizations. It is proposed that future Multinational Force (MNF) military headquarters (HQ) can achieve this flexibility through a modular organizational structure enabled by networked information management and communication technologies. This paper provides a critical examination of the human factors issues that would be involved in the future implementation of a modular structure to a MNF HQ.

DTIC

*Communication Networks; Construction*

**20070026659** Army Research Lab., Adelphi, MD USA

**A Unifying Strategy for Data Integration for Global Force Management (Briefing Charts)**

Chamberlain, Sam; Sprung, George; Sep 2004; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466670; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466670>

No abstract available

*Charts; Communication Networks; Data Integration; Data Management; Systems Integration*

**20070026697** QinetiQ Ltd., Malvern, UK

**From Simple Prescriptive to Complex Descriptive Models: An Example from a Recent Command Decision Experiment**

Dodd, Lorraine; Moffat, Jim; Smith, Jim Q; Mathieson, Graham; Jun 2003; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466751; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466751>

Recent research into command modeling has allowed us to build theoretical utility-based representations of the three layers: physical, information and cognitive (see Figure 1) to give models that transform observable data through interpretive indicators and onto course of action assessment. The key transfer function is driven by (a minimum of) two parameters and the function changes its shape (and influence) as the decision-maker’s context changes (for example, as local decisions become more global in their potential impact) [1]. The paper explores the applicability of the theory using results of a recent BG command decision-making experiment. The experimental results show that splitting factors can be derived from the subjective nature of the situation assessment, and the personality, training experience and history of the decision-maker need to be taken into account. The paper recommends that in order to capture these deeper aspects of the human decision-making process, there is a need to: Define a landscape whose contours are defined by the subjective context; Evaluate costs of moving over the landscape; and Overlay opponents current positions and intents. The landscapes are wholly subjective and will change as the decision-maker’s world changes over time. The example will illustrate these points showing that the move towards complex, less prescriptive C2 models will increase the need for more subjective C2 experimentation. The challenge then is how to capture this deeper representation of human decision making in a way that is useful for quantitative modeling.

DTIC

*Command and Control; Decision Making*

**20070026698** George Mason Univ., Fairfax, VA USA

**Re-Use of Integrated Dictionary Components for C4ISR Architectures**

Ali, Asma T; Jun 2003; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0267

Report No.(s): AD-A466759; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466759>

The C4ISR Architecture Framework Products can be developed using mapping between Structured Analysis products and the Framework products and also based on mapping between Object Orientation and Framework products [Levis and Wagenhals, Bienvenue, Shin and Levis, 2000]. Both of these methodologies for architecture design are adequate to obtain essential and supporting C4ISR products. However, sometimes the architect has to add new capabilities into the existing architecture that contains the products developed using either of the two approaches. If he uses the same approach (either Structured or Object Orientation) to develop the new set of products as was used for the original architecture, then the task of model concordance is not difficult, otherwise it is not easy. This paper discusses the reuse of the components of an Integrated Dictionary developed for the C4ISR products to add new products into the existing architecture. The C4ISR Architecture Framework products are developed using two approaches for a single operational concept, and then the contents of the two integrated dictionaries are compared to find out the similarities and differences.

DTIC

*Command and Control; Dictionaries; Reuse*

**20070026701** Aptima, Inc., Washington , DC USA

**Collaborative Critical Thinking**

Freeman, Jared; Hess, Kathleen P; Jun 2003; 51 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466768; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466768>

Command and Control (C2) organizations must operate decisively and synchronously, and do so in highly uncertain and dynamic settings. Individuals succeed in these settings in part by thinking critically about their assessments and plans. We argue that individual team members collaborate in their application of critical thinking in a process called collaborative critical thinking. We are developing this concept of Collaborative Critical Thinking (CCT) within C2 teams from three research threads concerning 1) individual critical thinking, 2) team process and architecture, and 3) human performance in information age warfare. This paper describes our CCT framework and the tools and training we are developing to improve CCT among team members.

DTIC

*Command and Control; Decision Making*

**20070026709** Dornier-Werke G.m.b.H., Friedrichshafen, Germany

**Command and Control in Peace Support Operations Model PAX - Approaching New Challenges in the Modeling of C2**

Schwarz, Gunther; Sep 2004; 6 pp.; In English

Report No.(s): AD-A466786; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466786>

The issue of Command and Control (C2) is not only of importance if talking about purely military processes and structures. The agent-based model PAX addresses basic concepts for dealing with C2 phenomena on the intra-civilian side and the interaction between the military and the nonmilitary side. PAX focuses on the evolution of aggressiveness and possibilities for de-escalation in Peace Support Operations.

DTIC

*Command and Control; Military Operations; Peacetime*

**20070026733** DSO National Labs., Singapore, Singapore

**Constructible Assessment for Situation Awareness in a Distributed C2 Environment**

Seet, Alfred W; Teh, Cheryl A; Soo, John K; Teo, Leonghwee; Sep 2004; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466920>

A method for assessing situation awareness (SA) in field command and control exercises is described in this paper. This

method is an adaptation of the Situation Awareness Global Assessment Technique (SAGAT) by M. R. Endsley (1995) that takes into account specific constraints for use in a field exercise, such as minimizing the level of intrusiveness. Endsley's model of SA separates SA into three levels: Level 1, perception of elements in the environment within a volume of time and space; Level 2, the comprehension of their meaning and integration of multiple pieces of information; and Level 3, the projection of the elements' future status and ability to forecast future situation dynamics. This constructible assessment for SA (CASA) requires that military subject matter experts observe exercise events, construct specific and relevant questions to probe the situational knowledge of the exercise participants, and decide upon the suitable timings for administration of these questions. CASA was tested in a division-level army C2 exercise. An objective of the exercise was to investigate issues related to distributed command teams using situation awareness as one of the measures. Having applied CASA in this exercise, the strengths and limitations of CASA were identified. To analyze the findings, several methods of computing situation awareness of teams were utilized. It was found that CASA yielded results consistent with expectations stemming from exercise roles and events. Further validation and refinement of CASA would improve its utility and efficacy as a tool to measure objective SA in a field exercise. Twenty-three briefing charts summarize the presentation.

DTIC

*Command and Control; Situational Awareness*

**20070026734** Evidence Based Research, Inc., Vienna, VA USA

**Transforming Coalition Warfare with Network Centric Capabilities**

Admire, John H; Sep 2004; 23 pp.; In English

Report No.(s): AD-A466921; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466921>

The challenges of preserving peace and prosecuting war are historically and inherently complicated. In today's changing international security environment, however, the traditional challenges of yesterday are becoming even more complex. The old challenges are contributing to the emergence of new concepts and new technologies as nations and coalitions transform to confront and resolve the timeless challenges of peace and war. This paper identifies and summarizes various transformation initiatives that today's nations and coalitions are pursuing to meet the demands of tomorrow's strategic environment. The initiatives include such concepts as Network-Centric Warfare (NCW), Effects-Based Operations (EBO), Collaborative Information Environment (CIE), and many others. A central theme throughout is that the often diverse, unpredictable, and asymmetric nature of evolving threats will require conscious and concerted efforts by nations to cooperate and collaborate. New thinking and new technologies are dominating these initiatives. Coalitions and multinational partnerships will become more important than ever to successfully defeat worldwide and full-spectrum threats. Threats that range from transnational actors to ideological terrorist organizations, from renegade states to emerging nationalism, will present new and dangerous challenges to peace and stability. This new era will require new thoughts and new capabilities. The challenges are immense and the threats imminent. Therefore, coalition warfare must transform, as individual nations transform, to attempt to set the pace and control the course of future actions in peace and war. This paper is about coalitions and the evolving concepts and technologies that will contribute to their future effectiveness. Ten briefing charts summarize the presentation.

DTIC

*Command and Control; Military Operations; Warfare*

**20070026801** Naval Sea Systems Command, Washington, DC USA

**Joint and Allied Logistics Opportunities and Tools Supporting 21st Century War Fighter Rapid Decisive Operations**

Flynn, John E; Bryant, Russell E; Jun 2002; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467472>

As the current review of DOD structures, capabilities, and plans are coming to completion and moving into implementation phases, a focus to maintain is the delivery of mission capabilities for the front line war fighters. The mission capabilities packages are supported by the material, and also by the materiel support process, which includes not only the hardware, but more importantly the people, training, maintenance and support, and the doctrine, concepts of operations, tactics, techniques, and procedures for the material. Following an updated discussion on Operational Engineering, this paper expands the authors concept of Operational Engineering, to several applied logistics options and discussions in support of rapid decisive operations. It finishes with an introduction discussion of a Logistics Commander Operational Planning Tool,

which potentially can support and enable generation of rapid decisive operations. This tool could assist Combatant Commanders and their war fighters to operate inside the decision cycle of opponents on the front lines.

DTIC

*Command and Control; Decision Support Systems; Logistics; Warfare*

**20070026808** Naval Research Lab., Washington, DC USA

**C4I Tactical Applications Utilizing Embedded Simulations**

Layman, Gene; Daly, John; Jun 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467508; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467508>

Embedded simulation technologies have matured suitably to allow C4I systems to incorporate simulations within their design. Simulation based mission applications such as a course of action analysis application, or visual representations of complicated operational assessment models, can significantly improve the quality and timeliness of tactical decisions for military operations. Simulation based applications have the ability to process C4I data beyond human cognition, and display it in an intuitive and meaningful way for key tactical decision makers. This paper reports progress on the Navy's Embedded Simulation Infrastructure (ESI) Program implementation and management of embedded models and simulations for C4I systems that are compliant with the Defense Information Infrastructure Common Operating Environment (DII COE). The ESI Program provides a robust set of common reusable DII COE simulation services and object-oriented links between simulations and DII COE services and data bases. The development of two Global Command and Control System (Maritime) Mission Applications utilizing this technology are discussed: the Planning Mission Editor and the Weapons of Mass Destruction Analysis Application.

DTIC

*Command and Control; Embedding; Simulation*

**20070026811** Naval Air Systems Command, Orlando, FL USA

**Performance Measurement for Diagnosing and Debriefing Distributed Command and Control Teams**

Johnston, Joan H; Serfaty, Daniel; Freeman, Jared; Jun 2003; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467513; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467513>

Distributed simulation-based training is a challenging and resource intensive effort that the services must perform on a day-to-day basis--within services, joint service, and in joint coalition forces. Research gains have been made that demonstrate advanced training assessment and diagnosis, however, there remains a need for research and development of automated capabilities for assessing team performance, diagnosing root causes of team failure, and debriefing the results across distributed platforms in exercises. A major thrust of this research needs to be the development of measurement technologies for distributed team training that advances the efficiency and speed of delivery to the war fighter in training. In this paper we draw from the recent research on adaptive team architectures for command and control, team decision-making and training, and examples of team measurement tools to derive assessment requirements that support the instructional processes required for distributed team training debrief and after action review.

DTIC

*Active Control; Command and Control; Distributed Interactive Simulation; Distributed Parameter Systems*

**20070026819** University of South Australia, Mawson Lakes, Australia

**A Cultural Framework for the Interoperability of C2 Systems**

Slay, Jill; Jun 2002; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467586; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467586>

In considering some of the difficulties experienced in coalition operations, it becomes apparent that attention is needed, is in establishing a cultural framework for the interoperability of personnel (the human agents) and the IT/IS infrastructure that they share. This paper extends the argument proposed in previous work (Burke 2000a; Burke 2000b; Slay 2001, Slay & Burke 2001)] that culture is an important system variable within any complex socio-technical system, such as a C2 system. The IFIP-IFAC (1999) Task Force has developed the Generalized Enterprise Reference Framework and Architecture (GERAM). GERAM allows the merger of change process methods from different disciplines and examines both the products of a system and the business processes by which they are produced. However, while recognizing the role of human agents within the

system, the GERAM framework does not cater for any cultural differences within the processes of decision making, monitoring, commanding and controlling or bringing about change. This paper extends the GERAM framework with theoretical anthropological and organizational frameworks discussed in previous work (Slay 2001, Slay & Burke 2001) and creates a specific cultural framework that is applied to the interoperability of C2 systems in coalition operations.

DTIC

*Command and Control; Interoperability*

**20070026828** Defence Research and Development Canada, Toronto, Ontario Canada

**Using the Command and Control Framework to Analyse Command Challenges**

McCann, Carol; Pigeau, Ross; English, Allan; Sep 2002; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467623; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467623>

This paper describes a study addressing the validation of the Pigeau-McCann framework for command and control. The framework is a re-conceptualization of command, control and C2 that is intended to provide a comprehensive and consistent base both for the scientific investigation of C2 and for the development of military C2 policy and doctrine. The validation approach involved the assessment of the explanatory power of the framework in the context of actual situations in which military personnel confronted operational challenges. The results endorse the value of the framework as a tool for categorizing and quantifying aspects of command, of control and of C2. Furthermore, with refinement, the tool could also be used by the military to analyze and understand challenging C2 situations.

DTIC

*Command and Control; Military Personnel*

**20070026831** Bolt, Beranek, and Newman, Inc., Pittsburgh, PA USA

**Managing Responsibility and Information Flow in Dynamic Team Decision-Making**

Hubbard, Paul; Kott, Alexander; Martin, Michael; Sep 2002; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467635; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467635>

We propose a method to allocate decision responsibility and arrange information flow dynamically within a team of decision-makers for command and control. A model of decision making which relates the decision load to decision accuracy is proposed and employed as an atomic building block to create predictive models of team decision making. An optimization problem is then proposed for a given set of forecast decision requirements in which the information flow between the atomic decision-making models is varied so as to maximize an aggregate measure of decision accuracy. A small-scale MATLAB Simulink implementation is presented as well as the outline of current work in which a genetic algorithm is employed to perform the optimization. Preliminary results indicate the technique improves the decision-making performance measure. We conclude with a discussion of implementation issues in a larger C2 context.

DTIC

*Decision Making; Information Flow*

**20070026832** Defense Information Systems Agency, Falls Church, VA USA

**A Model of Command and Control Processes for JWARS: Test Results from Controlled Experiments and Simulation Runs**

Hiniker, Paul J; Sep 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467636; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467636>

The purpose of this paper is to provide a basic model to aid assessment of the effects of changes in C2 on combat outcomes in JWARS. We lay out essential elements of a general Complex Adaptive System (CAS) model of C2 processes, develop measures of C2 performance and combat behavior, and derive some hypotheses on C2 effects on combat outcomes. C2 processes have a multiplicative effect with weaponry on combat outcome; combat decision loop speed and information superiority over the adversary increase combat performance; increased information load on decision makers and narrowed communications channels limit combat performance. Net Centric Warfare practices lift these limits and permit aggregated teams to fight in speedy synchronicity increasing combat performance. These hypotheses are tested against evidence from four

controlled experiments, three military exercises, and hundreds of simulation runs of stochastic combat models.

DTIC

*Combat; Command and Control; Models; Simulation; Warfare*

**20070026833** Defence Science and Technology Organisation, Edgecliff, Australia

**Optimising the Design of Land Force C2 Architectures**

Kirby, Brendan; Yen, Leong; Judd, Greg; Cropley, David; Jun 13, 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467642; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467642>

Two different configurations of the Australian Army Brigade HQ have been investigated using a Systems Engineering simulation tool known as CORE. A Military Appreciation Process (MAP) has been utilized as a common operational planning procedure for both configurations. The two configurations analyzed were a Future Land Force (FLF) where the Brigade HQ is divided into two different locations with separate functions, and the other is a Current Land Force (CLF) structure. The model included the Battlegroup (BG) planning process for both the FLF and CLF architectures. It has been shown that on average, the FLF design achieves the total Brigade-BG planning cycle 30% more quickly than the CLF configuration. This provides more time either to carry out further operational planning (and therefore achieve a higher quality plan within the allotted time), or to accelerate the Brigade commander's OODA loop to move within the enemy commander's decision action cycle.

DTIC

*Command and Control; Military Operations; Organizations; Planning; Warfare*

**20070026834** Naval Academy, Annapolis, MD USA

**Preparing Junior Officers for Roles in FORCEnet & Network Centric Operations**

Tempestilli, Mark; Jun 2003; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467652; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467652>

Forcenet is the integration of sensors, networks, weapons, platforms, information and people to provide agile, lethal, efficient combat power.

DTIC

*Combat; Command and Control; Communication Networks*

**20070026855** Naval Postgraduate School, Monterey, CA USA

**Signal Population in the License-Exempt Wireless-Radio Bands at the MOUT Site**

Vincent, Wilbur R; Adler, Richard W; Parker, Andrew A; Oct 2004; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468180; NPS-EC-05-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468180>

The radio-signal and radio-noise population at the MOUT site was examined in portions of the radio spectrum of interest. Measurements of the ambient signal population were made as well as the increased signal population during the conduct of a training exercise. In addition supplementary measurements of the signal population were obtained at the CIRPAS Hangar location.

DTIC

*Electromagnetic Spectra; Populations; Radio Frequencies*

**20070026865** Air Force Research Lab., Rome, NY USA

**The Outlook Y-JBI: An E-Mail Based Approach to Prototyping the Joint Battlespace Infosphere**

Marmelstein, Robert E; Jun 2001; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468222; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468222>

One approach for rapidly implementing a prototype Joint Battlespace Infosphere (YJBI) publish and subscribe (P&S) system is to leverage the existing e-mail transport infrastructure. E-mail has the advantage of being standardized, pervasive, robust, and scalable. This Y-JBI is implemented though the peer-to-peer interaction of publisher and subscriber agents. These agent pass subscription requests, acknowledgements, and information objects to each other using Extensible Markup

Language (XML) e-mail messages. Under this approach, Microsoft Exchange(Registered) is employed as the enterprise mail server with Microsoft Outlook(Registered) as the primary e-mail application servicing the JBI user. This system enables a direct flow of information from the publisher to subscriber-side fuselets that interface to Microsoft Office(Registered) planning tools.

DTIC

*Electronic Mail; Prototypes*

**20070026871** Unisys Corp., McLean, VA USA

**C4ISR Architectural Frameworks in Coalition Environments**

Myer, Charles R; Oct 2000; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468240; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468240>

The break-up of the Soviet Union unleashed a flood of nationalism throughout Southeastern Europe (SEE). Freed from the yoke of suppression, the nations of the region sought economic stability and security in a dramatically changing global environment. These nations are anxious to display Western leanings and to ensure national security through multinational regional coalitions. These coalitions, in turn, are being supported by a variety of national, NATO, and U.S. sponsored initiatives with the common goal of regional stability. Within the regions of the Pacific Rim, similar coalitions may emerge with similar goals to which the principles set forth in this paper will equally apply. The common thread through these SEE initiatives is the use of Information Technology (IT) to improve Command, Control, and Communications (C3) in a combined military/peace support domain. This paper proposes an IT-driven Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Architectural Framework approach to the integration of combat and peace support forces in regional coalition initiatives. Although the framework is applicable across the total C4ISR domain, only Command, Control, and Communications are relevant to the subject addressed in this paper and will be the term used throughout. Computers are assumed as a logical part of C3. This paper also proposes that this type of architectural approach is applicable to regional coalitions on a global basis.

DTIC

*Command and Control; Military Operations; Security*

**20070027247** Army Research Lab., Aberdeen Proving Ground, MD USA

**A Model for Predicting Intelligibility of Binaurally Perceived Speech**

Scharine, Angeline A; Henry, Paula P; Rao, Mohan D; Dreyer, Jason T; Apr 2007; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466840; ARL-TR-4075; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Predicting and modeling intelligibility of monaurally or binaurally presented speech is difficult because it depends primarily on the accuracy and interdependency of frequency, time, and spatial information arriving at the listener. Despite these complex relationships, a new pragmatic model is suggested for speech mixed with broadband noise. A form of the logistic regression function is used to characterize human performance data. The regression of these signal properties onto empirical speech recognition performance data estimates the relationship of these properties to speech recognition. This concept is illustrated by the modeling of human performance on Central Institute for the Deaf W-22 speech items presented monaurally and binaurally in both reverberant and non-reverberant conditions at different signal-to-noise ratios. Although the implementation of the present model is limited to the data considered, it is expected that other data can be modeled after the procedure outlined in this report. The model described is the first step in developing an objective binaural measure for predicting speech perception in noisy environments.

DTIC

*Intelligibility; Mathematical Models; Speech Recognition*

**20070027251** Army Research Lab., Aberdeen Proving Ground, MD USA

**Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications**

Glumm, Monica M; Kehring, Kathy L; White, Timothy L; Apr 2007; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A466869; ARL-TR-4074; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This laboratory experiment examined the effects of paired sensory cues that indicate the location of targets on target



acquisition performance, the recall of information presented in concurrent visual and auditory communications, and perceived workload. The multimodal cueing techniques assessed in this study were Visual+Spatial Language, Visual+3-D Audio, Visual+Tactile, and Spatial Language+Tactile. A unimodal visual only cue was included as a baseline. Except for reaction times to cues, no significant differences were found between the multimodal cue conditions and the Visual Only mode in primary and secondary task performance or subjective workload. Reaction times were faster in the Visual+3-D Audio and the Visual+Tactile conditions than in modes that included a spatial language cue. Reaction times to the visual+spatial language cue were faster than the spatial language+tactile cue, but no significant differences were found between the Visual+Spatial Language and the Visual Only modes. Adding the 3-D audio cue to the visual cue significantly improved reaction time beyond that of the Visual Only condition, but no significant difference was found between the Visual Only and the Visual+Tactile modes. Reaction times to cues were slower when communications were presented visually, but no interaction was found between communications modality and cue condition on this measure. Communications modality, however, did have a different effect on subjective ratings of effort in the Visual+Tactile mode than in the other cue conditions. In the Visual+Tactile mode, ratings of effort were significantly lower when communications were presented auditorily than when they were presented visually, but communications modality did not appear to affect ratings of effort in the other cue conditions.

DTIC

*Auditory Perception; Auditory Signals; Display Devices; Optical Communication; Position (Location); Sound Transmission; Target Acquisition; Telecommunication; Voice Communication*

**20070027276** Congressional Budget Office, Washington, DC USA

**A CBO Study. The Army's Bandwidth Bottleneck**

Aug 2003; 58 pp.; In English

Report No.(s): AD-A467024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Partial contents: Bandwidth Supply and Demand in Today s Army, Background on the Army's Digitization Initiative, Bandwidth Supply at Army Commands Today, Bandwidth Demand at Army Commands Today, Comparing Bandwidth Supply and Demand in 2003, Operation Iraqi Freedom, Bandwidth Supply and Demand in 2010, Bandwidth Supply at Army Commands in 2010, Bandwidth Demand at Army Commands in 2010, Comparing Bandwidth Supply and Demand in 2010, Mitigating Mismatches Between Bandwidth Supply and Demand, Buy Better Radios in Greater Quantities, Reallocate Currently Planned Spending, Reduce Demand and Better Manage Persisting Mismatches.

DTIC

*Bandwidth; Command and Control; Organizations*

**20070027277** Bolt, Beranek, and Newman, Inc., San Diego, CA USA

**Monitoring the Command and Control Weapon System. A Master Caution Panel for C2 System Monitoring**

Brown, Jr, Martin J; Sep 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper will highlight the Air Force Research Laboratory (AFRL) sponsored research being carried out by a team led by BBN Technologies to develop a Master Caution Panel (MCP) for modern, distributed command and control systems. The primary purpose of MCP is to provide military decision makers with situational awareness of the command and control weapon system. MCP accomplishes this by taking information technology (IT) resource data in the form of IT events and transforming them into operationally significant information. MCP bridges the gap between operational personnel and systems support personnel by providing each group with an independent views of the same set of IT related events. The operator can easily understand the impact of IT resource problems on mission accomplishment and can provide the systems support personnel with clear prioritization concerning where emphasis on fixing problems will have the most impact.

DTIC

*Command and Control; Decision Making; Situational Awareness; Weapon Systems*

**20070027279** Mitre Corp., McLean, VA USA

**Configuration Management Support for Long Haul C2 Circuit Switched Services**

Sligh, Robert; Wong, George; Vest, Sandi; Sep 2002; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To ensure our warfighting edge in information superiority across all joined forces, we must keep pace with technology advancement and build a state of the art network infrastructure that can adapt to changing needs and provide fast and reliable service delivery anytime, and anywhere in the world. This paper addresses the challenges that the Defense Switched Network

(DSN) faces, and offers a Configuration Management (CM) solution that is built upon a common DSN Core CM database with automated support systems to support integration of various Network Management functions.

DTIC

*Circuits; Command and Control; Configuration Management; Switching*

**20070027280** Defence Research and Development Canada, Valcartier, Quebec Canada

**Concept of C4I Data Fusion Command Center for Urban Operations**

Pigeon, Luc; Sep 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Within the last decade, military research on urban operations (UO) have become a critical challenge. Beirut, Mogadishu, and Grozny, are few examples of urban operations that highlight our actual doctrinal and/or material gaps. From a command and control perspective, the proposal for an urban data fusion command center (UDFCC) is already qualified as a key for urban operations success. The UDFCC main objective is to provide a robust understanding of an urban battlefield. This paper presents a summary of urban operations lessons learned in order to define the UDFCC sub-objectives and components. They are associated with the phases of the intelligence cycle: direction, collection, processing and dissemination. They are categorized into four themes: mission planning and rehearsal; synthetic urban battlefield up to date reproduction and formalization; urban battlefield data exploitation; and synthetic urban battlefield visualization.

DTIC

*Command and Control; Military Operations; Multisensor Fusion; Project Management*

**20070027288** Defence Science and Technology Organisation, Canberra, Australia

**Developing and Evolving a Joint Australian Task List**

Kingston, Gina; McCarthy, Anna; Sep 2002; 8 pp.; In English

Report No.(s): AD-A467065; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes the development of the Australian Joint Essential Tasks (AS JETs) list. These tasks were developed to support the planning for, and evaluation of, Joint Exercises. This approach is consistent with that of Australia's allies, who have been operating with such lists for a number of years. The USA's Universal Joint Task List (UJTL) was developed with an emphasis on training. In contrast, the UK and Canada have taken an enterprise-wide approach, capturing all core Defence tasks. While this approach has the benefit of encompassing the activities of the entire organization, it was believed that a more focused task list was required for Australian joint operations. The AS JETs were developed in line with current Australian doctrine, standard operating procedures, and emerging doctrinal concepts. They consist of a three-level hierarchy that is consistent with current command structures and represents the essential activities to be completed when conducting an operation. Also, the AS JETs were developed through close consultation with representatives from all levels of the Australian Defence Force (ADF). To remain consistent with the ADF's standard practice the AS JETs were designed to be a robust list capturing the tasks that need to be done, rather than specifying how to complete the tasks. It is, however, acknowledged that it is possible to change the AS JETs in both an evolutionary and revolutionary manner. This paper looks at two possible changes that may impact on the AS JETs. The concept of the Strategic Corporal suggests that the focus of the tasks may need to change to accommodate the fact that operations by low-level tactical units can have strategic consequences. With Ubiquitous C2 the scope of the AS JETs at an operational level may decrease, or disappear entirely.

DTIC

*Australia; Command and Control; Military Operations*

**20070027337** Naval Postgraduate School, Monterey, CA USA

**A Comparable Market Study of RFID for Manual Item-Level Accountability Inventory and Tracking Systems**

Courtney, Valencia V; Mar 2007; 111 pp.; In English

Report No.(s): AD-A467185; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis focuses on a return on investment (ROI) strategy for radio frequency identification (RFID) item-level tagging of assets by organizations that maintain manual inventory and tracking systems. The basis of strategy exists in leveraging benefits offered in repeated use of automated identify data and capture technology, RFID. The business model used for this thesis focuses on organizations that provide reference material management services (RMMS) (e.g. library reference material, employee privacy information records, laptops, etc) to internal and external customers. Although technology has created a means to digitized reference material, many organizations are required to maintain manual record systems for various reasons. In addition, a digitized capability does not address the issue of accounting for other pilferable items such as laptops, personal

digital assistants, etc. Therefore, evaluating capabilities available in RFID technology could lead to strategic options for eliminating the challenges posed by the lack of item visibility that exist in a manual RMMS business processes. Strategy development will derive from lessons learned in documented RMMS case studies that implemented an RFID solution. This thesis discusses and analyzes companies in private sector industry that have reported positive ROI with tangible benefits by implementing RFID for the purpose of asset control/management.

DTIC

*Inventories; Inventory Controls*

**20070027340** Naval Postgraduate School, Monterey, CA USA

**Mobile Sensor Networks: A Discrete Event Simulation of WMD Threat Detection in Urban Traffic Schemes**

Hyink, Jeffrey F; Mar 2007; 73 pp.; In English

Report No.(s): AD-A467188; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The rise of the threat of WMD attack on American soil necessitates new and innovative approaches to homeland security. A layered security model has been proposed in which an attacker must successfully penetrate multiple defensive constructs in order to complete an attack. As part of a layered defensive approach, a network of sensor equipped vehicles operating in urban traffic is considered. To-date, sensor packages have been developed for vehicles without detailed, area-specific analysis of their aggregate performance measures. The possible effectiveness of this network of sensors in detecting vehicle based WMD attacks is explored in this thesis. A Discrete Event Simulation using actual roadmap data was developed and analyzed to explore various configurations for searcher employment and in particular to generate a potential return on investment curve in the form of probability of detection generated as a function of the number of sensor equipped vehicles. The baseline scenario centers on an attacker utilizing a vehicle mounted WMD device. The attacker attempts a shortest-path route from a randomly selected starting point to a downtown target node. Patrol vehicles are equipped with sensors that can identify potential attacker vehicles in the adjacent lane of oncoming traffic. These vehicles patrol the roadway network, and are assumed to foil an attack when they detect an attack vehicle. The simulation model outputs data such as the proportion of foiled attacks and the distance from target, given a detection.

DTIC

*Communication Networks; Simulation; Urban Transportation*

**20070027346** Library of Congress, Washington, DC USA

**Privacy: An Abbreviated Outline of Federal Statutes Governing Wiretapping and Electronic Eavesdropping**

Stevens, Gina M; Doyle, Charles; May 5, 2006; 6 pp.; In English

Report No.(s): AD-A467198; CRS/DC-98-327; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is a federal crime to intentionally wiretap or electronically eavesdrop on the conversation of another without a court order or the consent of one of the parties to the conversation. Moreover, in eleven states, it is a state crime for anyone other than the police to intentionally wiretap and/or electronically eavesdrop on the conversation of another without the consent of all of the parties to the conversation. The federal crimes are punishable by imprisonment for up to five years and expose offenders to civil liability for damages, attorneys' fees, and possibly punitive damages. State crimes carry similar consequences. Even in states where one party consent interceptions are legal, they may well be contrary to the professional obligations of members of the bar. The proscriptions often include a ban on using or disclosing the fruits of an illegal interception. Statutory exceptions to these general prohibitions permit judicially supervised wiretapping or electronic eavesdropping conducted for law enforcement or foreign intelligence gathering purposes. Similar regimes proscriptions with exceptions for government access under limited circumstances exist for telephone records, e-mail and other forms of electronic communications.

DTIC

*Law (Jurisprudence); Telecommunication*

**20070027349** Naval Postgraduate School, Monterey, CA USA

**Partnerships: The Path to Improving Crisis Communication**

Fitzpatrick, Helen M; Mar 2007; 82 pp.; In English

Report No.(s): AD-A467218; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The global availability of 24-hour broadcast news establishes the media as a critical link to communicating with the public in times of crisis. As a result, the broadcast news media play a significant role in shaping how the public reacts in a crisis. Since fire and police departments will likely be the media's primary source for information in the initial stages of a disaster,

preventing the loss of lives depends on how quickly information is delivered to the public. However, positive working relationships between public safety and the media are often hampered by differences in police and fire culture, distrust and the lack of a clear understanding of each other's roles and responsibilities. The safety messages delivered by public safety officials and the media in an emergency have the power to influence the way the public behaves and the protective actions they take. This report examines how forming nontraditional partnerships between public safety agencies and the media can be used effectively to give direction to the public before, during and after a crisis. This report proposes a set of recommendations to help public safety agencies avoid costly communication mistakes through best practices and lessons learned from recent high profile incidents.

DTIC

*Broadcasting; Emergencies; Management Methods*

**20070027371** Army War Coll., Carlisle Barracks, PA USA

**Army and Air Force Transformation - Are They Synchronized?**

Forster, Richard A; Mar 30, 2007; 23 pp.; In English

Report No.(s): AD-A467300; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The future global security environment will be one of great uncertainty and complexity. USA military forces will be called upon to conduct operations in any number of environments. The ability to operate and succeed in this environment is dependent upon the Services abilities to work effectively as members of joint and coalition teams. The Army and Air Force are working toward that vision of joint forces that provide unrivaled capabilities to the nation's leaders. It is critical that the two Services ensure their transformation processes are linked. Ensuring unity of effort throughout the transformation processes ensures that the Services will be far more effective and have greater combined capabilities for the Combatant Commanders. While both Services are moving toward greater effectiveness in executing assigned roles and missions, there may be disconnects in the two processes that could have strategic impacts. Finally, it is critical that the Services move toward fully joint cultures that enable unity of effort and thus increase the effectiveness of the American military as a whole.

DTIC

*Interoperability; Military Operations*

**20070027395** Naval Postgraduate School, Monterey, CA USA

**A Model for Effective Organization and Communication of Homeland Security Activity at the State Level**

Smith, Johnnie L; Mar 2007; 95 pp.; In English

Report No.(s): AD-A467395; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis is concerned with the optimal state organizational structure to achieve homeland security missions, particular in the state of Wisconsin. It will therefore first review the relevant literature in order to identify a core set of critical homeland security functions germane to states. Four organizational models, as represented by four case states, will be examined to determine which meet those critical functions, to what degree and with what demonstrable success. Wisconsin's current organizational structure for homeland security is evaluated in a gap analysis in that state's capabilities, and finally a set of policy and organizational recommendations are provided for Wisconsin and indeed other states attempting to meet these core critical functions to achieve an effective design for organizing and communicating state homeland security activities within a structure that provides a comprehensive response and a stable and unambiguous communications flow pattern.

DTIC

*Hierarchies; Organizations; Security; Telecommunication*

**20070027409** University of South Australia, Mawson Lakes, Australia

**The Contribution of Command and Control to Unity of Effort**

Sproles, Noel; Sep 2002; 20 pp.; In English

Report No.(s): AD-A467488; No Copyright; Avail.: Defense Technical Information Center (DTIC)

While joint and multi-national operations are not a new phenomenon, achieving unity of effort in their conduct has generally proved elusive. Through much of history, whatever unity that had been achieved was the result of mutual cooperation between the commanders involved. Towards the end of the Great War it was becoming apparent that mutual cooperation alone was not sufficient and that a unified command system was needed. The Western Allies during World War II achieved levels of unified command that have probably not been exceeded since. This paper examines the function that command and control performs, through the medium of command arrangements, in achieving unity of command so as to attain unity of effort. By studying historical examples of joint and multi-national military operations, the importance of command

arrangements as a means to achieving unity of effort will be established. This leads to an approach not only for establishing the effectiveness of command arrangements, but of establishing the effectiveness of the other entities that are embraced by the umbrella term of 'Command and Control.'

DTIC

*Command and Control; Military Operations*

**20070027419** Defense Science Board, Washington, DC USA

**Defense Science Board 2006 Summer Study on Information Management for Net-Centric Operations. Volume 1: Main Report**

Schneider, Jr, William; Apr 2007; 120 pp.; In English

Report No.(s): AD-A467538; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The task force addressed combat operations, information management, information assurance, and architecture requirements, as well as the architecture framework currently being pursued by the department. The task force examined the overall conceptual strategy for the system and the operational value of the proposed information network. Additionally, the task force assessed cost/risk trades and technical network issues such as bandwidth, quality of service, availability, security, integrity for all missions and users, and knowledge management -- all of which support the distribution of knowledge that will ultimately support the missions and users in making effective decisions. These considerations converged on the simple question of how to provide robust, useful information at all levels from decision-makers to tactical users. The task force focused on support of combat operations, as it was felt to be the most stressing application of the system, as opposed to, for example, business processes and administration. However, it was recognized that all these applications are intertwined and must be operated as a whole. The task force did not examine the protection of the nation's total information network. Although critically important, it was deemed outside the scope of this study. To set the context of the study, the task force addressed four operational scenarios: 1. Prevent and protect the USA against catastrophic attack. 2. Conduct large-scale counter-insurgency operations, including stabilization and reconstruction. 3. Conduct global distributed, small-scale operations, including counter-terrorism and humanitarian relief (such as Hurricane Katrina). 4. Enable large-scale operations against near-peer adversaries.

DTIC

*Communication Networks; Information Management; Information Systems; Summer*

**20070027420** Defense Science Board, Washington, DC USA

**Defense Science Board 2006 Summer Study of Information Management for Net-Centric Operations. Volume 2. Operations Panel Report**

McCarthy, Jim; Kellog, Keith; Apr 2007; 81 pp.; In English

Report No.(s): AD-A467543; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report of the operations panel of the Information Management summer study served as the basis for the full summer study report sections that included warfighter assessments of needs and suggested improvements to enhance combat capabilities. The panel examined the operational value enabled by information networks. Particular attention was paid to emerging missions, counterinsurgency, counterterrorism, stabilization and reconstruction, and response to catastrophic disasters. The panel assessed the state of knowledge management for information networks. Additionally the panel focused on information discovery, sharing, collaboration, visualization, and storage for all missions and users. In addition, the elements of a Combat Information Capability (CIC) were developed and described. The panel's principal focus was on warfighter's needs as viewed through the eyes of those who experienced combat operations in both Iraq and Afghanistan. This perspective helped the study members appreciate the value of a CIC both as kludged in today's combat environment and desired for the future.

DTIC

*Communication Networks; Information Management; Information Systems; Summer*

**20070027431** Army Research Lab., Aberdeen Proving Ground, MD USA

**Identifying Battlefield Metrics Through Experimentation**

Heilman, Eric; O'May, Janet; Bodt, Barry; Forester, Joan; Sep 2002; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467562; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Command and Control (C2) is a commander's guidance of his/her forces (command) to accomplish a goal or mission while monitoring the directed movements (control). The U.S. Army Research Laboratory's (ARL) Battlespace Decision

Support Team (BDST) is exploring methods of evaluating the effectiveness of a commander's plan or course of action (COA). Part of our research involves the task of identifying metrics to rate a COA. We have modified the One Semi-Automated Forces (OneSAF) simulation to track direct fire hits and vehicle damage throughout simulated battles. One completed experiment ran a OneSAF scenario over 200 iterations and captured data. BDST will analyze the collected data to determine its utility in measuring COA effectiveness. Future applications of tools and techniques developed through this and other experiments will assist the commander as real-world battles unfold.

DTIC

*Command and Control; Identifying*

**20070027466** Defence Research and Development Canada, Valcartier, Quebec Canada

**Different Approaches for the Creation and Exploitation of 3D Urban Models**

Letourneau, Francois; Sep 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467639; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this new defense era, military urban operations represent an important context of operation for defense agencies. Considering the complexity of urban environments, new tools and capabilities are required into command and control systems to address the complexity of conducting urban operations. Integrating a high fidelity 3D model of an urban scene into command and control systems is certainly of high interest for a better conduction of urban operations. The creation of 3D urban models represents a real challenge, considering that short time for the creation of the models and relative unavailability of detailed geospatial data are both important constraints. As each operations are unique, there is no one-unique-solution that can be applied. This is why RDDC Valcartier investigated different approaches during the last two years in order to define different 3D model creation work flows that apply to a broad range of requirements and situations. This paper is focusing mainly on the results we obtained during our project. Two experiences on the ground helped us to validate the utility of various models for different situations. Finally some technical and operational considerations will be presented for the optimal usage of 3D models within command and control systems.

DTIC

*Cities; Command and Control; Exploitation; Military Operations; Three Dimensional Models; Urban Research*

**20070027475** Defence Science and Technology Organisation, Edgecliff, Australia

**A System Design Archetype for C4ISR Systems of the 21st Century**

Reid, Darryn; Johnson, Wayne; Sep 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467670; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we discuss the difficult issue of how to reliably design and build systems that are fundamentally suited to interoperate with one another. Ideally, all these systems would be constructed using the proposed design principles, but the requirement to interoperate with legacy systems is also recognized. It is not a traditional systems engineering or technology based approach. Rather, a set of key design principles is enumerated. They are, (i) interoperability and system integration, (ii) decoupling of architecture layers, (iii) decoupling of system components. There is also an emphasis placed on a design methodology embodying these design principles, which allows a flexible system design that changes infrequently, and a system implementation that changes constantly. Together with other invariants, these principles are embodied in a highly abstract and widely applicable system design archetype. Populating this archetype further with application frameworks and specifications of components and their behaviors progressively produces more detailed designs. In particular, the archetype identifies core components for storing and conveying arbitrary information between application components, as well as components for managing the dissemination of information around the wide-area network. Using this approach, a system concept demonstrator has been developed that embodies a new approach to building C4ISR support systems, in particular with the aim of addressing the challenges of tactical land environment. This concept demonstrator is an aspect of a broader integrated programme in which advanced technology solutions are developed in conjunction with new tactics, training, procedures, and organizational structures, within particular environmental and operational contexts.

DTIC

*Command and Control; Design Analysis; Interoperability; Systems Engineering*

**20070027507** Naval Postgraduate School, Monterey, CA USA

**Analysis and Classification of Traffic in Wireless Sensor Network**

Beng, Wang W; Mar 2007; 87 pp.; In English

Report No.(s): AD-A467755; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wireless sensor networks have been widely researched for use in both military and commercial applications. They are

especially of interest to the military planners as they can be deployed in hostile environments to collect vital information safely and cheaply. In view of this interest, there is a need to capture and categorize the data effectively under different operational conditions. This thesis captured traffic and data from sensor nodes to analyze and present characteristics of the traffic in a meaningful manner. Specifically, this thesis studied the traffic generated by wireless sensor networks by setting up two different commonly used network topologies, namely a direct connection to the base and a daisy-chain connection to base. A total of six runs of experiments were conducted, three for each topology. The data traffic between the nodes was captured over an extended duration of time. Using the captured information, analysis was performed to categorize and identify the information through anomalies and variations of traffic patterns. Data were also analyzed to study self-similarity and statistical distribution. The experimental results have shown that it is possible to differentiate the two different topologies by monitoring the traffic distribution or by analyzing the types of messages sent. The status of the nodes can also be determined with the traffic collected. Examples include new nodes joining the network and operational status of the nodes. Statistical analysis has also been done and found that wireless sensor network traffic is not self-similar except for the interarrival time of the direct connection mode.

DTIC

*Classifications; Communication Networks; Traffic*

**20070027538** Air Force Research Lab., Rome, NY USA

**The Combined Aerospace Operations Center (CAOC) of the Future**

Phister, Paul; Plonisch, Igor; Humiston, Todd; Jun 2001; 11 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467820; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The 'art of commanding aerospace power lies in integrating systems to produce the exact effects the nation needs.' Currently, information overload prevents C2 warriors from making operational decisions with precision and effect. The objective is to correct this and dominate the battlespace by making smarter decisions faster. Intelligent decision making will be enabled by awareness when and where it is needed, via an operationally superior information enterprise. This paper discusses a new Air Force Research Laboratory's Information Directorate initiative that combines prior work in areas such as Effects Based Operations, information fusion, decision support, mission training and enterprise defense. These efforts lay the groundwork so a Commander will receive the right information at the right time. This information will be displayed in a way to allow the Commander to do the right things, at the right time and in the right way. This paper discusses five applications built on JBI services that will fuse collected information to drive an 'effects based' operational solution along with the research and development efforts required to transform today's AOC into tomorrow's CAOC. Ultimately, the objective being to develop and field a capability using the Command and Control (C2) framework of Monitor, Assess, Plan and Execute.

DTIC

*Aerospace Systems; Command and Control; Decision Support Systems*

**20070027543** Space and Missile Systems Organization, Los Angeles AFB, CA USA

**Global Broadcast Service Security Classification/Declassification Guide (SCG)**

Apr 29, 2007; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467825; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Global Broadcast Service (GBS) is an extension of the Global Information Grid (GIG) that provides worldwide, high capacity, one-way transmission of video, imagery, and other high-bandwidth information, via Transmit Suites (including Theater Injection Points (TIP's)) to Receive Suites, supporting the nation's command centers and joint combat forces in garrison, in transit, and deployed within global combat zones. It employs readily available satellite-based broadcast commercial technologies, which are relatively inexpensive and easily integrated into existing systems and processes. To this end, GBS currently uses broadcast payloads on three Ultra-High Frequency Follow-On (UFO) satellites and leased commercial satellite transponders as required. This SCG provides guidance for uniform security classification, declassification, management and protection of classified information for the Global Broadcast Service (GBS) Program and activities associated with its systems, plans, programs, projects and user information.

DTIC

*Broadcasting; Classifications; Information Transfer; Satellite Communication; Security*

**20070027558** California Univ., Santa Cruz, CA USA

**Channel Hopping Multiple Access with Packet Trains for Ad Hoc Networks**

Tzamaloukas, Asimakis; Garcia-Luna-Aceves, J J; Jan 2000; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-97-2-0338

Report No.(s): AD-A467852; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a new medium-access control protocol for ad hoc networks that does not require carrier sensing or the preassignment of unique codes to nodes to ensure that intended receivers receive unicast, or multicast, or broadcast data packets without interference from hidden sources. We call this new protocol channel hopping access with trains (CHAT). CHAT combines the notion of packet trains with synchronous channel hopping to improve channel utilization. We compare CHAT against two of the most efficient protocols proposed to date based on the preassignment of codes (MACA-CT), or channel hopping with no predefined code assignment (CHMA) via simulations. The results show that CHAT provides considerable improvement in the throughput of an ad hoc network for unicast traffic, broadcast traffic and mixed traffic consisting of both unicast and broadcast transmissions. CHAT is applicable to ad hoc networks based on commercial off-the-shelf spread spectrum radios operating in unlicensed frequency bands.

DTIC

*Multichannel Communication; Multiple Access*

**20070027560** Naval War Coll., Newport, RI USA

**Making the Mix Work: Coalition C2 Interoperability during Recent Operations**

Ballard, John R; Jun 2001; 12 pp.; In English

Report No.(s): AD-A467855; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper analyzes multinational command and control (C2) arrangements since the Second World War with an eye to understanding how such arrangements have been successful. In particular, it considers the development of command relations from developments in the European Theater during the Second World War to modern day crises. Operations DESERT SHIELD/STORM were clearly a watershed. Since 1990 operations in Somalia, and Haiti, and subsequent operations in Southwest Asia and Eastern Europe have taught us much about multinational C2. In some ways we have now rediscovered the tools that worked so well in 1944 and learned to apply them to a wider range of operations and participating nations.

DTIC

*Command and Control; Interoperability; Military Operations*

**20070027572** Army Training and Doctrine Command, Fort Monroe, VA USA

**Command and Control Automation - MIP and MSC2 FOSC**

Bryant, Thomas E; Hartel, Robert; Jun 2001; 15 pp.; In English

Report No.(s): AD-A467878; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Multilateral Interoperability Program's work has been the a great leap forward in the coalition arena just as the Multi-Service Command And Control Flag Officer Steering Committee's work has been instrumental in bringing the Services together to discuss tactical interoperability and work to solve the hard problems. One of the most interesting aspects of these two undertakings has been the method of defining C2 requirements. The service tradition of working Service requirements first, then joint requirements, and finally multinational requirements is a long-standing sequential process that mimics the implementation process. Through these two efforts it is clear that this long practiced sequence is a questionable method for producing true interoperability.

DTIC

*Command and Control; Interoperability*

**20070027616** Naval War Coll., Newport, RI USA

**Finishing Together: Coalition End-State Development Since 1990**

Ballard, John R; Jun 2001; 14 pp.; In English

Report No.(s): AD-A467954; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the end of the Cold War multinational structures have dominated operational level command and control during crisis response. A key factor in the effective execution of these operations was the development of consensus among the national desired end states for each contributing nation. Lessons learned from the attempts to find end state consensus for operations in Haiti, Somalia, Iraq, Bosnia, Kosovo and East Timor can aide significantly in the development of coming C2 arrangements, transition operations, future training opportunities and developing C2 doctrine. This paper also looks at the



strategic interoperability issues and policy dilemmas among different nations participating in recent operations and the methods those nations have used to cope with such C2 challenges. It offers an assessment of the level of consensus attained by multinational force commanders in their search for military end states. Several useful techniques provide a clear foundation for future improvement in this vital arena.

DTIC

*Command and Control; Interoperability*

**20070027633** Mitre Corp., Hampton, VA USA

**Modeling and Simulation Links with Command & Control (C2) Systems: Considerations in Architecture Designs**

Brandt, Kevin; Jun 2001; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467997; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This concept paper explores objectives and requirements and proposes evaluation criteria for architectures linking command and control (C2) systems with modeling and simulation (M&S) systems. It focuses on design requirements for data flows between Joint training models and mission applications or segments within the Defense Information Infrastructure Common Operating Environment (DII COE) including the DII COE Shared Data Environment (SHADE).

DTIC

*Command and Control; Simulation*

**20070027656** Keystone Computer Associates, Inc., Falls Church, VA USA

**Report Out of the C4I Study Group**

Timian, Donald H; Lacetera, Joseph; Wertman, Chris; Hieb, Michael R; Tolk, Andreas; Brandt, Kevin; Jun 2001; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Simulation interfaces to Command, Control, Communications, Computers, Intelligence, Security, and Reconnaissance (C4ISR) systems are essential to support: Simulation Based Acquisition (SBA); the development of Doctrine, Tactics, Techniques, and Procedures (DTTP); Train as you fight; Embedded Training (both individual and collective); Course of Action Development and Analysis; Mission Planning and Rehearsal; and Execution Monitoring. Modeling and Simulation (M&S) systems have standardized on certain protocols and architectures for interoperability, such as the High Level Architecture (HLA). Within the Department of Defense (DoD), the C4ISR community is also moving to standardize on the Joint Technical Architecture (JTA) and the Defense Information Infrastructure Common Operating Environment (DII COE). These interoperability efforts, as well as efforts within the DoD and the international community to standardize message formats and develop common M&S and C4I data models may if the appropriate standards are identified and developed significantly enhance efforts to link M&S and C4ISR systems. However, a robust two-way dialog is required.

DTIC

*Command and Control; Interoperability*

**20070027694** California Univ., Berkeley, CA USA

**Observation Uncertainty in Gaussian Sensor Networks**

Sarwate, Anand D; Jan 23, 2006; 87 pp.; In English

Report No.(s): AD-A468140; UCB/EECS-2006-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The term 'sensor network' encompasses a wide range of engineering systems with dramatically different characteristics. We consider a specific class of sensor networks whose objective is to reconstruct a source at a central terminal. Our objective in this thesis is to quantify the asymptotic error in reconstructing the source as the number of data sources, sensors, and model complexity increases. We consider three types of estimation systems - unconstrained estimators for vector Gaussian sources that are allowed direct access to the sensor observations, estimators for discrete sources that receive information via rate constrained links from the sensors, and estimators for scalar Gaussians whose input is the output of a multiple-access channel. We first establish bounds on the optimal estimator performance of these networks using a centralized estimator with access to all of the sensor observations. We assume the observations are noisy linear functions of the source and are thus specified by a matrix. Because the asymptotic error depends only on the spectral properties of this matrix, we can use tools from matrix analysis to give bounds on the spectrum and error in terms of the entries of the matrix for a number of different scenarios. Finally, we look at the case where the matrix is partially unknown. In some cases we can estimate the matrix directly from the data and in others we must minimize the worst mismatch distortion.

DTIC

*Communication Networks; Detectors*

**20070027710** Army Nuclear and Chemical Agency, Springfield, VA USA

**Digital C4I Interoperability: The EM Protection Issue**

Pfeffer, Robert; Oct 2000; 12 pp.; In English

Report No.(s): AD-A468325; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, a unified protection methodology is applied to a digital mobile C4I platform subjected to several human-generated and nature-generated EM environments and effects. The unclassified values for self-induced electromagnetic interference (EMI), EM radiation (EMR), electrostatic discharge (ESD), near-strike lightning, and high-altitude EM pulse (HEMP) came from MIL-STD-464 and several commercial standards. By applying this methodology the EM protection requirements were estimated to be 70 dB enclosure port protection for frequencies between 100 MHz and 5 GHz, and 80 dB penetration port protection on the phone line for frequencies dependent upon the length of the phone line used. This EM protection strategy is both useful and cost effective to coalition forces, since validation testing and maintenance/surveillance testing to meet international standards reduce to simple, low-cost shield and penetration protection tests that can be conducted anywhere, even with the system operating. The application of this protection approach in the original system circuit design significantly reduces the number of breadboard and brassboard tests. Such protection also allows component replacement within the barrier, once the new component immunity level has been measured.

DTIC

*Command and Control; Computers; Digital Systems; Electromagnetic Interference; Protection*

**20070027746** Army Research Lab., Aberdeen Proving Ground, MD USA

**Bone Conduction: Anatomy, Physiology, and Communication**

Henry, Paula; Letowski, Tomasz R; May 2007; 206 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A468459; ARL-TR-4138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Humans hear through air and bone conduction pathways. Both pathways can be used to transmit sound to a listener and from a talker although traditionally, the air conduction pathway has been used. Communication through bone conduction is a feasible alternative to air conduction reception and transmission and provides benefits to the user that an air conduction system cannot provide. This report combines results of an extensive literature review of the anatomy and physiology of human hearing, theories behind the mechanisms of bone conduction transmission, devices for use in bone conduction transmission, and the use of the bone conduction pathway for communication. Bone conduction for the transmission of communication is effective and feasible for Soldiers because it provides a means of providing radio communication in combination with hearing protection devices.

DTIC

*Anatomy; Bones; Telecommunication*

**20070027750** Naval Postgraduate School, Monterey, CA USA

**The Mitigation of Radio Noise from External Sources at Receiving Sites**

Vincent, Wilbur R; Munsch, George F; Adler, Richard W; Parker, Andrew A; May 2007; 128 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468464; NPS-EC-07-002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Procedures to locate radio-noise source, identify source hardware, and mitigate noise problems are provided where the sources are external to a receiving site. In addition, procedures to assess the impact of man-made radio noise on signal reception are included. These procedures were developed over three decades of radio-noise investigations at more than 45 radio-receiving sites.

DTIC

*Electromagnetic Noise; Radio Receivers*

**20070027754** Rand Arroyo Center, Santa Monica, CA USA

**Hurricane Katrina: Lessons for Army Planning and Operations**

Davis, Lynn E; Rough, Jill; Cecchine, Gary; Gereben Schaefer, Agnes; Zeman, Laurinda L; Jan 2007; 104 pp.; In English

Contract(s)/Grant(s): W74V8H-06-C-0001

Report No.(s): AD-A468479; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hurricane Katrina was a catastrophic domestic emergency that, in its deaths and destruction, had many of the possible characteristics of future terrorist attacks, especially those that could occur simultaneously in different parts of the USA or

involve the use of weapons of mass destruction. It thus provides a case study that helps further our understanding of the problems that can arise during the nation's response to such an event. Such a case study will also help to determine how the USA might better prepare to respond to future catastrophic domestic emergencies. The efforts undertaken by civilian and military organizations in response to Hurricane Katrina were historically unprecedented. But, as the many 'lessons-learned' reports generated to date have documented, the response was tragically inadequate. Having researched what happened, the authors focused their analysis on the problems that affected the outcome of the response to Hurricane Katrina in a major way. The single most important problem was the speed with which the nation's local, state, and federal civilian organizations were overwhelmed. However, problems also were evident with the military response in the critical first few days of the disaster, problems that contributed to delays in evacuation and in accomplishing search and rescue operations throughout the storm-ravaged areas of Louisiana and Mississippi. The lessons-learned reports focus on the time it took for both the National Guard and active land forces to arrive in the region. Another problem in the military's response to Hurricane Katrina highlighted in the reports is the lack of a unified command and control (C2) structure, specifically the separation of the command structures for operations involving both National Guard and active-duty forces. The authors present recommendations for improving the Army's response to future catastrophic domestic emergencies.

DTIC

*Armed Forces (United States); Command and Control; Disasters; Hurricanes; Military Operations; Military Personnel; Responses*

**20070027769** Army Research Lab., Aberdeen Proving Ground, MD USA

**The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies**

Scribner, David R; Wiley, Patrick H; Jun 2007; 28 pp.; In English

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A468507; ARL-TR-4139; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Virtual environments are being used more frequently by researchers to collect human performance data before and in lieu of costly field experiments. The McKenna Military Operations in Urban Terrain (MOUT) site at Fort Benning, Georgia, is used for training and experimentation with Soldiers using new equipment and tactics. A low-cost reusable virtual representation of the McKenna MOUT site was built with the use of a popular first-person shooter PC game, Tom Clancy's Rainbow Six 3: Raven Shield, which focuses on small unit tactics in complex urban environments. The focus of this report is the process of building a new, cost-efficient, high-fidelity custom environment complete with accurate representations of buildings, terrain, vegetation, and combinations of enemy units and objectives to model real training situations.

DTIC

*Cities; Command and Control; Intelligence; Military Operations; Reconnaissance; Surveillance; Telecommunication; Terrain; Virtual Reality*

**20070027805** California Univ., Los Angeles, CA USA

**Time Synchronization in Wireless Sensor Networks**

Elson, Jeremy E; Jan 2003; 203 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DABT63-99-1-0011; F33615-01-C-1906

Report No.(s): AD-A468557; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent advances in miniaturization and low-cost, low-power design have led to active research in large-scale networks of small, wireless, low-power sensors and actuators. Time synchronization is a critical piece of infrastructure in any distributed system, but wireless sensor networks make particularly extensive use of synchronized time. Almost any form of sensor data fusion or coordinated actuation requires synchronized physical time for reasoning about events in the physical world. However, while the clock accuracy and precision requirements are often stricter in sensor networks than in traditional distributed systems, energy and channel constraints limit the resources available to meet these goals.

DTIC

*Communication Networks; Time Synchronization; Wireless Communication*

**20070028436** Naval Postgraduate School, Monterey, CA USA

**Network Aware Tactical Collaborative Environments**

Bordetsky, Alex; Hutchins, Susan G; Bourakov, Eugene; Kemple, William G; Sep 2004; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466748; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466748>

The implications of using mobile wireless communications are significant for emerging peer-to-peer (P2P) collaborative environments. From a networking perspective, the use of wireless technologies to support collaboration may impact bandwidth and spectrum utilization. This paper explores these network effects and describes an agent-based solution for providing feedback to system users regarding wireless P2P network behavior on the performance of collaboration support applications. We refer to this operational feedback as 'network awareness.' The underlying premise is that providing feedback on the status of the network will enable users to self-organize their behavior to maintain quality of data sharing. Results achieved during experiments conducted at the Naval Postgraduate School demonstrate significant effects of network behavior on application sharing performance and integration with client-server applications. A solution for improving network aware P2P collaboration, identified during the experiment, is discussed.

DTIC

*Communication Networks; Wireless Communication*

**20070028442** Solipsys Corp., Laurel, MD USA

**Network Centric Warfare for Coalition Integrated Defense Against Terrorism**

Firkin, Eric C; McMahon, Margaret M; Sep 2004; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466526; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466526>

The tragic events of 9-11, terrorist actions in Russia and the Philippines, along with cancellations of several international civilian air flights, have brought the world closer in forming an alliance pitting industrialized nations against less technically advanced, but extremely dedicated, international terrorists. The ability to operate as independent nations in this fight against loosely defined organizations requires a tightly netted collaboration of military and inter-governmental organizations working as a single entity, while maintaining some level of national independence. Through the use of a demonstrated Network-Centric Warfare (NCW) solution, called Tactical Component Network (TCN), countries exchange information among designated mission-centric groups with the distribution of data and its fidelity determined by the data's owner. TCN can use a local environment for small real-time operations or a global hub network that will integrate coalition partners in a shared network of sensors and intelligence information. TCN allows individual nations stove-piped systems to share data, common pictures, and intelligence information for any region of interest. The TCN architecture has successfully been demonstrated by the USA military in a variety of stressing applications. To facilitate the detection and neutralization of terrorists, this same infrastructure can support multi-national applications.

DTIC

*Communication Networks; Security; Terrorism; Warfare*

**20070028477** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Space Surveillance and Early Warning Radars: Buried Treasure for the Information Grid**

Satterthwaite, Charles P; Jun 2000; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468199; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468199>

A major emphasis of the modern Air Force is to drastically improve the capability of the Global Information Grid, also called the Global Grid. It is believed that the realization of this capability will greatly enhance the Dynamic Aerospace Command's desire to be able to be Globally Aware, be able to Globally Engage its forces, and also be able to make Dynamic Decisions. The expectation of the Global Grid is that it will be able to provide accurate, secure, and timely information to our commanders anywhere, anytime, and in their specific information application requirement. A strong emphasis has been placed on the new technologies needed to achieve this capability. Many of the Defense Advanced Research Project Agency's (DARPA) new research priorities have been focused at improving interoperability, information assurance, information accessibility, and new space based information platforms to accommodate the evolving Global Grid. There is a resource for the Global Grid that should not be forgotten. That is the Nation's investment in Space Surveillance and Early Warning Ground

Based Radar Systems. These systems were originally built to keep a constant watch for the real threat of nuclear missile attack throughout the world. The strong requirements for these systems provided an enormous capability to monitor air and deep space activities.

DTIC

*Early Warning Systems*

**20070028506** Space and Naval Warfare Systems Center, San Diego, CA USA

**Quality of Service Behavioral Model From Event Trace Analysis**

Drummond, John; Berzins, Valdis; Kemple, William; Mikhail, Auguston; Chaki, Nabendu; Sep 2002; 17 pp.; In English Report No.(s): AD-A467762; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The distributed command and control environment includes limited computer resources and numerous mission critical applications competing for these scarce resources. Additionally the stringent constraints and considerable complexity of distributed command & control systems can create a condition that places extreme demands upon the allocated resources and invites a potential for program errors. Consistent quality of service distribution can be a critical element in ensuring effective overall program completion while avoiding potential errors and process failures. The potential for errors and process failures can be understood and addressed by performing a practical analysis of the resource deployment procedures utilized within this environment. However, analyzing resource-based quality of service within a distributed command and control environment is a demanding endeavor. This difficult task can be simplified by directly examining specific quality of service actions that take place during program execution. Therefore, to pragmatically isolate these actions and develop a practical quality of service behavioral model, the research discussed in this paper has implemented an event trace approach to examine the exact quality of service execution path during program operation.

DTIC

*Command and Control; Vents*

**20070028509** Veridian, Brooks AFB, TX USA

**Investigation of Complex Command, Control and Communications Decisionmaking under Sustained Operations**

Elliott, Linda R; Barnes, Christopher; Brown, Leroy; Fischer, Joe; Miller, James C; Dalrymple, Mathieu; Whitmore, Jeff; Cardenas, Rebecca; Sep 2002; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467659; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we describe plans and initial progress in baseline investigations of fatigue on team performance in complex and operationally relevant task environments. Preliminary data collection used a PC-based analogue of command and control simulations. The platform was developed based on cognitive and functional analysis of C3 mission, tactics, team member roles, and role interdependencies. Tactical scenarios were developed to capture core team coordination, decision-making and problem-solving task demands. Issues regarding measures and scenario development are identified and discussed. Preliminary findings, indicating increased resistance to fatigue effects over time, are presented. Lessons learned are noted, along with plans for subsequent research.

DTIC

*Command and Control; Decision Making*

**20070028530** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Critiquing: A Methodology to Extract C2 Expertise**

Miller, Janet E; Jun 2003; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467484; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467484>

The higher a military person goes in the ranks, the sooner the transfer, meaning the commanders who make the highest level decisions have been in a particular assignment the shortest amount of time. To acquire and maintain the maximum level of efficiency and productivity as quickly as possible, the expertise of commanders must be understood so that appropriate decision support can be developed. Cognitive task analysis methods, including knowledge elicitation, can be applied to uncover the information about how a domain practitioner works. Such information on practitioner behavior provides valuable insight and data for incorporation into models used for training and development of automated support. However, knowledge elicitation methods face a number of challenges such as grounding in context, limited accessibility to experts and tasks, being labor intensive and time consuming, and difficulties with repeatability. In this study, a critiquing methodology was investigated in its ability to address these challenges. This baseline study involved a novice intelligence analyst performing a basic analysis

task. Then, six experts with various backgrounds critiqued the novice's process. The results suggest that the critiquing method addresses the challenges of knowledge elicitation methods and can be applied to understanding command and control.

DTIC

*Command and Control; Decision Making; Extraction*

**20070028533** Naval Postgraduate School, Monterey, CA USA

**A Computer Tool for Modeling C4I Applications**

Guan, Luqi; Guan, Jennifer Z; Jun 2003; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 40473-MA-SP

Report No.(s): AD-A467483; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467483>

The large-scale nature of C4I applications makes it difficult to formulate accessible requirements before putting lots of effort into development. Rapid modeling/prototyping has been proved to be efficient for requirement validation and verification by providing a mini scale software product. The latest updated software modeling/prototyping tool is an advanced tool for software prototyping and modeling via a unified graphical environment. To support complex requirement specification and elicitation, this tool is designed as a user centered modeling environment that represents requirements in multiple levels, supports project management, reduces modeling/prototyping effort, maintains model consistency and helps error prevention and elimination. This tool is demonstrated to be useful for modeling C4I applications.

DTIC

*Command and Control; Computers; Software Development Tools*

**20070028562** Government Accountability Office, Washington, DC, USA

**Information Security: Federal Deposit Insurance Corporation Needs to Sustain Progress Improving Its Program**

May 2007; 37 pp.; In English

Report No.(s): PB2007-108780; GAO-07-351; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Federal Deposit Insurance Corporation (FDIC) has a demanding responsibility enforcing banking laws, regulating financial institutions, and protecting depositors. As part of its audit of the calendar year 2006 financial statements, GAO assessed (1) the progress FDIC has made in correcting or mitigating information security weaknesses previously reported and (2) the effectiveness of FDIC's system integrity controls to protect the confidentiality and availability of its financial information and information systems. To do this, GAO examined pertinent security policies, procedures, and relevant reports. In addition, GAO conducted tests and observations of controls in operation.

NTIS

*Insurance (Contracts); Computer Information Security; Finance; Law (Jurisprudence)*

**20070028587** Little (Arthur D.), Inc., Washington, DC, USA

**Pager Phones: Installation**

Apr. 1975; 15 pp.; In English

Contract(s)/Grant(s): SO144082

Report No.(s): PB2007-108769; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The pager phones used in many underground coal mines are battery operated, party-line telephones with provisions for loudspeaker paging. The system is two-wire, non-polarized, and is operated by self-contained batteries. Many of the individual units are certified as permissible. Requirements for installation are specified in state and federal regulations, such as in the Code of Federal Regulations, Title 30, Mineral Resources, Part 75. The major federal regulations that affect communication in coal mines are noted below, with a brief description of the subject matter in each of the relevant paragraphs. Refer to the cited paragraphs of Title 30 for explicit details of these regulations. (This brief description is for reference purposes only.) (1) Minimum Requirements: (paragraphs 75.1600, 75.17 13-2, and 75.1003-1) Approved telephone or two-way communication will be provided between the surface and each main shaft landing and each working section; to the nearest medical assistance; and shall be protected from contact with trolley wires or trolley feeder wires. (2) Installation Requirements (paragraphs 75.5 16-2, 75.52 1, and 77.508-1 ) Communication wires will be supported on insulated hangers, attached to messenger cables, or buried, to protect against mechanical damage; installed opposite trolley wires; and insulated near power conductors... each cable will have lightning arresters within 100 feet of going below ground... and arresters will be provided wherever telephone wires enter a building. (3) Wire and Cable Requirements (paragraphs 75.5 16-2, 75.5 17, and 75.52 1) Communication cable means two or more insulated conductors, covered by an additional abrasion-resistant covering; power wires and cables shall

be adequately insulated and fully protected; and lightning arresters shall be connected to low-resistance grounds, more than 25 feet from neutral grounds. Arthur I3 Little Inc This technical bulletin is based on: the requirements of Title 30; installation practice recommended by equipment manufacturers; the experience of repair personnel; industrial telephone communication experience; and Rural Electrification Authority (REA) practices. A description of the many telephones available is included in the bulletin Introduction; the types of wire and cable to be used in these installations are described in the bulletin Cable Selection; and proper care and procedures for connecting and splicing the interconnecting cable are described in the bulletin Splices and Connections. The following text includes excerpts from those bulletins, to supplement the installation recommendations. Detailed information on each subject should be obtained from the individual technical bulletins.

NTIS

*Installing; Mining; Telephones; Industries*

**20070028589** Little (Arthur D.), Inc., Washington, DC, USA

**Pager Phones: Circuit Protection**

Jan. 1975; 9 pp.; In English

Contract(s)/Grant(s): SO144082

Report No.(s): PB2007-108768; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Wires leading to or from underground facilities can develop hazardous voltages because of lightning exposure. The locations of many mine portals are particularly susceptible to lightning effects. The application of protective devices to limit this potential danger is necessary. Requirement: The Code of Federal Regulations, Title 30, Mineral Resources, Part 75, paragraph 75.52 1 identifies the requirement for lightning arrestors to be used on ungrounded, exposed power conductors and telephone wires. 'Each ungrounded, exposed power conductor and telephone wire that leads underground shall be equipped with suitable lightning arrestors of approved type within 100 feet of the point where the circuit enters the mine.' For telephone circuits, a wide range of protective devices are available. The public service telephone companies and Rural Electrification Authority have considerable experience with the problem. The current recommendation by these organizations for such installations is to use gas-tube protectors, operating with a well-designed and constructed grounding circuit. Although pager phones are d-c systems, with signals in the audio range, many installations have coupled RF (Radio Frequency) signals on the same cable that is used for the pager system. The telephones themselves are constructed with isolating circuits, so as not to disturb RF transmission. Lightning arrestors and protective circuits must also provide this same isolation and circuit integrity for the RF signals. Capacitive protective elements cannot be used for lightning protection of such circuits, as they would short out the RF signals. Lightning strokes, either cloud-to-cloud or cloud-to-ground, release tremendous energy. The voltage associated with cloud-to-earth lightning strokes is about 5 to 20 million Volts, but the danger is in the large amounts of energy developed by the fields induced in exterior cabling. Arrestor Connection: In early telephone installations, carbon blocks of 3 mil (0.003 inch) carbon were used as a protective breakdown device for phone circuits, but in the past ten years gas-tube devices have become more acceptable. When sufficient energy is developed between two circuits, such as a telephone line and ground reference, the protective device ionizes and provides a low-impedance path to ground, thus Arthur I3 Little, Inc keeping the hazardous voltage from reaching the remainder of the system.

NTIS

*Circuit Protection; Lightning; Mining; Telephones*

**20070028591** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA

**Technology Review of Smart Sensors with Wireless Networks for Applications in Hazardous Work Environments**

Sammarco, J. J.; Paddock, R.; Fries, E. F.; Karra, V. K.; Apr. 2007; 59 pp.; In English

Report No.(s): PB2007-108766; NIOSH-2007-114; NIOSH-IC-9496; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Workers in hazardous environments such as mining are constantly exposed to the health and safety hazards of dynamic and unpredictable conditions. One approach to enable them to manage these hazards is to provide them with situational awareness: real-time data (environmental, physiological, and physical location data) obtained from wireless, wearable, smart sensor technologies deployed at the work area. The scope of this approach is limited to managing the hazards of the immediate work area for prevention purposes; it does not include technologies needed after a disaster. Three critical technologies emerge and converge to support this technical approach: smart-wearable sensors, wireless sensor networks, and low-power embedded computing. The major focus of this report is on smart sensors and wireless sensor networks. Wireless networks form the infrastructure to support the realization of situational awareness; therefore, there is a significant focus on wireless networks. Lastly, the 'Future Research' section pulls together the three critical technologies by proposing applications that are relevant to mining. The applications are injured miner (person-down) detection; a wireless, wearable remote viewer; and an ultrawide

band smart environment that enables localization and tracking of humans and resources. The smart environment could provide location data, physiological data, and communications (video, photos, graphical images, audio, and text messages).

NTIS

*Health; Mining; Safety*

**20070028594** Aptima, Inc., Woburn, MA USA

**A Systematic Approach to Optimize Organizations Operating in Uncertain Environments: Design Methodology and Applications**

Levchuk, Yuri N; Levchuk, Georgiy M; Pattipati, Krishna R; Sep 2002; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0101

Report No.(s): AD-A467668; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467668>

This paper presents a comprehensive methodology for solving diverse problems arising in performance optimization of organizations operating in uncertain environments. We introduce a technique to decompose a multi-dimensional organizational design problem into a series of coupled sub-problems whose iterative solution produces a near-optimal organizational structure, and decision processes. We illustrate our approach via an example to provide a step-by-step visualization of the modeling of complex and uncertain missions, and of synthesizing the concomitant organizations to optimize different sets of design objectives, while satisfying organizational constraints. Our methodology incorporates algorithms for optimizing the expected outcomes, collaborative organizational strategies, distributed resource utilization, mission processing schedule, and information management in an organization. The methodology serves as a valuable tool to address many practical problems arising in organizational design.

DTIC

*Organizations; Optimization; Methodology; Models*

**20070028595** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Inhibiting Adaptation**

Carley, Kathleen M; Jun 2002; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-97-1-0037

Report No.(s): AD-A467573; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467573>

It is widely believed that whether we are talking about command and control teams, joint task forces or coalition forces, the 'organization' must be adaptive. Unanticipated changes in mission, rapidly evolving technologies, intelligent and changing opponents, and so forth have created a need to create forces that can respond rapidly, accurately and can readily adapt to new situations. Over the past decade, progress has been made in understanding the set of factors that enable adaptation. If the opposing force can be made less adaptive, more predictable, more consistent then it will be easier to contain or constrain their activity. Consequently, it may be important to mitigate the adaptivity of the opposing force in order to minimize the need for both adaptability and high performance. Thus, we turn the question on its head and ask, 'How can we inhibit adaptation?' This paper reviews the findings on what makes organization's adaptive and provides suggestions for how to inhibit adaptation. A number of lessons learned about how to inhibit adaptiveness are presented.

DTIC

*Command and Control; Adaptation*

**20070028614** NATO Supreme Allied Command Transformation, Norfolk, VA USA

**'COM as Shooter' Operational Planning using C2 for Confronting and Collaborating**

Baan, Andy; Jun 2003; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466725; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466725>

No abstract available

*Decision Making; Operational Problems; Planning*



**20070028673** Transportoekonomisk Inst., Oslo, Norway

**How the Car Affects the Activity patterns of Children and Youth**

Hjorthol, R. J.; January 2006; 36 pp.; In Norwegian

Report No.(s): PB2007-109950; TOI-834/2006; Copyright; Avail.: National Technical Information Service (NTIS)

The following questions are raised in this essay: Are we socialising our children to be car users. What are the characteristics that make the car 'the natural tool' in organising everyday activities for children and parents. What impact does it have on children and their parents that we no longer walk, but are being driven around. Now, that almost everyone owns a car, can the car still be a cult object for young people. New communication technology interacts with car use. What impact does the interaction between the mobile telephone and the car have on the activity patterns of children and young people, and what are the trends.

NTIS

*Automobiles; Children; Lenses; Youth*

**20070028690** Department of the Air Force, Washington, DC USA

**USAF Command Doctrine of Centralized Control with Decentralized Execution: Never Divide the Fleet**

Baltrusaitis, Daniel; Sep 2004; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466500>

These briefing charts discuss the topics of how technology and doctrine are often at odds with one another. Those whose doctrine adapts to emerging technology often have order of magnitude advantage militarily. USAF C2 doctrine appears stagnant. Centralized control and decentralized execution of air and space power are critical to effective employment of air and space power. Indeed, they are the fundamental organizing principles for air and space power, having been proven over decades of experience as the most effective and efficient means of employing air and space power.

DTIC

*Command and Control; Military Technology*

**20070028700** Defence Science Technology Lab., Portsmouth West, UK

**Metrics for Command in an NEC Era: Operational Analysis of Way of Command in the Era of Network Enabled Capability**

Montgomery, John; Sep 2004; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466660; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466660>

This paper considers the need for methods and metrics for analyzing the Command-related factors involved in delivering military operational benefits through better exploitation of information. It does this by considering where Command fits within the UK Network Enabled Capability (NEC) concept and where NEC impacts upon the Way (or style) of Command. There are a number of interdependent aspects of Command which have been discussed in various treatments of network-enabled military capability. This paper considers the key characteristics of, and relationships between, these factors and proposes a causal map which brings them together. The Command-related factors which have been considered are: decentralization, organizational culture, the impact of digitization and agility. Metrics and analysis methods have been identified to support analysis of the various entities and relationships which make up the 'Way of Command' causal map. The result is an analysis framework which can support methodical consideration of Way of Command in the era of NEC and which highlights a number of fundamental issues for study. This provides a starting point for an experimental campaign which weaves Command issues into the medium and long-term NEC roadmap.

DTIC

*Communication Networks; Information Transfer; Military Technology*

**20070028755** Space and Naval Warfare Systems Command, San Diego, CA USA

**A Model of Tactical Battle Rhythm**

Duffy, LorRaine; Bordetsky, Alex; Bach, Eric; Blazeovich, Ryan; Oros, Carl; Jun 2004; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466128; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466128>

The purpose of battle rhythm management is the maintenance of synchronized activity and process among distributed

warfighters. It is most critical in rapidly evolving situations or in highly distributed operations. Successful battle rhythm implies the synergism of procedures, processes, technologies, individual activities and collective actions at warfighter, staff level, command node, and unit levels in order to facilitate military operations. The concept is ubiquitous in daily military operations (particularly at the operational level of command), but little exists to define it at the tactical level or substantiate its existence in the experimental or analytical literature. There is a need to establish a common referent, a model of tactical battle rhythm, in order to discover the methods best suited to command and control it. If the battlefield has turned electronic, then so too must our methods for synchronizing the actions of thousands of warfighters. We propose that the judicious employment of collaborative technologies among distributed warfighters is one strategy for managing tactical battle rhythm. We assert that the increasing reliance on collaborative technologies will lead to successful management of tactical battle rhythm. However, we need a way to model the tactical battle rhythm in order to predict the most effective times to use collaborative tools. We propose a conceptual framework of tactical battle rhythm (TBR) and present a model of real world TBR in the context of a notional humanitarian assistance operation. The focus of our model is at the battalion/squadron/ combat/service support group level, in an attempt to explore the execution phase of warfighter activities, the activities that define the tactical level.

DTIC

*Warfare; Military Operations; Command and Control; Combat; Support Systems*

**20070028769** Evidence Based Research, Inc., Vienna, VA USA

**Analysis of Metrics Utilized in U.S. Joint Experimentation of Future C2 Concepts**

Wheatley, Gary; Sep 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467665; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Joint Forces Command has been charged to lead the transformation of the U.S. Armed Forces through development and experimentation of new command and control concepts. In particular the Knowledge-C2 Working Group of the Concepts Division has focused on four related concepts: Adaptive Joint Command and Control (AJC2) Common Relevant Operational Picture (CROP), and the Collaborative Information Environment (CIE) Joint Interactive Planning (JIP) Multinational Operations (MNOPS) This paper discusses these Knowledge-C2 concepts and related experiments in the U.S. JFCOM experimental campaign. It then reports on the Unified Vision 2001 Experiment (UV01) results showing how the HEAT metrics were used to develop analyses baselines and quantitative results. Finally it discusses the future of the experimental campaign and events.

DTIC

*Command and Control; Econometrics; Military Operations; United States*

**20070028788** Space and Naval Warfare Systems Command, San Diego, CA USA

**Framework for Information Age Assessment Metrics**

Augustine, Thomas H; Broyles, James W; Jun 2004; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466046>

This paper presents the insights of John Zachman, the father of Enterprise Architecture, as they have been applied to the development and assessment of C4ISR systems. All technologies that are relevant at the enterprise level are fundamentally rooted in the six primitive interrogatories and therefore can be evaluated by some or all of these metrics. Specifically this paper discusses an Information Age Framework for Assessment Metrics and relates its elements to the fundamental facets of a C4ISR enterprise architecture. In a spiral development process design and assessment are adjacent phases and both profit from this powerful intellectual construct. Both the strengths and weaknesses of a particular technology can be the stimulus for a successful integration that provides the capabilities that will satisfy the needs and goals of the users.

DTIC

*Project Management; Information Systems*

**20070028789** Space and Naval Warfare Systems Command, San Diego, CA USA

**Information Age Architectures Must Be Enterprise Architecture**

Augustine, Thomas H; Jun 2004; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466045; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466045>

C2 will continue to be plagued by projects that overrun budgets, dissatisfy users, return poor performance, or result in

project termination until a critical mass of acquisition professionals understand what John Zachman calls Enterprise Physics. From his investigation of how other professions build complex things he was able to generalize the interaction of all these people into a simple schema. The people fit into a few common roles (planner, owner, designer, builder, and subcontractor). The columns are based on the six primitive interrogatories (who, what, when, where, why, and how). The framework is a powerful mechanism for resolving conflicts during project conception because each cell (role, interrogative pair) is unique. Uniqueness is very important precondition to successful requirements definition and requirements management. Uniqueness allows changes to be made without introducing conflicts that would otherwise arise from the same data variable's data value appearing in multiple locations and possibly holding multiple conflicting values. Uniqueness also allows efficient consistency checks which aid developing a complete set of requirements. These are fundamental relationships between the essential elements of an enterprise and the different organizational roles that are responsible for them. These relationships are not sufficient to guarantee success but if violated the chance for success is dramatically reduced. This paper what characterizes an Information Age architecture and why that architecture must be consistent with John Zachman's Enterprise Architecture Framework.

DTIC

*Project Management; Cost Analysis; Group Dynamics*

**20070028796** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft, Netherlands

**Development of a Battlefield Management System: How to Use the User**

Vertegaal, Merel; Jun 2001; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467956; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Royal Netherlands Army (RNLA) is currently developing a demonstrator Battlefield Management System (BMS), which will support soldiers by displaying and distributing the available C2 information. Throughout the entire development of the BMS, the future military users play a very important role. There is frequent contact between users and developers and new versions of the BMS are presented to and evaluated by users every few months. The development consists of several cycles, while users are involved in nearly every step in each cycle. This leads to commitment of the user, because he notices that his comments are taken seriously and are usually implemented in the next version of the BMS. This user-centered approach has worked very well so far for both developers and military users. Several evaluations, in different settings and environments, have been conducted over the past two and a half years. This paper describes two of them in more detail, and also covers the user-centered approach that was taken in the development of the BMS. The paper explains the approach that was chosen by the RNLA, and discusses the advantages of this approach, as opposed to situations where users are not involved in the development of C2 systems.

DTIC

*Command and Control; Management Planning*

**20070028800** Applied Futures, Inc., Arlington, VA USA

**NDIA FORCEnet Study - Overview of the Human Element Group's Findings: Implications for C2 and other Aspects of NCW**

MacNulty, Christine A; Poirier, John A; Jun 2003; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467326; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467326>

The National Defense Industrial Association, in a study sponsored by the Deputy Chief of Naval Operations for War fighting Requirements & Programs and the Commanding General of the Marine Corps Combat Development Command, spent a year investigating the critical technical, programmatic, organizational, and acquisition aspects of FORCEnet in order to develop a road map. One of the five study groups was focused on the Human Element. This paper provides an overview of that subgroup's findings covering everything from recruitment, selection, education, training and development of future warriors to changing ways of developing and assessing operational concepts, changing business processes and organizational structures, systems design and experimentation. This paper discusses the transformational aspects of FORCEnet and its contribution to Sea Power 21's enabling concepts, especially Sea Warrior, Sea Trial and Sea Enterprise, all from the Human Element perspective. Three key themes resulted from this investigation: 1. Equip the man, don't man the equipment 2. Humans decide, machines calculate, 3. We are moving from the human-in-the-loop to the human-as-the-loop.

DTIC

*Military Operations; Systems Engineering; Combat*

**20070028802** Office of Naval Research, Arlington, VA USA

**Network-Centric Applications and Tactical Networks**

Krout, Timothy; Durbano, Steven; Shearer, Ruth; Jun 2003; 48 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467317; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467317>

The focus of the paper is required interaction of Command and Control (C2) applications and the tactical network on which they effectively operate. Command and control applications will always require communications capabilities. There are numerous examples of command and control applications that have been developed without adequate attention to the realities of tactical networks. The results of various tests and experimental efforts where tactical networks were characterized in operationally realistic environments are provided within the discussion. Connectivity, latency, and throughput related data is presented to make a case that tactical communications cannot now, and will never likely, achieve wired communications capabilities. In fact, these environments perform significantly below the levels achievable on a wired network. As such, C2 applications must accommodate the anticipated performance characteristics associated with tactical networks in order to meet the required C2 capabilities, current and emerging, of the war fighters. Since these applications are dependant on the tactical communications, the development process must address the integration of these applications into the total operational architecture. Integration implies not only the sharing of common resources but also the resolution of compatibility issues, such as those discussed in this paper. Integration is not easily or inexpensively achieved after the fact, therefore must be addressed early in the application design process. Performance characteristics for the networks tested in the referenced efforts are provided as extrapolations to the anticipated tactical networks of the future. The relevant C2 test bed configurations are also discussed enabling C2 application development in wired environments, while simulating reasonable tactical network connectivity.

DTIC

*Communication Networks; Warfare; Test Stands*

**20070028804** Science Applications International Corp., Arlington, VA USA

**'How Much is a Pound of C4ISR Worth?' An Assessment methodology to Evolve Network Centric Measures and Metrics for Application to FORCENet**

Poirier, John A; Bates, Edgar; Tempestilli, Mark; Jun 2003; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467289; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467289>

This paper offers a foundation for an assessment framework involving C4ISR processes in FORCENet. It collects and expands upon work done by a number of organizations engaged in efforts to structure a process that links traditional and evolved C4ISR attributes, measures, and metrics to network centric outcomes including work being done in support of the Office of Force Transformation and the office of the Assistant Secretary of Defense for Networks, and Information Integration (ASD (NI2)). Using a capabilities based approach to analysis, metrics are recommended and developed to measure organizational performance. Performance improvements such as increased responsiveness and efficiency are measured in the context of Situation Awareness (SA), in a form consistent with the framework of a Capability Maturity Model. This paper offers five levels of Shared Situational Awareness that can provide the basis for assessing an organization in a specific domain relevant to FORCENet. These resources are intended to guide an organization in implementing a series of increasingly sophisticated practices and activities that can have a significant impact on individual, team, unit, and organizational performance.

DTIC

*Navy; Organizations; Human Performance; Decision Making*

**20070028808** QinetiQ Ltd., Kent, UK

**Methodology for Rapid Development of C2 Planning Systems**

Kelsey, Sheena; Snell, Simon; Jun 2003; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466925; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466925>

This paper proposes a methodology for rapid development of computer systems that offers benefits for the rapid and accurate elicitation and definition of user and system requirements. It also aids user acceptance and can reduce procurement time scales. The development of a successful planning system depends on a user-developer link where final user requirements can be developed through an adaptive process of learning and evolution. The methodology QinetiQ have developed is based on iterative and interactive 2 way links between User and System, User and Designer and between System and Designer. This

middle-out approach relies on the quick delivery of an initial system to which users can respond and thus clarify what they really need. This is known as rapid prototyping or Rapid Application Development (RAD). The refined method called Parallel Rapid Application Development has been developed in response to Urgent Operational Requirements (UOR). This involves designing and building an initial system using the methods detailed above but in a very short and concentrated time scale. This system is then fielded and further requirements are developed in response to information from the field. The system is updated and a new version sent to fielded system via secure email.

DTIC

*Command and Control; User Requirements; Rapid Prototyping; Computer Systems Design*

**20070028809** Naval Postgraduate School, Monterey, CA USA

#### **Evolution of C4I Systems**

Harn, M; Berzins, V; Kemple, W; Luqi,; Jun 1999; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 7DNAVYR010; 38690

Report No.(s): AD-A467887; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper formalizes evolution of C4I systems via a relational hypergraph model with primary- input- driven and secondary-input-driven dependencies. The evolution of C4I system is modeled by a multidimensional architecture containing successive software evolution steps and related software evolution components. We analyze a domain-specific software development architecture and give a standard software evolution process in developing a prototype system as well as a production software system. This model is applied in several real-time prototyping systems especially for Command and Control applications.

DTIC

*Command and Control; Computer Programming; Systems Engineering*

**20070028814** Military Academy, Brno, Czech Republic

#### **The Synergic Integrated Concepts of C2S**

Lukas, Ludek; Tomecek, Petr; Hruza, Petr; Sep 2004; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466868; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466868>

One of the features determining the strength of troops is command and control. The quality of command and control is determined by the quality of the command and control systems (C2S). To improve a C2S, it is necessary to define its basic concept a synergic integrated concept of C2S. The synergic integrated concept (SIC) of C2S defines its basic idea, rules and principles. By its employment we considerably improve C2S functionality. The synergic integrated concept is defined for a certain part or layer of C2S. To apply this SIC we improve the functions and order of this part, we improve its systemisation level. The C2 information support is improved as well. The basic synergic integrated concepts of C2S are battlefield digitalization and Network Centric Warfare.

DTIC

*Analog to Digital Converters; Quality Control; Command and Control*

**20070028853** Research and Technology Organization, Neuilly-sur-Seine, France

#### **Advanced Radar Signal and Data Processing**

September 2006; In English; Lecture Series presentation, 23-24 Jun. 2005, Lisbon, Portugal; See also 20070028854 - 20070028862

Report No.(s): RTO-EN-SET-086; AC/323(SET-086)TP/54; Copyright; Avail.: CASI: **C01**, CD-ROM

Radar is an important sensor characterized by day/night all-weather operation capability. A key-feature of radar is the ability of reconnaissance, surveillance of a wide area with target acquisition (RSTA). In addition it offers the potential of moving target detection via Doppler discrimination, and target classification via imaging (SAR or ISAR) or polarimetric and other techniques. New developments on radar technology has improved the performance on several fields, e.g. on electronic countermeasures (ECM). This terrain has been addressed with adaptive processing, low sidelobe antennas, and mainlobe cancellation techniques. The increasing capabilities of coherent, programmable sources, digital signal processing, and computing have allowed implementation of hardware and algorithms for improving the overall performance. Low frequency foliage penetration (FOPEN) systems take advantage of programmable sources to reduce interference to other electronic equipment in the VHF and UHF bands. Advanced signal processing and capable computers are key in FOPEN SAR, UWB target detection and recognition, bistatic systems for counter-stealth, and STAP for MTI in moving radar platforms. Advances

in target recognition remain key for reduction of fratricide. This improvement has been provided by increased microwave and digital-processing components.

Author

*Data Processing; Radar Detection; Target Recognition; Algorithms*

**20070028854** Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany

**Very High Resolution SAR and Multichannel SAR/MTI**

Berens, Patrick; Advanced Radar Signal and Data Processing; September 2006, pp. 8-1 - 8-14; In English; See also [20070028853](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

SAR is widely used today in earth observation and is a potential means for military surveillance. However, systems only operating in the basic SAR mode will be superseded by new developments which fulfill much more user demands. Highest resolution in flight direction combined with a far range operation cannot be reached in stripmap mode. The spotlight mode has to be implemented demanding for special capabilities of the hardware and the data processing chain. To achieve a fine resolution in range direction, transmit signals with very large bandwidth have to be used. Technological imitations force the developers to implement new strategies to acquire the necessary bandwidth. Multichannel SAR systems offer great advantages compared to the conventional ones. Depending on the antenna configuration such systems allow to measure the height of image pixels or to detect moving objects in the illuminated scene.

Author

*High Resolution; Antenna Design; Surveillance; Bandwidth; Data Processing*

**20070028855** Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

**Advanced Target Tracking Techniques**

Koch, Wolfgang; Advanced Radar Signal and Data Processing; September 2006, pp. 2-1 - 2-34; In English; See also [20070028853](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In many engineering applications, including surveillance, guidance, or navigation, single stand-alone sensors or sensor networks are used for collecting information on time varying quantities of interest, such as kinematical characteristics and measured attributes of moving or stationary objects of interest (e.g. maneuvering air targets, ground moving vehicles, or stationary movers such as a rotating antennas). More strictly speaking, in these applications the state vectors of stochastically moving objects are to be estimated from a series of sensor data sets, also called scans or data frames. The individual measurements are produced by the sensors at discrete instants of time, being referred to as scan or frame time, target revisit time, or data innovation time. These output data (sensor reports, observations, returns, hits, plots) typically result from complex estimation procedures themselves characterizing particular waveform parameters of the received sensor signals (signal processing). In case of moving point-source objects or small extended objects, i.e. typical radar targets, often relatively simple statistical models can be derived from basic physical laws describing their temporal behavior and thus defining the underlying dynamical system. In addition, appropriate sensor models are available or can be constructed, which characterize the statistical properties of the produced sensor data sufficiently correct. As an introduction to target tracking and data fusion applications characteristic problems occurring in typical radar applications are presented; key ideas relevant for their solution are discussed.

Author

*Radar Targets; Tracking (Position); Statistical Distributions; State Vectors; Navigation; Surveillance; Multisensor Fusion*

**20070028856** Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany

**Introduction to Synthetic Aperture Radar (SAR)**

Berens, Patrick; Advanced Radar Signal and Data Processing; September 2006, pp. 3-1 - 3-14; In English; See also [20070028853](#); Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The synthetic aperture radar principle has been discovered in the early 50th. Since then, a rapid development took place all over the world and a couple of air- and space-borne systems are operational today. Progress made in technology and digital signal processing lead to very flexible systems useful for military and civilian applications. Radar has proved to be valuable before, because of its day-and-night capability and the possibility to penetrate clouds and rain. Optical instruments however

had great advantages in the interpretation of depicted objects. The great wavelength of radar signals limits the achievable resolution in cross range direction of real aperture radar systems. Thus, imaging cannot be realized using static radar systems. The idea of SAR was to transmit pulses and store the scene echoes along a synthetic aperture (i.e. the path of the SAR sensor) and to combine the echoes afterwards by the application of an appropriate focussing algorithm. The combination is carried out coherently. As we will see, it is quite easy to understand the basic idea of SAR. We will show also the hardware concept of a SAR system and give an idea for a processing algorithm.

Author

*Synthetic Aperture Radar; Imaging Techniques; Signal Processing; Optical Equipment; Digital Systems*

**20070028857** Norwegian Defence Research Establishment, Kjeller, Norway

### **Bi- and Multistatic Radar**

Johnsen, Terje; Olsen, Karl Erik; Advanced Radar Signal and Data Processing; September 2006, pp. 4-1 - 4-34; In English; See also [20070028853](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Bi- and multistatic radar are expected to benefit from their separation of transmitter and receiver that denies receiver recognition by ARM, favours covered operation by their silent receivers, has higher detection possibilities of stealthy objects and is less vulnerable to jamming. The requirements of synchronisation in a separated transmitter-receiver system are discussed. The processing in bistatic radar must include the knowledge of geometry dependencies that exist for bistatic radar in range, Doppler and S/N ratio. Different track profiles relative to bistatic radar orientation and their range-Doppler relationships are presented together with examples from the processing in different types of bi- and multistatic radar. The extraction of target parameters, such as position, velocity and heading could require the combination of data as a function of time and/or contribution from several systems. A discussion of tracking in bi- and multistatic radar is included to the end that uses simulated input to estimate parameters with comparison of different methods of estimating measurement uncertainty and the use of bistatic or multistatic radar input data.

Author

*Multistatic Radar; Radar Data; Tracking Radar; Radar Range; Transmitter Receivers*

**20070028858** Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany

### **Fundamentals of Signal Processing for Phased Array Radar**

Nickel, Ulrich; Advanced Radar Signal and Data Processing; September 2006, pp. 1-1 - 1-22; In English; See also [20070028853](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This section gives a short survey of the principles and the terminology of phased array radar. Beamforming, radar detection and parameter estimation are described. The concept of subarrays and monopulse estimation with arbitrary subarrays is developed. As a preparation to adaptive beam forming, which is treated in several other sections, the topic of pattern shaping by deterministic weighting is presented in more detail.

Author

*Phased Arrays; Radar Detection; Signal Processing; Beamforming; Parameter Identification*

**20070028859** Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany

### **Principles of Adaptive Array Processing**

Nickel, Ulrich; Advanced Radar Signal and Data Processing; September 2006, pp. 5-1 - 5-20; In English; See also [20070028853](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this lecture we present the principles of adaptive beamforming, the problem of estimating the adaptive weights and several associated practical problems, like preserving low sidelobe patterns, using subarrays and GSLC configurations. We explain the detection problem with adaptive arrays and the methods for angle estimation. Finally the methods for resolution enhancement (super-resolution methods) are presented.

Author

*Antenna Arrays; Adaptation; Beamforming; Sidelobes*

**20070028860** Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany

**Space-Time Adaptive Processing: Fundamentals**

Buerger, Wolfram; Advanced Radar Signal and Data Processing; September 2006, pp. 6-1 - 6-14; In English; See also [20070028853](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this lecture, we present the principles of space-time adaptive processing (STAP) for radar, applied to moving target indication. We discuss the properties of optimum STAP, as well as problems associated with estimating the adaptive weights not encountered with spatial-only processing (i.e. beamforming).

Author

*Space-Time Adaptive Processing; Moving Target Indicators; Radar Beams; Radar Detection*

**20070028861** Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

**Tracking and Data Fusion Applications**

Koch, Wolfgang; Advanced Radar Signal and Data Processing; September 2006, pp. 9-1 - 9-36; In English; See also [20070028853](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In many engineering applications, including surveillance, guidance, or navigation, single stand-alone sensors or sensor networks are used for collecting information on time varying quantities of interest, such as kinematical characteristics and measured attributes of moving or stationary objects of interest (e.g. maneuvering air targets, ground moving vehicles, or stationary movers such as a rotating antennas). More strictly speaking, in these applications the state vectors of stochastically moving objects are to be estimated from a series of sensor data sets, also called scans or data frames. The individual measurements are produced by the sensors at discrete instants of time, being referred to as scan or frame time, target revisit time, or data innovation time. These output data (sensor reports, observations, returns, hits, plots) typically result from complex estimation procedures themselves characterizing particular waveform parameters of the received sensor signals (signal processing). In case of moving point-source objects or small extended objects, i.e. typical radar targets, often relatively simple statistical models can be derived from basic physical laws describing their temporal behavior and thus defining the underlying dynamical system. In addition, appropriate sensor models are available or can be constructed, which characterize the statistical properties of the produced sensor data sufficiently correct. As an introduction to target tracking and data fusion applications characteristic problems occurring in typical radar applications are presented; key ideas relevant for their solution are discussed.

Author

*Tracking (Position); Surveillance; Navigation; Multisensor Fusion; Radar Targets*

**20070028862** Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany

**Space-Time Adaptive Processing: Algorithms**

Buerger, Wolfram; Advanced Radar Signal and Data Processing; September 2006, pp. 7-1 - 7-12; In English; See also [20070028853](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this lecture, we present some suboptimum STAP algorithms for radar, applied to moving target indication. In addition, we show some MTI results obtained with the multi-channel airborne experimental radar AER-II of FGAN-FHR.

Author

*Algorithms; Space-Time Adaptive Processing; Radar Targets; Airborne Radar*

**20070029220** Lawrence Livermore National Lab., Livermore, CA USA

**Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA)**

Mendez, A. J.; Hernandez, V. J.; Gagliardi, R. M.; Bennett, C. V.; Jan. 03, 2007; 8 pp.; In English  
Report No.(s): DE2007-902287; UCRL-CONF-227043; No Copyright; Avail.: National Technical Information Service (NTIS)

M-ary pulse position modulation (M-ary PPM) is an alternative to on-off-keying (OOK) that transmits multiple bits as a single symbol occupying a frame of M slots. PPM does not require thresholding as in OOK signaling, instead performing a comparison test among all slots in a frame to make the slot decision. Combining PPM with optical code division multiple



access (PPM/O-CDMA) adds the benefit of supporting multiple concurrent, asynchronous bursty PPM users. While the advantages of PPM/O-CDMA are well known, implementing a receiver that performs the comparison test can be difficult. This paper describes the design of a novel array receiver for M-ary PPM/O-CDMA ( $M = 4$ ) where the received signal is mapped onto an xy-plane whose quadrants define the PPM slot decision by means of an associated control law. The receiver does not require buffering or nonlinear operations. In this paper we describe a planar lightwave circuit (PLCs) implementation of the receiver. We give detailed numerical simulations that test the concept and investigate the effects of multi-access interference (MAI) and optical beat interference (OBI) on the slot decisions. These simulations provide guidelines for subsequent experimental measurements that will be described.

NTIS

*Code Division Multiple Access; Optical Communication; Pulse Position Modulation; Quadrants; Receivers*

**20070029406** Texas Univ., Austin, TX, USA

**Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary**

Chiu, Y. C.; Haas, C.; Logman, H.; Chiu, M. N.; Sunkara, A.; Oct. 2003; 4 pp.; In English

Report No.(s): PB2007-110186; CTR-0-4449-S; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The researchers accomplished the following research activities during the 2003-2004 research period: (1) Documented the state-of-the-practice and past experience in deploying wireless communication system configurations, identified deficiency of current practice, and surveyed commonly encountered issues in technology acquisition by TxDOT engineers. Surveyed traffic operation applications involving wireless communication technologies include ITS applications, highway surveillance and traffic monitoring, portable traffic management systems, rural work zone management, etc. Engineers also expressed the need for an institutional effort to establish a knowledge management system that helps accumulate and share information, as well as advances in technological expertise. (2) Surveyed prevalent and emerging wireline and wireless technologies and investigated future impacts of wireless technology to traffic operation and ITS applications. The reviewed technologies include 802.11, 802.16, General Radio Packet Service, Multi-Code Direct Sequence Spectrum, Wide-Band Orthogonal Frequency Division Multiplexing, Multi-Hopping Technology, etc. The survey also included national service providers and regional service providers in Texas. Vendors and contractors who expressed interest in providing services to TxDOT were also interviewed and are listed. (3) Developed a life-cycle cost-and-risk analysis approach to characterize available communication technology choices and configurations, and analyze how they can be applied to various traffic operations applications. A particular methodology was developed to assist in the choosing cost-effective and minimal-risk communication technologies and configurations given the operational requirements and decision objectives. (4) Designed and implemented a web-based knowledge management system (WBKMS) not only to compile and document all the research findings, but also to facilitate the formation, accumulation, and advancement of institutional knowledge in wireless technologies among TxDOT engineers.

NTIS

*Communicating; Cost Effectiveness; Surveillance; Telecommunication; Traffic*

**20070029412** Texas Univ., Austin, TX, USA

**Impacts of Traveler Information on Transportation Network Operations and Potential Deployment Technologies**

Persad, K.; Walton, C. M.; Wang, Z.; May 2006; 75 pp.; In English

Report No.(s): PB2007-110172; CTR-5079-P2; No Copyright; Avail.: National Technical Information Service (NTIS)

This research product provides in-depth analysis of the impact of traveler information on commuters route choices in the toll road context. The details of a case study of the Austin, Texas, metropolitan area are presented, showing impacts on the non-tolled network as well as on proposed toll roads. Technologies for deploying traveler information systems are outlined, along with system design and scoping issues.

NTIS

*Deployment; Roads; Routes; Transportation Networks*

**20070029463** Texas Univ., Austin, TX, USA

**Electronic Vehicle Identification: Industry Standards, Performance, and Privacy Issues**

Persad, K.; Walton, C. M.; Hussain, S.; Jan. 2007; 42 pp.; In English

Report No.(s): PB2007-110231; REPT-0-5217-P2; No Copyright; Avail.: National Technical Information Service (NTIS)

In this research product, industry standards for dedicated short range communications (DSRC) are reviewed, followed by an evaluation of costs and performance. Privacy concerns regarding collection and use of data on vehicle movements are examined in the context of existing and potential legislation, and issues in electronic vehicle registration are introduced.

Ultimately, this research project will develop recommendations for vehicle identification/registration systems with the potential to link the tolling function to other transportation system management functions.

NTIS

*Data Acquisition; Industries; Privacy*

**20070029475** deAngeli (Michael), Jamestown, RI, USA

**Method for Constructing Antennas from Textile Fabrics and Components**

Deaett, M. A., Inventor; Weedon, W. H., Inventor; 28 Mar. 05; 10 pp.; In English

Contract(s)/Grant(s): DAAH01-02-C-R128; DMH01-03-C-R200

Patent Info.: Filed 28 Mar. 05; US-Patent-Appl-SN-11-090 598

Report No.(s): PB2007-108624; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Antennas are fabricated using fabric substrates, and, in some embodiments, known stitching techniques to fabricate the conductive members required, including connecting wiring and radiating and/or receiving elements. In one embodiment, one or more 'patch antennas', that is, planar radiating and/or receiving elements, are connected to transmitting and/or receiving electronics by means of a connector and feed line structure. The antenna structure comprises multiple layers of fabric, some of which may contain patch antenna and/or feedline patterns made of conductive fabric, made by embroidery using conductive thread or yarn, or onto which patch antennas may be bonded. A ground plane layer may be fabricated similarly. Between the fabric layers containing the conductive patterns, there are one or more layers of insulating fabrics that separate the conductive fabric layers by a dielectric layer. Additional sheets of adhesive between the fabric layers may be used to attach the fabric layers. Alternatively, stitching of insulating thread can be used to attach the multiple fabric layers together. Conductive thread may be used where a connection is desired, that is, the microwave antenna may include a 'via' (an interlayer electrical connection) of conductive thread sewn through insulating fabric layers to connect one or more conductive components, typically of conductive fabric. The antenna may be flexible, so as to be used on clothing and the like, or may be impregnated with a curable resin, for forming a rigid structure for incorporation into a larger structure.

NTIS

*Fabrication; Fabrics; Textiles; Patch Antennas*

**20070029481** Swedish Defence Research Establishment, Linköping, Sweden

**Pilot Study: Parasitic and Passive Radar**

Ulander, L. M.; Andersson, B.; Bjoerklund, S.; Follo, P.; Froelind, P. O.; Sep. 2006; 52 pp.; In Swedish

Report No.(s): PB2007-106493; FOI-R-2015-SE; No Copyright; Avail.: National Technical Information Service (NTIS)

The report describes principles and potential applications of PPR (parasitic and passive radar) PPR is a passive technology which-in contrast to traditional radar-is based on using non-cooperative transmitters (e.g. radar-, TV-, or radio transmitters) as illuminators, wideband receivers, and advanced signal processing methods in order to extract target information. PPR may be combined with electronic support measures (ESM) in an integrated passive sensor system. ESM would contribute several critical functions such as detection, classification and positioning of transmitters. Advantages of PPR include generating all-weather target maps without revealing its presence, without needing a transmission license, and with a lower cost per unit. Disadvantages are that the technology is more complex than traditional radar and uncertainties regarding the availability of suitable transmitters. Important potential applications of PPR include air surveillance for anti-aircraft units, sea surveillance for submarines and surface vessels, and ground situation picture for army units. Civilian applications are also possible (e.g. traffic monitoring and covert police surveillance). Examples of suitable transmitters are given in the report and important research questions are identified, e.g. suppression of the direct path signal, positioning of transmitters, and clutter suppression using PPR in combination with SAR ('synthetic aperture radar') and GMTI ('ground moving target indication'). There are only a few operational PPR-systems today and the technology is often classified. A literature search has been performed which indicates that PPR-related research has increased during recent years.

NTIS

*Radar; Aerial Reconnaissance; Air Traffic Control; Radio Transmitters; Technologies*

**20070029513** TRADOC Analysis Command, Fort Leavenworth, KS USA

**US/UK Sensor-To-Shooter Multinational C4 Interoperability Study Force-On-Force Effectiveness Methodology**

Bailey, Timothy J; Oct 2000; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468602; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468602>

This paper documents the simulation-based methodology currently being used by the US Army TRADOC Analysis Center

(TRAC) to measure the effects on overall combat effectiveness of command and control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) systems and architectures and their interoperability among joint and multinational forces. This methodology has been successfully applied to Army, joint, and multinational studies. The latest of these studies, the US/UK Sensor-To-Shooter Multinational C4 Interoperability Study Force-On-Force Analysis, was an effort to measure the value (in terms of force-on-force combat effectiveness) of enhancing the interoperability between US and UK forces. This paper presents the results of this US/UK study, as a case study, to illustrate the capabilities of this methodology. The overall objective of the US/UK study was to develop a multinational US/UK system and operational architecture that applies to fixed-wing (FW) and call-for-fire (CFF) precision engagements and to decisive maneuver operations. The purpose of the TRAC portion of the study was to provide a force-on-force analysis to the US Joint Staff, so they could make multinational interoperability recommendations to the US Joint Requirements Oversight Council and the UK Ministry of Defense. This paper focuses on the operational-level, force-on-force analysis of the alternative US/UK interoperability architectures for the FW/CFF portion of the study.

DTIC

*Combat; Command and Control; Computers; Interoperability*

**20070029551** Firstmark Technologies Ltd., Ottawa, Ontario Canada

**A Conceptual Operational Model for Command and Control of International Missions in the Canadian Forces**

Cochran, Larry; Wheaton, Kendall; Sep 2002; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468699; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468699>

Defence Research and Development Canada-Valcartier has sponsored the development of a Conceptual Operational Model of the strategic planning process within the Canadian Forces Joint Staff. This model is intended to convey an understanding of the processes within the headquarters for planning and monitoring international missions. As such, it captures the command and control processes at the strategic level of the Department of National Defence. The objective was to construct an IDEF process model. An IDEF model is, however, a rather abstract representation and is not easily interpreted by itself. Therefore, the process adopted was to apply the information from surveying the Joint Staff in constructing three different views that contribute to the construction of an IDEF model. The first step was a simple context model that shows a single process (Plan development) and the primary interfaces with that process. The context diagram was supplemented with an activity diagram that breaks the process down into discrete activities and allocates those activities to the organizational elements. The third view constructed was a hierarchical view of the activities that provides a structured and more detailed breakdown of the activities. The three views of the planning process provide most of the information, in an easily understood form, that can be applied to the construction of an IDEF model. The model describes the process activities, objects, and attributes necessary to enable an evaluation of the headquarters process. The model enables the identification of target organizational cells for which new tools may be offered to improve the effectiveness of specific activities, such as mission planning, or to improve the quality of the products of those activities. The Conceptual Operational Model is the first step in the development of new support tools specifically in the domain of situation awareness and strategic planning.

DTIC

*Canada; Command and Control; Military Operations; Models; Planning*

**20070029565** National Defense Univ., Norfolk, VA USA

**Foreign Policy Effects on Strategic Communications and the Ability to Influence**

Roth, Robert M; May 17, 2007; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468761; JFSC-25789; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468761>

This paper provides an analytical analysis of how the USA Government conducted strategic communications from post World War II until the end of the Cold War with the former Soviet Union. In the post Cold War environment, the paper continues to analyze how the U.S. Government conducted strategic communications into the 21st Century without an executive agency to lead this very important form of national power. The discussion leads to an understanding of how deeds and words are inseparable when communicating with the global community, and how policymakers must understand the perceptions of the global community in order to develop effective policies that serve the mutual interests of the U.S. and the region for which the policy is intended. Regardless of the message we try to send, our deeds must match our words in order to communicate and ultimately influence the global community through dialogue. However, with the deactivation of the U.S. Information Agency the leaders in the United States have all but lost their ability to communicate with the international public. As a result, the U.S. fails to lead the global community as the champion of human rights in the struggle against militant

religious extremism. This has resulted in the loss of a critical vulnerability within the U.S. Government at a time when the U.S. is attempting to fight an enemy whose base of support is primarily ideological. The paper concludes with a discussion and recommendation on how better to organize and use Informational Power within the U.S. Government.

DTIC

*Foreign Policy; News Media*

**20070029597** Army War Coll., Carlisle Barracks, PA USA

**Winning the Battle of Ideas in the War on Terrorism**

Roberts, Joel E; Mar 30, 2007; 23 pp.; In English

Report No.(s): AD-A468842; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468842>

This paper focuses on the USA's need to adapt its strategic communication strategy (themes, goals, and organization) in fighting the Global War on Terrorism - GWOT. While addressing the USA Army War College on 27 March 2006, former Defense Secretary Donald Rumsfeld said the country is faring poorly in its effort to counter ideological support for terrorism, in part because the government does not communicate effectively. 'If I were grading I would say we probably deserve a 'D' or a 'D-plus' as a country as to how well we're doing in the battle of ideas that's taking place in the world today.' To support this position, this paper first examines the radical ideology of our enemy plus the means and effectiveness with which that ideology is communicated. It then evaluates the strategic communication strategies employed by the Bush administration from September 11, 2001 through the end of 2006. Because we can learn from the past, it presents successful communication themes and strategies focusing on World War II and the early years of the Cold War. This paper concludes by offering recommended strategies our leaders should consider in order to win the battle of ideas.

DTIC

*Terrorism; Warfare*

**20070029606** National Defense Univ., Norfolk, VA USA

**Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement**

McFarland, Blair J; May 17, 2007; 70 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468867; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468867>

Interoperable first responder wireless communications are a key strategic requirement for effectively and efficiently responding to and recovering from man-made and natural disasters. 'Communications -- particularly wireless communications -- are the critical enabler of all other functions in any disaster relief operation.' Recent major events provide terrible examples of the unnecessary loss of lives and severe confusion in which lack of interoperability played a significant role. These events resulted in renewed efforts from all levels of national government to fix the interoperability problem. The breadth and complexity of the problem resulted in numerous recommendations to improve interoperability for first responders. The most successful of these initiatives are not top-down federal approaches. Rather, they result from local and state personnel driving the solutions that work in local incidents as well as in larger emergencies. An effective national strategy for improving first responder wireless communications interoperability depends on greater involvement of the National Guard. This requires greater emphasis on the National Guard's role in proactively interfacing with local first responders to better understand the current state of the dynamic communications environment. A National Guard situation awareness cell at each JFHQ-State that is focused on first responder wireless communications interoperability within the state is key to improving emergency response during the next national crisis.

DTIC

*Armed Forces (United States); Communication Networks; Disasters; Emergencies; Interoperability; Transponders; Wireless Communication*

**20070029717** Army War Coll., Carlisle Barracks, PA USA

**Impact of Information Technology-For Strategic Leaders**

Price, Richard; Mar 13, 2007; 19 pp.; In English

Report No.(s): AD-A468954; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468954>

The development of Network Centric Warfare and the rapid infusion of emergent technologies create enormous potential

for the USA Army along with some tremendous challenges. Rapid fielding and integration of technological advancements in communication and information platforms provide strategic leaders with a plethora of information in near real time. The synchronization of these platforms with other battlefield systems produces a lethal capability on the battlefield. However, the rapid production and abundance of information places a tremendous demand on the strategic leader's decision cycle and soldier execution of mission. This paper will describe these systems and analyze the challenges of employing information technology and network centric warfare for strategic leaders.

DTIC

*Information Systems; Leadership; Security*

**20070029749** Army War Coll., Carlisle Barracks, PA USA

**Command, Control, Coordination, and Cooperation during Defense Support to Civil Authority Operations**

Schwabel, Jason E; Feb 26, 2007; 23 pp.; In English

Report No.(s): AD-A469028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469028>

Hurricane Katrina response operations revealed that command, control, coordination, and cooperation (C4) between Title 10 and Title 32 forces needed improvement. The lack of effective C4 between Title 10 and Title 32 resulted in duplicate effort and less than optimal use of critical resources. Through the use of the Emergency Management Assistance Compact (EMAC), more than 456,000 National Guard soldiers, airmen, and their equipment from all states are available to support emergency operations. However, large scale and sustained operations that would be required in the response to an Incidence of National Significance (INS) or catastrophic event require a more systematic approach. This paper will define an appropriate C4 relationship between, USNORTHCOM, The National Guard Bureau (NGB), and The States Governors/State Adjutants General in time of INC or Catastrophic event.

DTIC

*Command and Control; Coordinates; Coordination; Military Operations*

**20070029806** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Distributed Fault-Tolerant Quality Of Service Routing in Hybrid Directional Wireless Networks**

Llewellyn, II, Larry C; Mar 2007; 129 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469151; AFIT/GE/ENG/07-15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469151>

This thesis presents a distributed fault-tolerant routing protocol (EFDCB) for QoS supporting hybrid mobile ad hoc networks with the aim of mitigating QoS disruption time when network failures occur. The experimental design presented in this thesis describes 22 experiments aimed at illustrating EFDCB's ability to handle fault-tolerance. The interpreted results show that EFDCB excels over a global rerouting protocol at this challenge which is the goal of this work.

DTIC

*Communication Networks; Fault Tolerance*

**20070029823** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Effective Mobile Routing Through Dynamic Addressing**

Park, Heungsoon; Mar 2007; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469171; AFIT/GCS/ENG/07-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469171>

Military communications has always been an important factor in military victory and will surely play an important part in future combat. In modern warfare, military units are usually deployed without existing network infrastructure. The IP routing protocol, designed for hierarchical networks cannot easily be applied in military networks due to the dynamic topology expected in military environments. Mobile ad-hoc networks (MANETs) represent an appropriate network for small military networks. But, most ad-hoc routing protocols suffer from the problem of scalability for large networks. Hierarchical routing schemes based on the IP address structure are more scalable than ad-hoc routing but are not flexible for a network with very dynamic topology. This research seeks a compromise between the two; a hybrid routing structure which combines mobile ad-hoc network routing with hierarchical network routing using pre-planned knowledge about where the various military units will be located and probable connections available. This research evaluates the performance of the hybrid routing and compares that routing with a flat ad-hoc routing protocol, namely the Ad-hoc On-demand Distance Vector (AODV) routing protocol with respect to goodput ratio, packet end-to-end delay, and routing packet overhead. It shows that hybrid routing

generates lower routing control overhead, better goodput ratio, and lower end-to-end packet delay than AODV routing protocol in situations where some a-priori knowledge is available.

DTIC

*Military Technology; Networks; Organizations; Telecommunication*

**20070029978** Texas Univ., Austin, TX, USA

**Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems**

Chiu, Y. C.; Logman, H.; Chiu, M. N.; Sunkara, A.; Haas, C.; Mar. 2005; 108 pp.; In English

Report No.(s): PB2007-110193; No Copyright; Avail.: National Technical Information Service (NTIS)

The advances of modern communication technologies have changed the way the roadway information is collected. Innovative surveillance systems powered by various communication technologies have been installed to support various transportation operations. The abundance of available communication technologies and multiple available communication system configurations presents overwhelming challenges for traffic engineers in selecting proper communication technologies for users of various traffic operation and ITS applications. The objective of this research is to propose an effective approach to characterize available communication technology choices, and analyze how they can be applied to various traffic operations. Of particular interest is the development of a guidebook to facilitate the decision-making in choosing appropriate communication technology given the operational requirements and decision objectives. Because of the fast-paced developments in communication technologies, a web-based Knowledge Management System that enables on-line learning of applications vs. communication technology choices, as well as continual updates of the technology choice set, has been developed to ensure the continual usability of this research product.

NTIS

*Cost Effectiveness; Handbooks; Traffic; Transportation; Wireless Communication*

**20070030004** Wertz Consulting, Vienna, VA USA

**Coalition Information Sharing: Lessons from Kosovo**

Wentz, Larry K; Oct 2000; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468900; XD-OASD/C3I; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468900>

Increased civil-military involvement in peacekeeping and humanitarian operations around the world is matched in part by the rise in the number and complexity of these situations. There are many more actors on today's peace operations battlefield with competing as well as common interests and expectations. The need to improve coordination and more open information sharing is on the rise. Efforts to improve and facilitate more open information sharing among the disparate participants must overcome a continuing lack of trust among the civil-military actors and outdated organization cultural traditions and behavior patterns. All actors need to better understand each other and the roles they can and should play in an increasingly complex operational environment. In order to obtain closure and improve information sharing in the future, the actors must develop relationships based on mutual trust and there must be a clear understanding that information sharing operates on a two-way, transparent basis. Since no two operations are really the same, one should be careful not to generalize too much on experiences and lessons learned. Each experience is different but lessons from previous operations can place the community on a higher level of awareness and facilitate the tailoring of actions to meet the needs of the new operation. The Balkans is certainly an example of this. Kosovo was not Bosnia for a number of reasons and therefore, although many things have been learned in the Bosnia operation not all lessons are directly applicable to the challenges of Kosovo. For example, despite extensive Bosnia experience, civil-military information sharing in the Kosovo operation was problematic. Although some progress has been made through local collaborative initiatives, there is still a ways to go to meet expectations. Experiences such as the Balkans are highlighting the urgency to improve and this coupled with the information technology revolution offers a means to an end.

DTIC

*Information Systems; Bosnia and Herzegovina; Peacetime*

## ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. For related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

**20070026408** SatCon Technology Corp., Boston, MA USA

**Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint)**

Davis, Gregg; Casey, Leo; Jordan, Brett; Scofield, Jim; Keller, Kirby; Sheahan, Jim; Roach, Jeffrey; Scherrer, Michael; Singh, Ranbir; Nov 2006; 20 pp.; In English

Contract(s)/Grant(s): FA8650-06-M-2636; Proj-3005

Report No.(s): AD-A466111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466111>

This report was developed under a SBIR contract. This paper presents an approach to predictive control and prognostication intended to increase the confidence levels for power converters in aerospace applications. One goal of this work is to accelerate the adoption of new technologies, such as advanced power semiconductor devices. While the devices are immature the technology provides significant overall performance advantages. Using prognostication it is hoped to significantly increase the confidence levels for successful mission completion and so overcome reservations about adopting these new technologies. The methodology uses predictive modeling and simple, robust, sensing, attempting to avoid excessive sensing requirements in the prognostics of complex converters. This approach requires detailed knowledge of the dominant aging and failure mechanisms, the physical driving forces behind these mechanisms and the observable precursors of failure. The precise history of the power converter system, combined with measurement and modeling, can then predict whether the system can operate successfully for a given time duration, with a high degree of confidence.

DTIC

*Broadband; Controllers; Energy Conversion; Energy Gaps (Solid State); Predictions; Semiconductor Devices; Silicon Carbides*

**20070026410** Cree Research, Inc., Durham, NC USA

**A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint)**

Ryu, Sei-Hyung; Krishnaswami, Sumi; Hull, Brett; Heath, Bradley; Husna, Fatima; Richmond, James; Agarwal, Anant; Palmour, John; Scofield, James; Aug 2006; 6 pp.; In English

Contract(s)/Grant(s): FA8650-04-2-2410; F33615-01-C-2188; Proj-3145

Report No.(s): AD-A466113; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466113>

High temperature characteristics of 4H-SiC power JFETs and DMOSFETs are presented in this paper. Both devices are based on pn junctions in 4H-SiC, and are capable of 300 degrees C operation. The 4H-SiC JFET showed very predictable, well understood temperature dependent characteristics, because current conduction depends on the drift of electrons in the bulk region, which is not restricted by traps in the MOS interface or pn junctions. However, in a 4H-SiC DMOSFET, electrons must flow through the MOS inversion layer with very high interface state density. At high temperatures, transconductance of the device improves and threshold voltage shifts negative because less electrons are trapped in the interface states, resulting in a much lower MOS channel resistance. This cancels out the increase in drift layer resistance, and as a result, a temperature insensitive on-resistance can be demonstrated. Performances of the two devices are compared, and a discussion of issues for high temperature applications is presented.

DTIC

*Field Effect Transistors; High Temperature; Metal Oxide Semiconductors; Silicon Carbides*

**20070026412** Idaho Univ., Moscow, ID USA

**Advanced Materials Deposition for Semiconductor Nanostructures Using Supercritical Fluids**

Wai, Chien M; Apr 2007; 78 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0361

Report No.(s): AD-A466115; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466115>

Supercritical fluid carbon dioxide provides an attractive medium for depositing materials in small structures with high aspect ratios and poorly wettable substrates due to the fact that it is able to dissolve solutes like a liquid and transport dissolved

materials like a gas. Metal and metal sulfide nanoparticles of controllable size can be synthesized in supercritical fluid carbon dioxide using water-in-CO<sub>2</sub> microemulsion as template. Continuous tuning the size of metallic nanoparticles and metal sulfide nanoparticles with diameters from less than 2 nm to over 10 nm can be achieved by varying the density of the fluid phase in the synthetic process. The synthesized nanoparticles are stabilized in the fluid phase using an alkylthiol compound. Deposition of the stabilized metal nanoparticles in the fluid phase forming self-assembled arrays has been demonstrated. Supercritical fluid deposition of metals on surfaces of carbon nanotubes has also been studied. Metal nanoparticles of narrow size distributions can be uniformly attached to carbon nanotube surfaces using this method. The carbon nanotube-supported platinum group metal nanoparticles show remarkably high activities for catalyzing chemical and electrochemical reactions. Examples of utilizing the carbon nanotube-nanoparticle composite materials as catalysts for chemical reactions, fuel cells and sensor applications are given.

DTIC

*Deposition; Nanostructures (Devices); Semiconductors (Materials); Supercritical Flow; Supercritical Fluids*

**20070026447** Drexel Univ., Philadelphia, PA USA

**Fault Tolerance in Autonomous Acoustic Arrays**

Rosen, Warren A; George, Alan D; Jan 1999; 15 pp.; In English

Contract(s)/Grant(s): N00014-96-1-0569; N00014-97-1-0117

Report No.(s): AD-A466164; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466164>

The problem of fault tolerance in autonomous disposable fiber-optic based acoustic arrays is considered. The principal source of failures over relatively short mission times is node outage due to battery run-down resulting in possible network failure, degradation in the beam power pattern, and possible loss of critical processing elements[ Network integrity in the presence of node failures requires an optical bypass capable of bypassing several adjacent failed nodes. The effect of node failure on the beam power pattern is principally in the side lobes rather than in the main beam, and is amenable to relatively simple solutions for the case of failures near the ends of the array, but failures near the center are more intractable. The loss of critical processing elements can be dealt with by distributing the processing load over processing elements located in each telemetry node of the network, thereby turning the array into a distributed parallel computer.

DTIC

*Acoustic Measurement; Arrays; Autonomy; Fault Tolerance*

**20070026470** Texas Instruments, Inc., Dallas, TX USA

**Non-Equilibrium Quantum Dots: Transport**

Reed, Mark A; Randall, John N; Luscombe, James H; Mar 19, 1990; 5 pp.; In English

Report No.(s): AD-A466213; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466213>

The electronic transport through three-dimensionally confined semiconductor quantum dots is investigated and analyzed. The spectrum corresponds to resonant tunneling from laterally confined emitter contact subbands through the discrete three-dimensionally confined quantum dot states. Momentum non-conservation is observed in these structures.

DTIC

*Electron Transfer; Electron Transitions; Nanostructures (Devices); Nanotechnology; Quantum Dots; Resonant Tunneling; Semiconductors (Materials)*

**20070026471** Yale Univ., New Haven, CT USA

**Semiconductor Quantum Dot Resonant Tunnelling Spectroscopy**

Reed, Mark A; Randall, John N; Luscombe, James H; Jan 1992; 4 pp.; In English

Report No.(s): AD-A466214; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466214>

Recently, three-dimensionally laterally confined semiconductor quantum wells ('quantum dots') were realized. These structures are analogous to semiconductor atoms. They have an energy level separation of order 25meV and are tunable by means of the confining potentials. A systematic study reveals a (radius)<sup>-1</sup> dependence on the energy separation. In this paper, electron transport through quantum dots is presented and analyzed. The spectra correspond to resonant tunneling from laterally



confined emitter contact subbands through the discrete three-dimensionally confined quantum dot states. The effects of two dots in series, and Fermi-level effects, are presented.

DTIC

*Electron Transfer; Nanostructures (Devices); Nanotechnology; Quantum Dots; Resonant Tunneling; Semiconductors (Materials); Spectroscopy*

**20070026482** Pohang Univ. of Science and Technology, Pohang, Korea, Republic of  
**Fabrications and Characterizations of ZnO/Zn<sub>1-x</sub>Mg<sub>x</sub>O Nanorod Quantum Structures**

Yi, Gyu-Chul; Nov 2, 2005; 12 pp.; In English

Report No.(s): AD-A466259; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466259>

Recent demonstration of semiconductor nanorod heterostructures opens up significant opportunities for fabrication of electronic and photonic nanodevices on single nanorods. The semiconductor nanorod quantum structures with well defined interfaces are main components for nanoscale resonant tunneling devices, field effect transistors, and light-emitting devices since the nanorod quantum structures (Qs) enable novel physical properties such as quantum confinement to be exploited.

DTIC

*Emission; Excitons; Fabrication; Nanorods; Nanostructures (Devices); Nanotechnology; Quantum Theory*

**20070026518** Texas Instruments, Inc., Dallas, TX USA

**Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor**

Seabaugh, Alan C; Frensley, William R; Randall, John N; Reed, Mark A; Farrington, Dewey L; Matyi, Richard J; Oct 1989; 8 pp.; In English

Contract(s)/Grant(s): 9770400.1304

Report No.(s): AD-A466364; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466364>

A bipolar tunneling transistor has been fabricated in which ohmic contact is made to the strained p<sup>+</sup> InGaAs quantum well of a double-barrier resonant-tunneling structure. The heterojunction transistor consists of an n-GaAs emitter and collector, undoped AlAs tunnel barriers, and a pseudomorphic p<sup>+</sup> InGaAs quantum-well base. By making ohmic contact to the p-type quantum well, the hole density in the quantum-well base is used to modulate the base potential relative to the emitter and collector terminals. With control of the quantum-well potential, the tunneling current can be modulated by application of a base-to-emitter potential. This paper details the physical and electrical characteristics of the device. It is found that the base-emitter voltages required to bias the transistor into resonance are well predicted by a self-consistent calculation of the electrostatic potential.

DTIC

*Bipolar Transistors; Bipolarity; Indium Gallium Arsenides; Quantum Wells; Resonant Tunneling; Semiconductors (Materials); Transistors*

**20070026552** Yale Univ., New Haven, CT USA

**Microfabrication of a Mechanically Controllable Break Junction in Silicon**

Zhou, C; Muller, C J; Deshpande, M R; Sleight, J W; Reed, M A; Aug 21, 1995; 4 pp.; In English

Report No.(s): AD-A466432; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466432>

The authors present a detailed description of the microfabrication and operation at room temperature of a novel type of tunnel displacement transducer. Instead of a feedback system, it relies on a large reduction factor, assuring an inherently stable device. Stability measurements in the tunnel regime infer an electrode stability within 3 pm in a 1 kHz bandwidth. In the contact regime, the conductance takes on a discrete number of values when the constriction is reduced atom by atom. This reflects the conduction through discrete channels.

DTIC

*Displacement; Electric Current; Microinstrumentation; Micromachining; Sensors; Silicon; Silicon Dioxide; Transducers*

**20070026560** Yale Univ., New Haven, CT USA

**Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions**

Chen, J; Wang, W; Reed, M A; Rawlett, A M; Price, D W; Tour, J M; Aug 21, 2000; 4 pp.; In English

Contract(s)/Grant(s): N00014-99-1-0406

Report No.(s): AD-A466466; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466466>

Molecular devices are reported utilizing active self-assembled monolayers containing the nitroamine [2'-amino-4,4'-di(ethynylphenyl)-5'-nitro-1-benzenethiolate] or the nitro compound [4,4'-di(ethynylphenyl)-2'-nitro-1-benzenethiolate] as the active components. Both of these compounds have active redox centers. Current voltage measurements of the devices exhibited negative differential resistance at room temperature and an on off peak-to-valley ratio in excess of 1000:1 at low temperature.

DTIC

*Negative Resistance Circuits; Room Temperature*

**20070026568** Army Research Lab., Aberdeen Proving Ground, MD USA

**Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects**

Clayton, John D; Chung, Peter W; Grinfeld, Michael A; Nothwang, William D; Apr 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466487; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466487>

A mathematical continuum theory is developed to describe the electromechanical behavior of dielectric and piezoelectric solids containing imperfections. The macroscopic distortion field consists of recoverable elasticity, deviatoric plasticity arising from dislocation glide, and volumetric deformation from vacancies. A connection on the spatial manifold of deformed lattice vectors describes gradients of stretch and rotation at the microscale caused by various lattice defects. It is shown that parallel transport of a lattice director vector with respect to this connection about a closed loop yields a discontinuity with contributions from the torsion of the connection (physically, from dislocations) and curvature (physically, from domain walls and vacancy gradients). Classical balance laws of electrostatics and mass and momentum conservation are implemented. A free energy function dependent upon lattice distortion, polarization, temperature, and defect densities is suggested. Thermodynamically consistent kinetics relations for dislocation glide and vacancy diffusion are then derived, with the chemical potential for the latter depending upon defect density, electric potential, hydrostatic pressure, and elastic energy density. Vacancy migration and mass rearrangement at the free surface of the substance are also considered explicitly.

DTIC

*Dielectrics; Diffusion; Electromechanics; Feedback Control; Kinetics; Piezoelectric Crystals; Piezoelectricity; Point Defects; Solid State; Surface Defects*

**20070026574** Akron Univ., Akron, OH USA

**Atomistic Calculation of Elastic Moduli in Strained Silicon**

Zhu, Richard; Pan, Ernian; Chung, Peter W; Cai, Xinli; Liew, Kim M; Buldum, Alper; Apr 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-2-0038; Proj-6U2MCL; Proj-R6XSCA5

Report No.(s): AD-A466493; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466493>

Strained silicon is becoming a new technology in silicon industry where the novel strain-induced features are utilized. In this report we present a molecular dynamic prediction for the elastic stiffnesses C11, C12, and C44 in strained silicon as functions of the volumetric strain level. Our approach combines basic continuum mechanics with the classical molecular dynamic approach, supplemented with the Stillinger Weber potential. Using our approach, the bulk modulus, effective elastic stiffnesses C11, C12, and C44 of the strained silicon, including also the effective Young's modulus and Poisson's ratio, are all calculated and presented in terms of figures and formulae. In general, our simulation indicates that the bulk moduli, C11 and C12, increase with increasing volumetric strain whilst C44 is almost independent of the volumetric strain. The difference between strained moduli and those at zero strain can be very large, and therefore use of standard free-strained moduli should be cautious.

DTIC

*Continuum Mechanics; Modulus of Elasticity; Molecular Dynamics; Silicon*

**20070026594** National Chiao Tung Univ., Hsinchu, Taiwan, Province of China

**Dynamics of Epitaxy on the Nano-sized Semiconductor Surfaces**

Lin, Deng-Sung; Sep 5, 2006; 17 pp.; In English

Report No.(s): AD-A466533; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466533>

Semiconductor self assembled quantum dots (QDs) have emerged as one of the simplest subjects for exploring and exploiting the physics and device applications of charge carriers and excitons in the three dimensional confinement regime. Nanoscale-sized surface in the form of mesa or ridges on patterned substrates offer opportunities not only for creating large densities of QDs with great homogeneity but also for novel growth-control engineering. This project aims at a fundamental understanding of the size-dependent crystal growth phenomena during the formation of QDs on the surfaces of Si stripe and mesa structures. Employing variable-temperature scanning probe microscope (VT-SPM) on the patterned substrates, we plan to observe in situ the atomistic chemical vapor deposition (CVD) growth mechanism of the QDs on the top terraces as well as on the sidewalls of pre-patterned structures. The key objective in this proposed research is to fabricate patterned structures with well-defined side walls. Specifically, we plan to fabricate patterned mesa and stripe structure with the flat (111) sidewalls on the Si(100) substrates by means of lithography and anisotropic wet chemical etch. When the patterned surface consists only of low-index surfaces with well-characterized structures, its growth behavior become more predictable and tunable. We will then perform epitaxy on the patterned surfaces and observe their evolution in atomic structure and in surface morphology on both the (100) top terraces and (111) sidewalls and QD formation in situ, in real time and in real space using VT-SPM. The fundamental understanding of the results could provide useful physical guidelines in preparing QDs for many researchers and contribute to device application development in a long-term base.

DTIC

*Crystal Growth; Epitaxy; Quantum Dots; Semiconductors (Materials)*

**20070026689** North Carolina Univ., Chapel Hill, NC USA

**Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale**

Superfine, Richard; Falvo, Michael; Taylor, II, Russell M; Washburn, Sean; Jan 2002; 52 pp.; In English

Report No.(s): AD-A466718; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466718>

The study of novel materials produces many challenges in the areas of synthesis, modeling and characterization. For the latter, one would like to be able to determine mechanical, electrical and dynamical properties, and correlate them with structure. In the following chapter, we describe work performed at the University of North Carolina-Chapel Hill (UNC) in the development of microscopy instrument systems, including a natural interface for scanned probe microscopy we call the nanoManipulator. We describe the principle design features of the instrument system including the visual display of data, the haptic (force-feedback) control and display capabilities. Second, we describe the combination of microscopy and manipulation in a joint Scanning Electron Microscopy/Scanning Probe Microscopy system. These systems have been used for studies of nanotube mechanical dynamical and electrical properties,<sup>8</sup> and for the study of biological macromolecular structures such as viruses, fibers (pili, fibrin, microtubules, etc.) and molecules (DNA). We describe examples of these studies drawn from our work on nanotubes and viruses.

DTIC

*Buckling; Manipulators; Microscopy; Nanostructures (Devices); Viruses*

**20070026707** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Simultaneous Localization and Tracking in Wireless Ad-hoc Sensor Networks**

Taylor, Christopher J; May 31, 2005; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466781; MIT-CSAIL-TR-2005-037; AITR-2005-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466781>

In this thesis we present LaSLAT, a sensor network algorithm that uses range measurements between sensors and a moving target to simultaneously localize the sensors, calibrate sensing hardware, and recover the target's trajectory. LaSLAT is based on a Bayesian filter that updates a probability distribution over the parameters of interest as measurements arrive. The algorithm is distributable and requires a fixed amount of storage space with respect to the number of measurements it has incorporated. LaSLAT is easy to adapt to new types of hardware and new physical environments due to its use of intuitive probability distributions: one adaptation demonstrated in this thesis uses a mixture measurement model to detect and compensate for bad acoustic range measurements due to echoes. We present results from a centralized implementation of

LaSLAT using a network of Cricket sensors. In both 2D and 3D networks, LaSLAT is able to localize sensors to within several centimeters of their ground truth positions while recovering a range measurement bias for each sensor and the complete trajectory of the mobile.

DTIC

*Detectors; Networks; Position (Location); Targets*

**20070026747** World Technology Evaluation Center, Baltimore, MD USA

**Spin Electronics**

Awschalom, David D; Buhrman, Robert A; Daughton, James M; Roukes, Michael L; von Molnar, Stephan; Aug 2003; 168 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): ECS-0107941; ENG-0104476

Report No.(s): AD-A467012; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467012>

This report is a comparative review of spin electronics ( spintronics ) research and development activities in the USA, Japan, and Western Europe conducted by a panel of leading U.S. experts in the field. It covers materials, fabrication and characterization of magnetic nanostructures, magnetism and spin control in magnetic nanostructures, magneto-optical properties of semiconductors, and magnetoelectronics and devices. The panel s conclusions are based on a literature review and a series of site visits to leading spin electronics research centers in Japan and Western Europe. The panel found that Japan is clearly the world leader in new material synthesis and characterization; it is also a leader in magneto-optical properties of semiconductor devices. Europe is strong in theory pertaining to spin electronics, including injection device structures such as tunneling devices, and band structure predictions of materials properties, and in development of magnetic semiconductors and semiconductor heterostructures. The USA is a leader in optoelectronics including optical detection and injection, as well as novel instrumentation e.g., ballistic electron magnetic microscopy (BEEM). The USA is also the international leader in applications including read heads, magnetic random access memory (MRAM), sensors, and magnetic device production. Additional details are included in an executive summary conveying the panel's overall conclusions.

DTIC

*Magnetic Properties; Magneto-Optics; Nanostructures (Devices); Semiconductor Devices*

**20070026781** Michigan State Univ., East Lansing, MI USA

**Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties**

Kanatzidis, Mercouri; Hogan, Timothy; Murray, Chris; Apr 23, 2007; 20 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0867

Report No.(s): AD-A467427; 4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467427>

We discovered a grand homologous series which may help in the future to systematically identify thermoelectric materials with high performance. Namely, the series  $Am[M1+1Se2+1]2m[M21+nSe2+31+n]$  (A = alkali metal, M = Pb, Bi) has structure-predicting properties. The modular construction of these structures from evolving building blocks permits many of the criteria necessary for good thermoelectrics to be met.  $K2Bi8Se13$  is a member of this series and was found to be a promising thermoelectric. The charge transport properties were studied under pressure, where a significant increase in the power factor was observed. Several other promising materials were also discovered. In another part of this project we prepared nanocrystals of thermoelectric semiconductors and studied their properties. We investigated the assembly of nanocrystal components into well-organized arrays. The goal was to utilize quantum dot building blocks of desired thermal and electronic properties to design composite materials with improved power generation, thermoelectric characteristics. We devised new ways to prepare nanocrystals of PbTe, AgSbTe<sub>2</sub> and AgPb<sub>2</sub>SbTe<sub>4</sub>.

DTIC

*Nanostructure (Characteristics); Quantum Dots; Semiconductors (Materials); Thermoelectric Materials; Thermoelectricity*

**20070026798** Harris Corp., Alexandria, VA USA

**A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas**

Cain, J B; Billhartz, Tom; Foore, Larry; Althouse, Edwin; Schlorff, John; Jan 2003; 7 pp.; In English

Contract(s)/Grant(s): N00014-96-C-2063

Report No.(s): AD-A467467; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467467>

There is strong interest within DoD to utilize high-gain. directional antennas at both the transmitting and receiving end

of the link in a dynamic, ad hoc network environment. However, the application of directional antennas (e.g., phased-array or sectorized antennas) in a dynamic network of mobile nodes requires coordination of antenna steering at both the receiver and transmitter ends of the link. Our solution is to apply adaptive, link-state routing (be performed by the OLSR ad hoc routing protocol) supported by a distributed, adaptive Time Division Multiple Access (TDMA) scheduler, which determines schedules based on cooperative decisions between each pair of neighbor nodes. The architecture that has been developed contains a high rate mission data channel with an adaptive TDMA link scheduling protocol designed to take advantage of high-gain directional antennas. Time slots on this channel are adaptively scheduled to meet dynamic traffic demand requirements and to avoid interference from adjacent transmitting nodes. In addition, the link scheduling protocol must adapt to changes in node neighborhood topology caused by node mobility and link obstructions. This architecture will be tested and evaluated in two ways: by OPNET simulations and by field demonstrations.

DTIC

*Data Links; Directional Antennas; Multiple Access; Scheduling; Time Division Multiple Access*

**20070026800** Florida Univ., Gainesville, FL USA

**MEMS Shear Stress Sensors: Promise and Progress**

Sheplak, Mark; Cattafesta, Louis; Nishida, Toshi; McGinley, Catherine B; Jul 1, 2004; 14 pp.; In English

Contract(s)/Grant(s): F4962-97-1-0507; CTS-04352835

Report No.(s): AD-A467470; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467470>

This paper reviews existing microelectromechanical systems (MEMS)-based shear stress sensors. The promise and progress of MEMS scaling advantages to improve the spatial and temporal resolution and accuracy of shear stress measurement is critically reviewed. The advantages and limitations of existing devices are discussed. Finally, unresolved technical issues are summarized for future sensor development.

DTIC

*Detectors; Microelectromechanical Systems; Shear Stress*

**20070026806** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Receptive Field Structures for Recognition**

Balas, Benjamin; Sinha, Pawan; Mar 1, 2005; 18 pp.; In English

Report No.(s): AD-A467499; MIT-CSAIL-TR-2005-015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467499>

Localized operators, like Gabor wavelets and difference-of-Gaussian filters, are considered to be useful tools for image representation. This is due to their ability to form a sparse code that can serve as a basis set for high-fidelity reconstruction of natural images. However, for many visual tasks, the more appropriate criterion of representational efficacy is recognition, rather than reconstruction. It is unclear whether simple local features provide the stability necessary to subserve robust recognition of complex objects. In this paper, we search the space of two-lobed differential operators for those that constitute a good representational code under recognition/discrimination criteria. We find that a novel operator, which we call the dissociated dipole displays useful properties in this regard. We describe simple computational experiments to assess the merits of such dipoles relative to the more traditional local operators. The results suggest that non-local operators constitute a vocabulary that is stable across a range of image transformations. Acknowledgements: BJB is a National Defense Science and Engineering Graduate Fellow. This research was funded in part by the DARPA HumanID Program and the National Science Foundation ITR Program. PS is supported by an Alfred P. Sloan Fellowship in neuroscience and a Merck Foundation Fellowship.

DTIC

*Display Devices; Images; Numerical Analysis; Quadratures*

**20070026810** Florida Univ., Gainesville, FL USA

**10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates**

Lin, Jau-Jr; Guo, Xiaoling; Li, Ran; Branch, Jason; Brewer, Joe E; 0, Kenneth K; Jan 2004; 5 pp.; In English

Contract(s)/Grant(s): N66001-03-1-8901

Report No.(s): AD-A467511; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467511>

This paper reports the techniques for improving the characteristics of integrated antennas fabricated on silicon substrates

for communications over air. Using these, the pair gain (Ga) of antennas on 20-Omega-cm substrates has been improved by ~10x over the previously reported result. Lastly, the possibility of realizing single chip radios with integrated antennas for communication over air is suggested by picking up, amplifying, and frequency dividing a 15-GHz sine wave transmitted from a 2-mm long on-chip antenna located 40 cm away using a packaged clock receiver with a 2-mm long on-chip zigzag antenna.  
DTIC

*Antenna Design; Microelectronics; Silicon; Substrates*

**20070026837** Loyola Coll., Baltimore, MD USA

**Microsystems Research in Japan**

Howe, Roger T; Allen, Mark G; Berlin, Andrew A; Hui, Elliot E; Monk, David J; Najafi, Khalil; Yamakawa, Mineo; Sep 2003; 195 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): ECS-0107941; ENG-0104476

Report No.(s): AD-A467674; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467674>

This report reviews Japan's research and development activities and strategies in the field of microsystems and microelectromechanical systems (MEMS). Topics covered include the future outlook of national initiatives, interactions between industry and universities, technology and manufacturing infrastructure, and emerging applications research. The panel's findings include the following: non-silicon microsystem technologies, together with parallel assembly technologies for low-cost mass manufacturing, merit increased attention. Incorporating non-silicon technologies into the MEMS Exchange should be considered, in order to identify, support, and standardize U.S. capabilities. Opportunities should be identified for exploiting early applications of synthetic nanostructures in microsystems. Metrology, process control, and device standardization should be pursued, in collaboration with Asia and Europe. Additional findings are outlined in the panel's executive summary.

DTIC

*Japan; Microelectromechanical Systems*

**20070026850** Army Nuclear and Chemical Agency, Springfield, VA USA

**A Rationale for Establishing Survivability Requirements for Objective Force Unmanned Army Platforms and Systems**

Pfeffer, Robert A; Jun 2003; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468167; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468167>

The introduction of high-tech equipment into the Army inventory has substantially increased battle effectiveness, reduced personnel requirements, and in some cases allowed the replacement of several manned operational platforms and systems with unmanned equivalents. The continued trend toward digital robotics in the battlespace has become extremely attractive to military planners, so much so that future warfighters are expected to employ a considerable number of unmanned platforms and systems. Up to this point in time, however, nuclear hardening criteria have been applied principally to manned systems and have been balanced to the nuclear survivability of the operating crew. This paper provides the rationale for establishing reasonable nuclear hardening criteria for objective force unmanned mission critical equipment. It starts with the survivability requirement and then identifies the process used to establish criteria for five unmanned equipment classes. Also included are the factors to be considered and the steps to be taken to establish hardening criteria for all nuclear weapons effects (NWE) and for all weapon yields of interest. The paper concludes with an application of the process to a hypothetical system. Details given in this paper form the basis for proposed Quadripartite Standardization Agreement (QSTAG) 2041, a standard for the Armies of the USA, the UK, Canada, and Australia.

DTIC

*Nuclear Radiation; Radiation Protection*

**20070027254** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Analysis of the Thermal Shielding Properties of Camouflage Materials**

Bennett, John G; Polsen, Erik S; Feb 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466873; TARDEC-16963; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In a previous paper, we discussed our techniques for measuring the thermal shielding of materials. Two heated panels served as surrogates for heated vehicle components, such as armor heated by the engine. The outer surface of each panel was thermostatically controlled to the same temperature. The camouflage material covered one of the panels, while the other,

uncovered, panel acted as the baseline. Periodically, we collected calibrated infrared images of the two panels at 3 to 5 and 8 to 12 microns. In this paper, we present techniques to analyze further data from these measurements. The goal of the analysis is to quantify the relative capability of materials to shield from view warm vehicle components. We also present results of a simple experiment to measure the effect of air movement on the shielding properties of the materials.

DTIC

*Camouflage; Heat Shielding*

**20070027258** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Analysis of the Thermal Shielding Properties of Camouflage Materials Brief**

Bennett, John G; Polsen, Erik S; Feb 5, 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466885; TR-16962; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Analysis of the Thermal Shielding Properties of Camouflage Materials consists of thermal shielding analysis, measurement techniques and the results on the impact of still and flowing air. The techniques shown are suitable for evaluating the thermal shielding performance of camouflage materials. Air flow has a strong influence on thermal shielding performance of camouflage materials.

DTIC

*Air Flow; Camouflage; Heat Shielding; Infrared Radiation; Shielding; Thermodynamic Properties*

**20070027259** RFMD Infrastructure Product Group, Inc., Charlotte, NC USA

**Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures**

Vetury, R; Shealy, J B; Green, D S; McKenna, J; Brown, J D; Leverich, K; Garber, P M; Poulton, M J; Jul 2006; 6 pp.; In English

Contract(s)/Grant(s): FA8650-05-C-5411; Proj-4348

Report No.(s): AD-A466887; No Copyright; Avail.: Defense Technical Information Center (DTIC)

AlGaN/GaN HEMTs on SiC have been fabricated with dual and single gate device geometries. Sub-threshold characteristics and drain bias dependence of large signal parameters were compared to identify differences in electric field. Degradation under RF stress reveals the relative impact of temperature and electric field. The results illustrate the beneficial effects of the dual gate geometry for performance and reliability.

DTIC

*Gallium Nitrides; High Electron Mobility Transistors; Radio Frequencies; Reliability; Silicon Carbides*

**20070027263** Army Tank-Automotive Research and Development Command, Warren, MI USA

**M1114 -- Golden HMMWV Power: Electrical Systems Used in Theater**

Aboona, Jonathan; Jan 20, 2007; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466899; 16947-RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

These three briefing charts present a summary of the electrical systems used in the M1114 Golden High Mobility Multipurpose Wheeled Vehicle (HMMWV). Chart 1 pictures a number of the M1114's electrical systems, including the Common Remotely Operated Weapons Station (CROWS), the Improved Target Acquisition Sight (ITAS), the Battery Powered Motorized Turret Unit (BPMTU), the CREW 2 (DUKE) jammer, the Long-Range Acoustic Device (LRAD (trademark)), the Blue Force Tracker (FBCB2), Drivers Vision Enhancement (DVE), the DAGR/PLGR GPS System, and the SINCGARS and VIC-3 system. Chart 2 presents 2 tables. One table shows power draws for 12 M1114 electrical systems under steady state and surge on the Golden's 200A alternator, which can provide between 110-180 Amps of usable power. The second table shows steady state and surge Amp draws for 12 future and optional systems. Chart 3 presents 14 acronyms for M1114 electrical systems and their spelled-out versions.

DTIC

*Combat; Electric Equipment; Energy Consumption; Military Vehicles; Steady State; Surges*

**20070027273** California Polytechnic State Univ., San Luis Obispo, CA USA

**The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration**

Opava, Susan C; Adams, Nikki; Arakai, Dean; Beckett, Jonathon; Bensky, Thomas; Carpenter, Thomas; Chadwell, Charles; Crockett, Robert; Davol, Andrew; Echols, Robert; Fernando, Raymond; Fiegel, Gregg; Franklin, Diana; Freed, Tali; Gollery, Steven; Hanson, James; Harfenist, Steven; Immoos, Chad; Jimenez-Flores, Rafael; Jin, Xiaomin; Apr 26, 2007; 661 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0855

Report No.(s): AD-A466958; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary purpose of this initiative is to forge a strong link between private sector R&D and University applied research, to speed the development of new knowledge and the transfer of technology to the public and private sectors. To this end, communications infrastructure and R&D facilities have been developed. Relationships with private companies engaged in R&D have been advanced. Important research has been carried out in areas of interest to the DOD and national security. These areas include: Nanotechnology, hyperspectral imaging and analysis, smart materials, energy efficiency, communications, network technologies, sensors, malaria, ultraviolet irradiation, biohazards, chemical agents, RFID, visual speech analysis, artificial neural networks, fluid dynamics and underwater optical sensing

DTIC

*Coasts; Fluid Dynamics; Imagery; Industries; Nanotechnology; Security*

**20070027308** Naval Postgraduate School, Monterey, CA USA

**Solid State Capacitor Discharge Pulsed Power Supply Design for Railguns**

Black, Jesse H; Mar 2007; 74 pp.; In English

Report No.(s): AD-A467108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis presents a solid state thyristor switched power supply capable of providing 50 kJ from a high voltage capacitor to a railgun. The efficiency with which energy is transferred from a power supply to a projectile depends strongly on power supply characteristics. This design will provide a better impedance match to the railgun than power supplies utilizing spark gap switches. This supply will cost less and take up less volume than a similar supply using spark gap switches; it will also produce a smaller electromagnetic pulse. Voltage limitations on the thyristors require two in series acting as a single switch. Railgun, snubber circuit and gate control systems were modeled for a 50 kJ railgun supply. These simulations yielded component values necessary to protect and control the thyristors for voltages up to 10 kV, currents up to 180 kA, and changes in current with respect to time up to  $10(\exp 9)$  A/s.

DTIC

*Capacitors; Circuits; Electromagnetic Pulses; Railgun Accelerators; Solid State; Thyristors*

**20070027315** Boeing Phantom Works, Seattle, WA USA

**Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE**

Rempt, Raymond D; Koltenebah, Benjamin; Oct 2005; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-03-D-5204-0001; Proj-4349

Report No.(s): AD-A467119; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the exploitation of the attractive performance of magnetoresistive (MR) sensors for NDE of metallic aircraft structure, into an imaging array for rapid scanning, and the demonstration of the performance of that array. There were a number of issues requiring resolution for this development. These included array geometry, excitation geometry, signal processing, software, calibration, and operation. The geometry chosen was a linear array with sensitivity axis normal to the surface being scanned, and the excitation geometry is that of a uniform current 'sheet'. The array has been initially demonstrated on several test samples, and shown to be able to detect small flaws/cracks at depths of upwards of one-half inch. In many cases, cracks with length only a fraction of the covering metal are easily seen with no additional data manipulation. The array has been integrated and demonstrated with the MAUS scanning platform. Because of the chosen geometry, dependence on circular symmetry is obviated, and therefore rapid scanning along a row of fasteners is possible, with real time imaging. In the future, the bounding of applicability of the array for Air Force inspection scenarios must be determined, as well as flaw signature enhancement through additional processing.

DTIC

*Cracks; Damage; Detectors; Linear Arrays; Magnetoresistivity; Models; Nondestructive Tests; Signal Processing*



**20070027434** Teledyne Scientific and Imaging, LLC, Thousand Oaks, CA USA  
**Investigation of Lattice and Thermal Stress in GaN/AlGaIn Field-Effect Transistors**  
Boutros, Karim; May 15, 2007; 7 pp.; In English  
Contract(s)/Grant(s): N00014-05-C-0120  
Report No.(s): AD-A467566; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes work performed in support of the program 'Investigation of Lattice and Thermal Stress in GaN/AlGaIn Field-Effect Transistors' (Contract No N00014-05-C-0120) for the period 10/1/06 - 4/30/07. Our overall goal is to understand the role and contribution of residual stress and junction temperature on the degradation of AlGaIn/GaN HEMT electrical device characteristics. To execute this goal, electrical stress measurements will be performed on devices with varying residual stress, and under varying conditions. We plan to use the micro-Raman technique to monitor the evolution of residual stress in the active region of the device over time and under quiescent electrical bias. The question of whether a stress relaxation, potentially inducing dislocations, or simply changing the piezoelectric contribution to the 2DEG charge, contributes to device degradation will be investigated. We will seek to understand the influence of junction temperature on the magnitude of the stress at the active junction. The effect of physical, thermal, and electrical stress on device reliability will be investigated.

DTIC

*Degradation; Field Effect Transistors; Residual Stress; Thermal Stresses*

**20070027436** Missile Defense Agency, Washington, DC USA  
**Venturing Through the Forbidden Band**  
Dec 2004; 44 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467568; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over the past three decades, industry and the U.S. Government have invested hundreds of millions of dollars in an emerging area called wide-bandgap materials. The technical significance of these materials is that they can be made into semiconductor devices capable of handling much higher voltages than silicon, while withstanding and operating at much higher temperatures. Such materials also have unique optoelectronic capabilities that allow them to emit blue and UV light. Thus, many aspects of our lives can be touched by transistors and diodes made from a new class of materials. What makes a semiconductor wide bandgap? The answer remains at the atomic level of the material. A range of energies called the forbidden band separates the valence band and the conduction band of a solid-state material. The valence and conduction bands hold electrons; however, no electrons may reside in the forbidden band. When the forbidden band is wider, more energy is required to promote an electron from the valence band into the conduction band. If a material has no forbidden band (i.e., the conduction band is the valence band), it behaves as metal. If it has a very wide band, it is a good insulator. Semiconductors lie somewhere in the middle. When we speak of wide-bandgap materials, we are referring to gallium nitride (GaN), silicon carbide (SiC), and other compound semiconductors that have a relatively wide forbidden band (on the order of between 1.7 and 7 electron volts) compared with silicon and gallium arsenide. More work is still needed for this technology to be available for many of the applications mentioned in this publication. Issues such as gate leakage and defect densities (which affect wafer size) need to be addressed.

DTIC

*Forbidden Bands; Semiconductors (Materials)*

**20070027527** Colorado Univ., Boulder, CO USA  
**Atomtronics: Ultracold Atom Analogs of Electronic Devices**  
Seaman, B T; Kraemer, M; Anderson, D Z; Holland, M J; Jun 23, 2006; 13 pp.; In English  
Contract(s)/Grant(s): FA9550-04-1-0460; Proj-T139/00  
Report No.(s): AD-A467798; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Atomtronics focuses on atom analogs of electronic materials, devices and circuits. A strongly interacting ultracold Bose gas in a lattice potential is analogous to electrons in solid-state crystalline media. As a consequence of the band structure, cold atoms in a lattice can exhibit insulator or conductor properties. P-type and N-type material analogs can be created by introducing impurity sites into the lattice. Current through an atomtronic wire is generated by connecting the wire to an atomtronic battery which maintains the two contacts at different chemical potentials. The design of an atomtronic diode with a strongly asymmetric current-voltage curve exploits the existence of superfluid and insulating regimes in the phase diagram analog of a bipolar junction transistor. Our results provide the building blocks for more advanced atomtronic devices and circuits such as amplifiers, oscillators and fundamental logic gates.

DTIC

*Analogs; Atoms; Electronic Equipment*

**20070027531** New Mexico Univ., Albuquerque, NM USA

**Polarimeter in a Pixel**

Krishna, Sanjay; Mar 13, 2007; 6 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0396

Report No.(s): AD-A467805; 1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An imaging polarimeter captures an image with both the intensity and the average polarization state recorded for each pixel. A polarimetric image has more information than a simple intensity image and improves remote sensing and automatic target recognition. The current technology of imaging polarimeters cannot reliably measure high-spatiotemporal polarization or high-spectral-resolution polarization of a moving scene; the camera reports huge errors at the boundaries of objects in the scene or trades-off spatial and spectral resolution to achieve faster measurements. The aim of the proposed project is to realize a new optoelectronic device that completely and instantaneously measures the incident light's polarization for a narrow wavelength band in a single physical pixel. We have undertaken theoretical modeling of the Polarimeter in a Pixel and undertook one round of fabrication of the device. Although the device exhibited good mid infrared absorption, the electrical characteristics were poor due to residual Silicon Nitride. We are requesting follow on funding to undertake experimental studies on this project in collaboration with AFRL/VSSS.

DTIC

*Imaging Techniques; Pixels; Polarimeters*

**20070027569** Naval Postgraduate School, Monterey, CA USA

**Spread Spectrum Signal Characteristic Estimation Using Exponential Averaging and an AD-HOC Chip rate Estimator**

Weber, John B; Mar 2007; 155 pp.; In English

Report No.(s): AD-A467872; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This dissertation investigates two methods of spread spectrum (SS) signal characteristic estimation for the two principle types of SS systems, frequency-hopped (FH) and direct sequence SS. The exponential averaging detector is used to detect and estimate the hopped frequencies of a SS-FH signal in the presence of interference signals as well as additive-white-Gaussian-noise (AWGN). The detection method provides an estimate of the AWGN plus interference spectrum using exponential averaging and then generates an estimate of the desired signal spectrum by combining the estimated AWGN plus interference spectrum with the composite (desired signal plus interference plus AWGN) spectrum. Finally, this dissertation evaluates the detector's performance as a function of the exponential coefficient, the combining method, the probability of false alarm, signal-to-AWGN ratio, and signal-to-interference ratio. The second method of SS signal characteristic estimation uses a digital ad-hoc chip rate estimator (ACRE). The ACRE is used to estimate the chip rate of a half-sine pulse shaped SS direct-sequence signal. The ACRE is explained in relation to its similarities and contrasts to the chip rate detector. The components and performance of the ACRE are presented for standard-ACRE, ACRE with additional filtering, and ACRE with incrementing. The additional filtering results in a reduced chip rate search range but yields improved estimation performance and incrementing has the potential for parallel processing, resulting in dramatically decreased computational time, without loss of performance.

DTIC

*Chips; Estimates; Signal to Noise Ratios; Spectra; Spread Spectrum Transmission*

**20070027579** Illinois Univ., Chicago, IL USA

**Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems**

Uslenghi, Piergiorgio L; Erricolo, Danilo; Yang, Hung-Yu D; Feb 28, 2007; 55 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0436

Report No.(s): AD-A467894; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research is directed to understanding and modeling the effects of electromagnetic pulse interactions with electronic circuits and systems, and is focused on four major tasks. (1) Characterization of coupling mechanisms responsible for guiding electromagnetic energy from the source to the electronic components, via topology schemes based on a generalized scattering matrix. Frequency-domain and time-domain solvers are developed for large-scale systems. The results are validated via measurements and via comparison with new canonical solutions to scattering and penetration problems. (2) Characterization of the spurious waveforms at the input ports of the electronic systems. A full-wave three-dimensional analysis of linear passive systems is developed to convert the radiating and conducting EMI into sets of noise sources at the ports of nonlinear active circuits. A network-oriented nonlinear transient simulator is developed for small-signal and large-signal analysis of nonlinear electronics, including the distributed nature of the coupling path and EMI sources. (3) Determination of conditions for induced change-of-logic states and alterations of logic functions for digital circuits and computer systems. A fault-tolerance analysis

is developed to determine, classify, monitor and control various system program errors under EM threat. (4) Experiments to validate EM penetration and coupling predictions, and circuit and system fault models.

DTIC

*Broadband; Circuits; Electromagnetic Interference; Electromagnetic Pulses; Microwaves; Topology*

**20070027651** Palacky Univ., Olomouc, Czechoslovakia

**Nonclassical Properties of Pulsed Second-Subharmonic Generation in Photonic-Band-Gap Structures**

Perina, Jan; Haderka, Ondrej; Scalora, Michael; Apr 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N62558-05-P-0421

Report No.(s): AD-A468027; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A waveguide made of LiNbO<sub>3</sub> with a periodic linear corrugation on its surface is analyzed from the point of view of squeezed-light generation. It is shown that scattering of nonlinearly interacting optical fields caused by the corrugation improves efficiency of the nonlinear process under certain conditions. These conditions are found approximately analytically and confirmed numerically. The linear corrugation can be tuned both into the pump as well as second-subharmonic field in order to improve efficiency of the nonlinear process. The analysis provides a detailed understanding of the role of all parameters of the waveguide and this enables to specify optimum values of parameters to achieve the best values of squeezing. In pulsed regime the right choice of spectral modes is important to observe squeezing. These modes are found using the Bloch-Messiah reduction of the appropriate Green functions.

DTIC

*Energy Gaps (Solid State); Harmonic Generations; Lithium Niobates; Waveguides*

**20070027692** Wisconsin Univ., Milwaukee, WI USA

**Feasibility Study on Magnetic Content Addressable Memory**

Wang, Weizhong; May 10, 2007; 4 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0942

Report No.(s): AD-A468138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project is to investigate the feasibility of the novel magnetic content addressable memory (MCAM) design. The proposed MCAM is to integrate the data storage function and logic function together by using the Magnetic Tunneling Junction (MTJ). The major challenge is to individually program the two ferromagnets in MTJ which are separated by 2 nm. Our approach is to use layer thickness difference and magnetic field confinement within the ferromagnetic materials for programming. We used LLO micro-magnetic simulator to investigate the feasibility of the proposed MCAM operation. The feasibility studies covers both Cobalt and Permalloy based devices. The simulated structures included ideal 'picture frame' structure' as well as structures with non-ideal parts which can be introduced during fabrication. In all cases, the simulation results indicate that the MCAM can operate as expected. There are some vortex states introduced in non-ideal structures. However, the read currents are orders of magnitude below threshold current for domain wall movement. The MCAM is expected to work with those non-ideal structures.

DTIC

*Associative Memory; Computer Storage Devices; Data Storage; Feasibility; Ferromagnetic Materials; Magnetic Storage*

**20070027701** National Tsing Hua Univ., Hsinchu, Taiwan, Province of China

**Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices**

Hwang, Huey-Liang; Hwang, Jung-Min; Yei, Brian; Lee, Kuan-Feng; Sep 5, 2006; 95 pp.; In English

Report No.(s): AD-A468270; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wide-gap III-Nitride based white light emission had been proven to yield luminescence efficiency (20-30 Lumen/W) and the III-Nitride devices proved long lifetime (>10khr). It is expected that high efficiency III-Nitride based white light emission will be the major lighting source for daily illumination in the coming decades. In 1998, the world energy consumption of energy is 69,000 TWh. There had been 2300 TWh consumption in illumination with rather inefficiently way. To further largely improve the luminescence efficiency beyond 100 Lumen/W and to increase thermal stability of the III-Nitride based LED, devices in the quantum structure is the viable way to pursuit.

DTIC

*Etching; Fabrication; Gallium Nitrides; Nitrides; Quantum Dots; Semiconducting Films*

**20070027703** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**Novel Organic Field Effect Transistors via Nano-Modification**

Wen, Ten-Chin; Chou, Wei-Yang; Guo, Tzung-Fang; Wang, Yeong-Her; Jul 2005; 52 pp.; In English

Contract(s)/Grant(s): FA5209-04-P-0518

Report No.(s): AD-A468286; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In recent years, organic/polymer field-effect transistors (FETs) provide inherent advantages of low cost, large area fabrication, simple packing, and compatibility with flexible substrates. The performance of organic FETs is determined primarily by the field effect mobility of the carriers in the organic semiconductor layers and by the efficiency of injecting and extracting carriers at source and drain currents. For virtually all classes of organic semiconductors, the intrinsic carrier mobility depends on the degree of molecular ordering critically and the extent of the stacking in the material. Under these conditions, we propose to enhance carrier mobility by using two kinds of nano-scale films. One is to apply the photoalignment method on a nano-scale film to control the orientation of pentacene molecules as an active layer in the thin-film transistors with conspicuously anisotropic electrical characteristics. Another is to employ also a nano-scale film (polymer electrolyte) to control moving of ions in/out an active semiconductor, pentacene or conducting polymer, for improving carrier mobility. In this project, pentacene or a series of conducting polymers, such as the derivatives of PANI and P3HT will be patterned and manufactured in FETs. Nano-scale films including polyimide for photoalignment/ion beam treatment and polymer electrolyte for ion doped/doped modification are to achieve the high mobility.

DTIC

*Field Effect Transistors; Nanotechnology; Organic Materials*

**20070027730** Illinois Univ., Urbana, IL USA

**New Column Designs for MicroGC (Preprint)**

Radadia, Adarsh D; Masel, Richard I; Shannon, Mark A; Nov 2006; 6 pp.; In English

Contract(s)/Grant(s): FA8650-04-1-7121; Proj-4H20

Report No.(s): AD-A468403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

New column designs that give lower dispersion than column designs presented previously are presented. All of the work so far has concentrated on columns that are arranged with a spiral geometry. Spiral columns show lower dispersion than serpentine in chip scale electrophoresis and the assumption has been that spirals would also give lower dispersion than serpentine for microGC. We also test various turn geometries to see which gives the lowest dispersion. We have examined spiral and serpentine columns. We have also considered several turn geometries.

DTIC

*Experiment Design; Fabrication; Methane; Wave Dispersion*

**20070027736** Materials Research Society, Warrendale, PA USA

**Symposium Q: Magnetic Thin Films, Heterostructures, and Device Materials**

Bailey, William; May 22, 2007; 25 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0281

Report No.(s): AD-A468427; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In Symposium Q on Magnetic Thin Films, Heterostructures, and Device Materials, spin-dependent tunneling junctions were presented, with a particular focus on Fe/MgO/Fe junctions. Tunneling magnetoresistance values in this system have recently attained up to 350% at room temperature, several times higher than those seen in any other materials system. High magnetoresistance values were presented experimentally, treated through ab initio models, and correlated with MgO barrier structure by in situ STM and XPs characterization. Prospects for incorporation into nonvolatile magnetic RAM devices were also reviewed. Among other highlights were possibilities for novel interactions of ferromagnetic layers with other functional material types; novel rectifying possibilities, predicted theoretically, for the integration of ferroelectric such as SrTiO<sub>3</sub>, in the tunnel barrier between metallic Co electrodes; unambiguous proof of electrical injection and detection of spin-polarized electrons from metallic ferromagnets through GaAs, through the Hanle effect; and all-oxide magnetic tunneling junctions based on NiMn<sub>2</sub>O<sub>4</sub> barriers. Materials approaches to increasing subnanosecond switching speeds, critical for high-data-rate (>10 GHz) information storage, were presented. It was shown that the damping constant for high-speed motion can be predicted from first principles only in layered structures; controlled in epitaxial Fe alloys, potentially reduced below the intrinsic value of pure Fe; correlated with the femtosecond demagnetization process; and understood microscopically through picosecond-scale time-resolved x-ray spectroscopy. Composition spread approaches for the discovery of high-frequency magnetic materials were also reviewed.

DTIC

*Conferences; Heterogeneity; Magnetic Films; Magnetic Materials; Magnetoresistivity; Thin Films*

**20070027801** Geophex Ltd., Raleigh, NC USA

**Handheld Broadband Electromagnetic UXO Sensor**

Won, I J; SanFilipo, Bill; Oren, Alex; Dec 2006; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-MM-0036

Report No.(s): AD-A468547; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Detection of unexploded ordnance (UXO) and discrimination between UXO and metallic clutter pose challenges to cost-effective remediation of UXO-contaminated land in order to reclaim it for civilian use. The need to develop sensors that can be deployed in a realistic setting and accomplish these goals motivated this project. The broadband electromagnetic sensor improvement and demonstration undertaken in this project took the prototype GEM-3 and evolved it into an operational sensor with increased bandwidth and dynamic range, and enough memory and processing power to allow efficient data acquisition while decreasing the weight for ease of operation. Specifically, the frequency range was doubled from 24 kHz to 48 kHz; the 24-bit analog-to-digital converter (ADC) replaced the 16-bit ADC, providing 48 dB increased dynamic range; the digital signal processor (DSP) was upgraded to be fast enough to allow continuous operation at more than 10 frequencies simultaneously; and compact-flash memory was added, accommodating internal storage of a day's surveying. In addition to the original handheld configuration specified at the outset, a cart-mounted, large-coil configuration has also been developed for surveying large open areas. A more detailed description is provided in Section 2.0, Technology Description.

DTIC

*Ammunition; Broadband; Detectors; Portable Equipment*

**20070027803** Colorado State Univ., Fort Collins, CO USA

**Electronically Induced Redox Barriers for Treatment of Groundwater**

Sale, Tom; Gilbert, David; Oct 2006; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-0112

Report No.(s): AD-A468551; ER-0112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes results from a 3-year collaboration between the Environmental Security Technology Certification Program (ESTCP) and Colorado State University (CSU). The focus is an innovative electrolytic approach for managing redox-sensitive contaminants in groundwater, referred to as electrically induced redox barrier (e-barriers). The overarching objective of the work is to demonstrate/validate a new technology for managing contaminated groundwater at the Department of Defense (DoD) facilities that holds promise in terms of efficacy and cost. The premise underlying the technology is that closely spaced permeable electrodes can be installed through a groundwater contaminant plume in the format of a permeable reactive barrier. Application of low voltage direct current (DC) drives sequential oxidation and/or reduction of contaminants with the net benefit of reducing contaminant flux. The site selected for the demonstration is a shallow alluvial plume containing approximately 300 micrograms/L of trichloroethene (TCE). The e-barrier was designed and fabricated at CSU in May through July 2002 and was installed at F.E. Warren Air Force Base (AFB) in August 2002. Following installation, the e-barrier was allowed to equilibrate with the contaminant in the plume for 5 months. Power was applied to the e-barrier in January 2003, and as of August 2004, the e-barrier has been operating continuously (approximately 19 months). As implemented, the e-barrier met the functional objective of the demonstration, and experience gained through the demonstration provides insight into avenues for optimization. Electrical cost and performance is monitored continuously using a remote data acquisition system. Eighteen months of operation indicates that the electrical components are reliable and power costs low (an average of \$0.013/m<sup>2</sup>/day).

DTIC

*Ground Water; Oxidation-Reduction Reactions; Pollution Control; Water Pollution*

**20070027811** Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA

**Taiwan - AFOSR Nanoscience Initiative Status**

Fay, Anne M; Dec 6, 2005; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468563; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of the conference was to establish mutually beneficial scientific interactions between researchers in Taiwan and AFRL scientists. It was to foster basic research innovation and interactions between scientists and enhance future USAF capabilities through support of Air Force fundamental nanoscience research efforts. The definition of USAF Nanoscience is to work at the atomic, molecular and supramolecular levels, in the length scale of approximately 1-100 nm in range; understand

novel phenomena, properties and functions that occur on nm length scales; manipulate matter at the nanoscale to control those properties and functions; and achieve macroscale functionality based on properties at the nonoscale.

DTIC

*Military Technology; Nanotechnology; Research and Development; Taiwan*

**20070028429** Virginia Univ., Charlottesville, VA, USA

**Sharp-Looking Geometric Partitioning**

Bapat, S; Cohoon, J P; Feb 1991; 6 pp.; In English

Contract(s)/Grant(s): N00014-89-J1699

Report No.(s): AD-A466431; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466431>

A new technique, named SHARP, is presented for the partitioning of Very-Large-Scale Integration (VLSI) integrated circuits. SHARP is a hill-climbing heuristic that is designed to be incorporated into a partitioning-based placement algorithm. The method is more strongly influenced by the geometry of the layout surface than other partitioning methods, such as min-cut partitioning and the quadrisection approach. It is tuned for intra-package connections rather than inter-package connections. The method is named SHARP because the layout circuit surface is decomposed geometrically into nine regions in a manner that resembles a musical ‘#’, or sharp sign. Its other important features include a multi-objective function that more accurately represents wire usage than the standard min-cut criterion, and extensive use of Steiner trees. A series of experiments demonstrates that the SHARP technique produces very high quality partitions.

DTIC

*Circuits; Computer Aided Design; Decomposition; Geometry; Very Large Scale Integration*

**20070028435** Washington Univ., Seattle, WA USA

**Meso-Scale Self-Assembly Pilot Study**

Parviz, Babak A; Apr 17, 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0578

Report No.(s): AD-A466178; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466178>

The project investigates the formation of micro-scale structures using capillary force-driven self-assembly. Two main activities were undertaken during the course of the project: determination of the proper self-assembly environment and scaling of the metal contacts, and development of microfabrication processes that can generate micron-scale single crystal silicon parts that can participate in a self-assembly process. The effect of the alloy composition, chemical composition of the self-assembly environment, and contact metallization were extensively studied and an optimum condition for scaling the metal contacts was determined. Microfabrication processes on SOI wafers were developed to form parts that can participate in 2D and 3D self-assembly processes.

DTIC

*Alloys; Integrated Circuits; Self Assembly*

**20070028564** Okeefe Egan and Peterman, LLP, Austin, TX, USA

**Non-Multiple Delay Element Values for Phase Shifting**

Hein, P. W., Inventor; 29 Apr 04; 14 pp.; In English

Contract(s)/Grant(s): F33657-00-G-4029-0204

Patent Info.: Filed Filed 29 Apr 04; US-Patent-Appl-SN-10-835-274

Report No.(s): PB2007-104056; No Copyright; Avail.: CASI: A03, Hardcopy

Non-multiple delay element values that may be implemented to reduce periodic quantization errors associated with phase shifting devices used in phased array apparatus. The non-multiple delay element values may be implemented so that a magnitude of phase shift imparted by a given delay element of a phase shifting scheme is not a multiple or a factor of the magnitude of the phase shift imparted by any other delay element employed in the same phase shifting scheme.

NTIS

*Antenna Arrays; Phase Shift*

**20070028566** Wells Saint John, P.S, Spokane, WA, USA

**Tag Device, Luggage Tag, and Method of Manufacturing a Tag Device**

Lind, M. A., Inventor; Bagaglio, M. J., Inventor; Morgan, G. B., Inventor; 29 Apr 04; 11 pp.; In English

Contract(s)/Grant(s): DE-AC0676RLO1830

Patent Info.: Filed Filed 29 Apr 04; US-Patent-Appl-SN-10-837-128

Report No.(s): PB2007-104055; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A tag device includes a strap having a first end and a second end and configured to encircle a member to which the tag device is to be secured, the first end being configured to be attached to the second end of the strap, with the strap encircling a member to which the tag device is to be secured; and circuitry supported by the strap and useful for determining if the strap has been removed from the member after the first end has been attached to the second end. Other apparatus and a method of manufacturing a tag device are also provided.

NTIS

*Baggage; Manufacturing; Security; Identifying*

**20070028568** Air Force Research Lab., Rome, NY, USA

**T/R Module for Satellite TT&C Ground Link**

Tomasic, B., Inventor; Bharj, S. S., Inventor; Oleski, P. J., Inventor; Turtle, J. P., Inventor; 29 Apr 05; 13 pp.; In English

Patent Info.: Filed Filed 29 Apr 05; US-Patent-Appl-SN-11-124-511

Report No.(s): PB2007-104054; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Transmit/Receive (T/R) module that provides multiple simultaneous ground to satellite links with rapid pointing and acquisition. The (T/R) module incorporates independent gain and phase control. Left-hand or right-hand circular polarization can be supplied to dual feed antennas. Present invention allows each antenna to be independently polarized. Low-cost componentry is utilized throughout. On-board control of the (T/R) module is obtained using a complex programmable logic device (CPLD) and a micro controller. CPLD provides separate control of four phase shifters, attenuators, channel polarization as well as transmitter on/off control. Telemetry is provided through built-in test (BIT) routine.

NTIS

*Antenna Arrays; Satellite Networks; Transmitter Receivers; Data Links*

**20070028570** Kodak (Kelly K.), Dallas, TX, USA

**Self Limiting Gate Leakage Driver**

Ngo, H. C., Inventor; Kuang, J. B., Inventor; Nowka, K. J., Inventor; 29 Apr 04; 19 pp.; In English

Contract(s)/Grant(s): DARPA-NBCH30390004

Patent Info.: Filed Filed 29 Apr 04; US-Patent-Appl-SN-10-835-501

Report No.(s): PB2007-104053; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A buffer/driver having large output devices for driving multiple loads is configured with three parallel paths. The first logic path is made of small devices and is configured to provide the logic function of the buffer without the ability to drive large loads. Second and third logic paths have the logic function of the first logic path up to the last inverting stage. The last inverting stage in each path is a single device for driving the logic states of the buffer output. The second and third logic paths have power-gating that allows the input to the pull-up and pull-down devices to float removing gate-leakage voltage stress. When the second and third logic paths are power-gated, the first logic path provides a keeper function to hold the logic state of the buffer output. The buffer may be an inverter, non-inverter, or provide a multiple input logic function.

NTIS

*Circuits; Leakage; Metal Oxide Semiconductors*

**20070028571** California Univ., Oakland, CA, USA

**Two Bit/Four Bit SONOS Flash Memory Cell**

She, M., Inventor; King, T. J., Inventor; 2 May 05; 15 pp.; In English

Contract(s)/Grant(s): DARPA-MDA972-01-1-0035

Patent Info.: Filed Filed 2 May 05; US-Patent-Appl-SN-11-120-468

Report No.(s): PB2007-104052; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Charge migration in a SONOS memory cell is eliminated by physically separating nitride layer storage sites with

dielectric material. Increased storage in a cell is realized with a double gate structure for controlling bit storage in line channels between a source and a drain, such as with a FinFET structure in which the gates are folded over the channels on sides of a fin.

NTIS

*Computer Storage Devices; Memory (Computers); Nitrides; Random Access; Semiconductors (Materials); Silicon Oxides*

**20070028575** Honeywell International, Inc., Morristown, NJ, USA

**Self-Aligned Body Tie for a Partially Depletion SOI Device Structure**

Fechner, P., Inventor; 31 Mar 05; 17 pp.; In English

Contract(s)/Grant(s): DTRA 01-00-C-0017

Patent Info.: Filed Filed 31 Mar 05; US-Patent-Appl-SN-11-096-014

Report No.(s): PB2007-104595; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A silicon-on-insulator (SOI) device structure 100 formed using a self-aligned body tie (SABT) process. The SABT process connects the silicon body of a partially depleted (PD) structure to a bias terminal. In addition, the SABT process creates a self-aligned area of silicon around the edge of the active areas, as defined by the standard transistor active area mask, providing an area efficient device layout. By reducing the overall gate area, the speed and yield of the device may be increased. In addition, the process flow minimizes the sensitivity of critical device parameters due to misalignment and critical dimension control. The SABT process also suppresses the parasitic gate capacitance created with standard body tie techniques.

NTIS

*Depletion; Semiconductors (Materials); Silicon*

**20070028593** Kucshman (Brooks), P.C., Southfield, MI, USA

**Micromechanical Resonator Device Having a Desired Mode Shape**

Nguyen, C. T. C., Inventor; Xie, Y., Inventor; 17 Nov 04; 6 pp.; In English

Contract(s)/Grant(s): DARPA-F30602-01-1-0573

Patent Info.: Filed Filed 17 Nov 04; US-Patent-Appl-SN-10-990-785

Report No.(s): PB2007-104589; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A micromechanical resonate device having an extensional wine-glass mode shape is described herein. Different embodiments of the device may employ vibrating polysilicon micromechanical ring resonators, utilizing a unique extensional wine-glass mode shape to achieve lower impedance than previous UHF resonators at frequencies as high as 1.2-GHz with a Q of 3,700, and 1.47-GHz (highest to date for polysilicon micromechanical resonators) with a Q of 2,300. The 1.2-GHz resonator exhibits a measured motional resistance of 560 k(OMEGA) with a dc-bias voltage of 20V, which is 6(times) lower than measured on radial contour mode disk counterparts at the same frequency, and which can be driven down as low as 2 k(OMEGA) when a dc-bias voltage of 100V and electrode-to-resonator gap spacing of 460 (ANG) are used. The above high Q and low impedance advantages, together with the multiple frequency, on-chip integration advantages afforded by electrostatically-transduced (mu)mechanical resonators, may be utilized in the front-end RF filtering and oscillator functions needed by wireless communication devices.

NTIS

*Microelectromechanical Systems; Micromechanics; Resonators; Vibration Mode*

**20070028609** Chau (F.) and Associates, LLC, East Meadow, NY, USA

**Method of Forming Quantum Dots at Predetermined Positions on a Substrate**

Kammler, M., Inventor; Ross, F. M., Inventor; Reuter, M. C., Inventor; Hull, R., Inventor; Vlasov, Y. A., Inventor; 13 Feb 04; 9 pp.; In English

Contract(s)/Grant(s): NIST-DMR0080016

Patent Info.: Filed Filed 13 Feb 04; US-Patent-Appl-SN-10-779-457

Report No.(s): PB2007-104299; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method of forming at least one quantum dot on a predetermined area of a substrate includes forming a nucleation site having at least one surface or subsurface defect at the predetermined area of the substrate by implantation with ions, and growing a quantum dot on the nucleation site.

NTIS

*Quantum Dots; Quantum Electronics; Substrates*



**20070028611** Haynes and Boone, LLP, Dallas, TX, USA

**Microconnectors and Non-Powered Microassembly Therewith**

Tsul, K., Inventor; Geisberger, A., Inventor; Skidmore, G., Inventor; 13 Feb 04; 18 pp.; In English

Contract(s)/Grant(s): NIST-70NANB1H3021

Patent Info.: Filed Filed 13 Feb 04; US-Patent-Appl-SN-10-778-460

Report No.(s): PB2007-104297; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A MEMS microconnector including a compliant handle and a deflectable connection member. The compliant handle is configured to frictionally engage a manipulation probe. The deflectable connection member includes a first end coupled to the handle and a second end configured to deflect and thereby engage a receptacle in response to disengagement of the manipulation probe from the handle.

NTIS

*Microelectromechanical Systems; Microelectronics; Connectors*

**20070028681** Swedish Defence Research Establishment, Linköping, Sweden

**Radiated Susceptibility Test in Reverberation Chamber**

Hojjer, M.; Jun. 2006; 51 pp.; In English

Report No.(s): PB2007-109932; FOI-R-2007-SE; Copyright; Avail.: National Technical Information Service (NTIS)

We show, by theory and experiment, that the stress put onto the equipment under test (EUT) when performing a radiated susceptibility test (RST) in a reverberation chamber (RC) is not affected by either the directivity pattern or the polarisation pattern of the EUT. The stress put onto the EUT will differ from the stress measured by a reference antenna in the RC. We have developed distribution functions for this discrepancy.

NTIS

*Reverberation Chambers; Test Chambers; Distribution Functions*

**20070028683** Army Research Lab., Aberdeen Proving Ground, MD USA

**Incident, Action, Recovery, and Recommissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD**

Zielinski, Alex; Del Guercio, Miguel; Michlin, Alex; Niles, Steve; Canami, Anthony; Glassman, Robert; Apr 2007; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-AH80

Report No.(s): AD-A466484; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466484>

A 4.5-MJ capacitor-based pulsed power system (PPS), previously owned and operated by General Dynamics Land Systems in the early 1990s, was acquired by the U.S. Army Research Laboratory. The system was placed in storage in the late 1990s. It was recently modified and, in 2001, was placed back in operation at barricade C to operate with an electromagnetic (EM) railgun load. On 9 February 2006, a capacitor in module 4 developed an internal short while charged to 7.2 kV. Further inspection revealed arc damage at the center post terminal on 20 capacitors in nearby modules and some amount of rust on every capacitor case. After the incident, all modules were charged individually to 3.2 kV and discharged into a short. The data indicates that the damaged center posts likely occurred quite some time ago. New hardware was required to restore relevant capability to barricade C. The capacitors from the primary and essential basis for the system. The PPS must be capable of reliably delivering higher energy pulses. New capacitors using modern manufacturing techniques and improved dielectrics were purchased. New center posts were designed and replaced concomitant with the installation of new capacitors. Lastly, the bus work that connects the pulse-forming inductor to the pulse-forming-network output cable was replaced in order to decrease the number of bolted joints and increase reliability at high-energy operation. Upon completing the upgrade in hardware, each module was discharged into a short at the breech of the railgun at initial charge voltages of 3, 5, and 7 kV. Additionally, all 18 modules were sequentially discharged into the shorted breech. Lastly, firings using a railgun were completed without incident. All simulation models were updated as necessary throughout the commissioning process. The stored energy at the maximum charge voltage of 11 kV is now 5.2 MJ.

DTIC

*Armatures; Electric Potential; Loads (Forces)*

**20070028772** Space and Naval Warfare Systems Command, San Diego, CA USA

**A Pareto Approach to Lossy Matching**

Allen, J C; Arceo, D; Sep 2006; 62 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467597; SSC-TR-1942; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report originated in the In-House Laboratory Independent Research Program of SPAWAR Systems Center San Diego and continues the migration of H(infinity) Engineering into fleet applications. As more communication systems are installed and radar cross-section requirements become stricter, shipboard space has become extremely limited and new antenna designs must be considered. As antenna size is reduced, a tradeoff between efficiency and bandwidth is forced. This report offers a multiobjective solution where transducer power gain is traded to reduce the large reflection at the feed of the antenna. Although lossy matching is an anathema for standard antenna matching, trading gain against reflection is rational design objective for a small antenna provided the corresponding Pareto front can be computed. This report offers several techniques to compute the Pareto front for a given lossy topology random sampling, orbit techniques based on lossless matching, and the adaptation of the H(infinity) techniques. These Pareto front computations readily adapt to other lossy matching tradeoffs and offer a general approach to lossy matching.

DTIC

*Ships; Antenna Design*

**20070028880** Lawrence Livermore National Lab., Livermore, CA USA

**Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses**

Javedani, J. B.; Goerz, D. A.; Houck, T. L.; Lauer, E. J.; Speer, R. D.; Mar. 06, 2007; 64 pp.; In English

Report No.(s): DE2007-902244; UCRL-TR-228713; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report we summarize our modeling and simulation efforts, theoretical studies, and experimental investigations. The computational work began by exploring the limits of commercially available codes and demonstrating methods to examine field enhancements and defect mechanisms at microscopic levels. Plasma simulations with particle codes used in conjunction with circuit models of the experimental apparatus enabled comparisons with experimental measurements. The large scale plasma (LSP) particle-in-cell (PIC) code was run on multiprocessor platforms and used to simulate expanding plasma conditions in vacuum gap regions. Algorithms were incorporated into LSP to handle secondary electron emission from dielectric materials to enable detailed simulations of flashover phenomenon. Theoretical studies were focused on explaining a possible mechanism for anode initiated surface flashover that involves an electron avalanche process starting near the anode, not a mechanism involving bulk dielectric breakdown. Experiments were performed in Engineering's Pulsed Power Lab using an available 100-kV, 10-ns pulse generator and vacuum chamber. The initial experiments were done with polyethylene insulator material in the shape of a truncated cone cut at +45DG angle between flat electrodes with a gap of 1.0 cm. The insulator was sized so there were no flashovers or breakdowns under nominal operating conditions. Insulator flashover or gap closure was induced by introducing a plasma source, a tuft of velvet, in proximity to the insulator or electrode.

NTIS

*High Voltages; Insulators; Vacuum*

**20070028882** Fermi National Accelerator Lab., Batavia, IL, USA

**Structural Investigations of Surface and Orientation-Specific Phenomena in Nanocrystals and Their Assemblies**

Aruguete, D. M.; 1 Jan. 2006; 175 pp.; In English

Report No.(s): DE2007-901229; No Copyright; Avail.: Department of Energy Information Bridge

Studies of colloidal nanocrystals and their assemblies are presented. Two of these studies concern the atomic-level structural characterization of the surfaces, interfaces, and interiors present in II-VI semiconductor nanorods. The third study investigates the crystallographic arrangement of cobalt nanocrystals in self-assembled aggregates. Crystallographically-aligned assemblies of colloidal CdSe nanorods are examined with linearly-polarized Se-EXAFS spectroscopy, which probes bonding along different directions in the nanorod. This orientation-specific probe is used, because it is expected that the presence of specific surfaces in a nanorod might cause bond relaxations specific to different crystallographic directions. Se-Se distances are found to be contracted along the long axis of the nanorod, while Cd-Se distances display no angular dependence, which is different from the bulk. Ab-initio density functional theory calculations upon CdSe nanowires indicate that relaxations on the rod surfaces cause these changes.

NTIS

*Cobalt; Colloids; Nanocrystals; Nanorods; Semiconductors (Materials)*

**20070029249** Sandia National Labs., Albuquerque, NM USA

**Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems**

Sullivan, J. P.; Modine, N. A.; Czaplewski, D. A.; Friedmann, T. A.; Wendt, J. R.; Jan. 2007; 58 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): DE2007-900851; SAND2006-7937; No Copyright; Avail.: National Technical Information Service (NTIS)

Understanding internal dissipation in resonant mechanical systems at the micro- and nanoscale is of great technological and fundamental interest. Resonant mechanical systems are central to many sensor technologies, and microscale resonators form the basis of a variety of scanning probe microscopies. Furthermore, coupled resonant mechanical systems are of great utility for the study of complex dynamics in systems ranging from biology to electronics to photonics. In this work, we report the detailed experimental study of internal dissipation in micro- and nano-mechanical oscillators fabricated from amorphous and crystalline diamond materials, atomistic modeling of dissipation in amorphous, defect-free, and defect-containing crystalline silicon, and experimental work on the properties of one-dimensional and two-dimensional coupled mechanical oscillator arrays. We have identified that internal dissipation in most micro- and nano-scale oscillators is limited by defect relaxation processes, with large differences in the nature of the defects as the local order of the material ranges from amorphous to crystalline. Atomistic simulations also showed a dominant role of defect relaxation processes in controlling internal dissipation. Our studies of one-dimensional and two-dimensional coupled oscillator arrays revealed that it is possible to create mechanical systems that should be ideal for the study of non-linear dynamics and localization.

NTIS

*Defects; Resonators; Microelectromechanical Systems*

**20070029255** Arizona Univ., Tucson, AZ, USA

**Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor**

Saavedra, S. S.; Armstrong, N. R.; Feb. 20, 2007; 11 pp.; In English

Report No.(s): DE2007-899970; No Copyright; Avail.: National Technical Information Service (NTIS)

This research program explored development of artificial, biomimetic photosynthetic assemblies that perform the initial steps of bacterial photosynthesis, visible light absorption, charge separation, and vectorial proton pumping, in a planar supported lipid bilayer (PSLB), coupled to a semiconductor electrode. The creation of a light-driven, transmembrane proton pump interfaced to an electrically active support is significant because at the most basic level, the development of a proton motive force (pmf) across a biological membrane is one of the essential elements of biological energy conversion.

NTIS

*Bacteria; Biomimetics; Energy Conversion; Lipids; Membranes; Photosynthesis; Semiconductors (Materials); Solar Energy*

**20070029273** Swedish Defence Research Establishment, Linköping, Sweden

**Demonstratore Foer Stoerskydd av GNSS-Mottagare (Demonstrator for Anti-Jamming of GNSS Receivers)**

Paeaejaervi, L.; Andersson, P.; Dec. 2005; 36 pp.; In Swedish

Report No.(s): PB2007-106437; FOI-R-1823-SE; No Copyright; Avail.: National Technical Information Service (NTIS)

In the project Electronic Warfare on GNSS, sponsored by the Armed Forces, jamming and anti-jam techniques for GNSS receivers are studied. Antenna arrays and beam-forming is used as an anti-jam technique, and jamming of such systems is also considered. This report gives up-to-date overview of the demonstrator development within this project. The demonstrator is general and intended to be used for several tasks. One example is development, and selection, of beam-forming algorithms, later to be implemented on a more advanced platform. Measurements of the different parts of the demonstrator have been made. Antenna array measurements showed that the antenna array performs well, and that it should be possible to use it to direct beams towards the satellites. Measurements of the 4-channel front end established high levels of cross-talk between the printed circuit cards and the front end must hence be shielded.

NTIS

*Deception; Electronic Warfare; Jamming; Proving; Receivers*

**20070029309** Lawrence Livermore National Lab., Livermore, CA USA

**Infiniband Performance Comparisons of SDR, DDR and Infinipath**

Minich, M.; Jun. 02, 2006; 22 pp.; In English

Report No.(s): DE2007-900097; UCRL-TR-221775; No Copyright; Avail.: National Technical Information Service (NTIS)

This technical report will be comparing the performance between the most common infiniband-related technologies

currently available. Included will be TCP-based, MPI-based and low-level performance tests to see what performance can be expected from Mellanox's SDR and DDR as well as PathScale's Innipath. Also, we will be performing comparisons of the Innipath on both OpenIB as well as PathScale's ipath stack.

NTIS

*Performance Tests; Bandwidth*

**20070029348** Lawrence Livermore National Lab., Livermore, CA USA

**Electrostatic Modeling of Vacuum Insulator Triple Junctions**

Tully, L. K.; Goerz, D. A.; Houck, T. L.; Javedani, J. B.; Oct. 25, 2006; 7 pp.; In English

Report No.(s): DE2007-900151; UCRL-TR-227505; No Copyright; Avail.: National Technical Information Service (NTIS)

Triple junctions are often initiation points for insulator flashover in pulsed power devices. The twodimensional finite-element TriComp (1) modeling software suite was utilized for its electrostatic field modeling package to investigate electric field behavior in the anode and cathode triple junctions of a high voltage vacuum-insulator interface. TriComp enables simple extraction of values from a macroscopic solution for use as boundary conditions in a subset solution. Electric fields computed with this zoom capability correlate with theoretical analysis of the anode and cathode triple junctions within submicron distances for nominal electrode spacing of 1.0 cm. This paper will discuss the iterative zoom process with TriComp finite-element software and the corresponding theoretical verification of the results.

NTIS

*Electrostatics; Insulators; Vacuum*

**20070029358** Reinhart, Boerner, Van Deuren S.C., Milwaukee, MI, USA

**Perylene N-Type Semiconductors and Related Devices**

Marks, T. J., Inventor; Wasielewski, M. R., Inventor; Facchetti, A., Inventor; Abrens, M. J., Inventor; Jones, B. A., Inventor; 26 Jan 05; 21 pp.; In English

Contract(s)/Grant(s): N00014-02-0909; 0650-300-F445

Patent Info.: Filed Filed 26 Jan 05; US-Patent-Appl-SN-11-043 814

Report No.(s): PB2007-104626; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Organic semiconductors based on molecular and polymeric materials have become a major part of the electronics industry in the last 25 years as a complement to the shortcomings of inorganic semiconductors. Most notably, organic semiconductors offer, with respect to current inorganic-based technology, greater ease in substrate compatibility, device processability, flexibility, large area coverage, and reduced cost; as well as facile tuning of the frontier molecular orbital energies by molecular design. A key device used in the electronic industry is the field-effect transistor (FET) based on inorganic electrodes, insulators, and semiconductors. FETs based on organic semiconductors (OFET) may find niche applications in low-performance memory elements as well as integrated optoelectronic devices, such as pixel drive and switching elements in active-matrix organic light-emitting diode (LED) displays.

NTIS

*N-Type Semiconductors; Optoelectronic Devices; Organic Semiconductors; Molecular Orbitals*

**20070029359** Swedish National Testing and Research Inst., Boras, Sweden

**Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments**

Fast, L.; Franzon, J.; Mannikoff, A.; Boerjesson, A.; Jan. 2005; 60 pp.; In English

Report No.(s): PB2007-103412; SP-RAPP-2005:09; No Copyright; Avail.: National Technical Information Service (NTIS)

Electrical safety is top priority issue for most companies in the world today, both regarding the electrical safety of their customers, but also concerning their own employees during the manufacturing phase. Laws and regulations are very strict on the producers'/employers' responsibility on these issues. By introducing Electro Static Discharge (ESD) protection in a production facility, i.e. creating an ESD Protected Area (EPA), one can jeopardize the electrical safety for the personal; therefore it is highly advisable to always have authorized personal inspecting the EPA, with respect to electrical safety, after any alterations/installations have been performed.

NTIS

*Electronic Equipment; Garments; Protectors; Safety*

**20070029372** Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA

**Electrospray Emitter for Microfluidic Channel**

Kameoka, J., Inventor; Craighead, H. G., Inventor; 17 Mar 05; 10 pp.; In English

Contract(s)/Grant(s): ECS-9876771

Patent Info.: Filed Filed 17 Mar 05; US-Patent-Appl-SN-11-082 329

Report No.(s): PB2007-104646; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An electrospray ionization device incorporates a shaped thin film with a microfluidic channel. The device may be interfaced to a time-of-flight mass spectrometer (TFOMS). In one embodiment, the shaped thin film has a polygonal-shaped or triangle-shaped thin polymer tip formed by lithography and etching. The microfluidic channel is approximately 20 micrometer wide and 10 micrometers deep, and embossed in a substrate using a silicon master. The shaped thin film is aligned with the channel and bonded between the channel substrate and a flat plate to create a microfluidic channel with a wicking tip protruding from the end of the channel. Application of a high voltage at one end of the channel creates an electrospray from the tip, which is provided to the TFOMS.

NTIS

*Emitters; Microfluidic Devices*

**20070029374** Haynes and Boone, LLP, Dallas, TX, USA

**Method, System and Device for Microscopic Examination Employing Fib-Prepared Sample Grasping Element**

Sidmore, G., Inventor; Ellis, M. D., Inventor; Geisberger, A., Inventor; Bray, K., Inventor; Tuck, K., Inventor; 23 Sep 04; 25 pp.; In English

Contract(s)/Grant(s): NIST-70NANB1H3021

Patent Info.: Filed Filed 23 Sep 04; US-Patent-Appl-SN-10-948 385

Report No.(s): PB2007-104644; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method including, in one embodiment, severing a sample at least partially from a substrate by cutting the substrate with a focused ion beam (FIB), capturing the substrate sample by activating a grasping element, and separating the captured sample from the substrate. The captured sample may be separated from the substrate and transported to an electron microscope for examination.

NTIS

*Electron Microscopes; Activation*

**20070029387** Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA

**Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 378)**

Schaff, W. J., Inventor; Hwang, J., Inventor; 17 Mar 05; 15 pp.; In English

Contract(s)/Grant(s): NSF-0123453

Patent Info.: Filed Filed 17 Mar 05; US-Patent-Appl-SN-11-082 378

Report No.(s): PB2007-104643; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of forming a highly doped layer of AlGa<sub>N</sub>, is practiced by first removing contaminants from a MBE machine. Wafers are then outgassed in the machine at very low pressures. A nitride is then formed on the wafer and an AlN layer is grown. The highly doped GaAlN layer is then formed having electron densities beyond  $1 \times 10^{20}$  cm<sup>-3</sup> at Al mole fractions up to 65% are obtained. These levels of doping application of n-type bulk, and n/p tunnel injection to short wavelength UV emitters. Some applications include light emitting diodes having wavelengths between approximately 254 and 290 nm for use in fluorescent light bulbs, hazardous materials detection, water purification and other decontamination environments. Lasers formed using the highly doped layers are useful in high-density storage applications or telecommunications applications. In yet a further embodiment, a transistor is formed utilizing the highly doped layer as a channel.

NTIS

*Doped Crystals; Nitrides; Semiconductors (Materials)*

**20070029388** Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA

**Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 070)**

Schaff, W. J., Inventor; Hwang, J., Inventor; 16 Mar 05; 14 pp.; In English

Contract(s)/Grant(s): NSF-0123453

Patent Info.: Filed Filed 16 Mar 05; US-Patent-Appl-SN-11-082 070

Report No.(s): PB2007-104642; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A wide bandgap semiconductor material is heavily doped to a degenerate level. Impurity densities approaching 1% of the volume of the semiconductor crystal are obtained to greatly increase conductivity. In one embodiment, a layer of AlGa<sub>N</sub> is formed on a wafer by first removing contaminants from a MBE machine. Wafers are then outgassed in the machine at very

low pressures. A nitride is then formed on the wafer and an AlN layer is grown. The highly doped GaAlN layer is then formed having electron densities beyond  $1 \times 10^{20} \text{ cm}^{-3}$  at Al mole fractions up to 65% are obtained.

NTIS

*Doped Crystals; Nitrides; Semiconductors (Materials)*

**20070029448** Sandia National Labs., Albuquerque, NM USA

**Model Based Statistical Estimation of Sandia RF Ohmic Switch Dynamic Operation from Stroboscopic X-ray Imaging**

Diegert, C.; Dec. 01, 2006; 37 pp.; In English

Contract(s)/Grant(s): DE-AC04-97AL85000

Report No.(s): DE2007-900418; SAND2006-7894; No Copyright; Avail.: National Technical Information Service (NTIS)

The author defines a new diagnostic method where computationally-intensive numerical solutions are used as an integral part of making difficult, non-contact, nanometerscale measurements. The limited scope of this report comprises most of a due diligence investigation into implementing the new diagnostic for measuring dynamic operation of Sandia's RF Ohmic Switch. Our results are all positive, providing insight into how this switch deforms during normal operation. Future work should contribute important measurements on a variety of operating MEMS devices, with insights that are complimentary to those from measurements made using interferometry and laser Doppler methods. More generally, the work opens up a broad front of possibility where exploiting massive high-performance computers enable new measurements.

NTIS

*Imaging Techniques; Radio Frequencies; Statistical Analysis; Switches; Switching Circuits; X Ray Imagery*

**20070029451** Shapiro and Dupont, LLP, Santa Monica, CA, CA, USA

**Superlattice Nanopatterning of Wires and Complex Patterns**

Heath, J. R., Inventor; Petroff, P. M., Inventor; Melosh, N. A., Inventor; 28 Jul 03; 21 pp.; In English

Contract(s)/Grant(s): DARPA-MDA972-01-3-0005

Patent Info.: Filed 28 Jul. 03; US-Patent-Appl-SN-10-521 714

Report No.(s): PB2007-108663; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Fabrication of metallic or non-metallic wires with nanometer widths and nanometer separation distances without the use of lithography. Wires are created in a two-step process involving forming the wires at the desired dimensions and transferring them to a planar substrate. The dimensions and separation of the wires are determined by the thicknesses of alternating layers of different materials that are in the form of a superlattice. Wires are created by evaporating the desired material onto the superlattice that has been selectively etched to provide height contrast between layers. The wires thus formed upon one set of superlattice layers are then transferred to a substrate.

NTIS

*Superlattices; Wire*

**20070029472** Dority and Manning, Greenville, SC, USA

**Novel Synthesis of Branched Carbon Nanotubes**

Rao, A. M., Inventor; Gothard, N. W., Inventor; Gaillard, J. B., Inventor; 22 Apr 04; 16 pp.; In English

Contract(s)/Grant(s): NSF-NIRT 0304019; NSF-0132573

Patent Info.: Filed 22 Apr. 04; US-Patent-Appl-SN-10-829 660

Report No.(s): PB2007-104136; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention discloses a relatively simple CVD method for forming branched carbon nanotubes. In general, the method includes adding a dopant to the precursor materials. The dopant can be a material that has a thermodynamically more favorable carbide-forming reaction at the reactor conditions than does the catalyst that is provided to the reactor by a second precursor material. The doped nanoparticles formed in the reactor can adhere to the walls of the developing nanotubes and provide a nucleation site for the development of one or more branches on the nanotube. The nanotubes formed according to the invention can be recognized as such due to the presence of the doped nanoparticles adhered along the walls of the branched nanotubes.

NTIS

*Carbon Nanotubes; Nanostructure Growth; Patent Applications; Vapor Deposition*

**20070029477** Reinhart Boerner Van Deuren S.C., Milwaukee, WI, USA; Northwestern Univ., Chicago, IL, USA

**Organic Light-Emitting Diodes and Related Hole Transport Compounds**

Marks, T. J., Inventor; Huang, Q., Inventor; 24 Aug 04; 42 pp.; In English

Contract(s)/Grant(s): ONR-N0014-95-1-1319; NSF-DMR-00769097

Patent Info.: Filed 24 Aug. 04; US-Patent-Appl-SN-10-924 730

Report No.(s): PB2007-108621; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This invention relates generally to organic electroluminescent devices with organic films between anodic and cathodic electrodes, and more particularly to such devices and methods for their assembly using the condensation of various silicon moieties.

NTIS

*Light Emitting Diodes; Transport Theory; Electroluminescence*

**20070029483** Naval Surface Warfare Center, Panama City, FL, USA

**Object Detection in Electro-Optic Sensor Images**

Nevis, A. J., Inventor; Bryan, J. F., Inventor; Cordes, B. W., Inventor; Taylor, J. S., Inventor; Hulgan, M. C., Inventor; 26 Apr 04; 9 pp.; In English

Patent Info.: Filed 26 Apr 04; US-Patent-Appl-SN-10-834 155

Report No.(s): PB2007-104133; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method of object detection in an image uses a background anomaly approach that searches for anomalies of a particular size and shape that are distinguishable from the image's local background. Included is a geometric classifier used to distinguish regularly-shaped objects from irregularly-shaped objects.

NTIS

*Detection; Electro-Optics; Image Processing; Sensors*

**20070029484** Ostrager, Chong, Flaherty, and Broitman, P.C., New York, NY, USA

**Reconfigurable Linear Sensor Arrays for Reduced Channel Count**

Thomenius, K. E., Inventor; Fisher, R. A., Inventor; Wodnicko, R. G., Inventor; Hazard, C. R., Inventor; Smith, L. S., Inventor; 21 Dec 04; 21 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0181

Patent Info.: Filed 21 Dec 04; US-Patent-Appl-SN-11-018 238

Report No.(s): PB2007-104132; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A reconfigurable linear array of sensors (e.g., optical, thermal, pressure, ultrasonic). The reconfigurability allows the size and spacing of the sensor elements to be a function of the distance from the beam center. This feature improves performance for imaging systems having a limited channel count. The improved performance, for applications in which multiple transmit focal zones are employed, arises from the ability to adjust the aperture for a particular depth.

NTIS

*Linear Arrays; Pressure Sensors; Linearity*

**20070029488** Baker and Daniels, LLP, Indianapolis, IN, USA

**Ultrasound Phased Arrays**

Seip, R., Inventor; Chen, W. H., Inventor; Sanghvi, N. T., Inventor; 2 Mar 05; 24 pp.; In English

Contract(s)/Grant(s): NIH SBIR IR43 CA81340-01; NIH-2R44 CA081340-02

Patent Info.: Filed 2 Mar 05; US-Patent-Appl-SN-11-070 371

Report No.(s): PB2007-104098; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Ultrasound transducers are disclosed which focus acoustic energy at various focal locations while minimizing focal spot degradation and the generation of unwanted on-axis or off-axis energy concentrations through using a generally constant f-number at the various focal locations.

NTIS

*Phased Arrays; Therapy; Tissues (Biology); Ultrasonic Wave Transducers; Ultrasonics*

**20070029490** Dilworth and Barrese, LLP, Uniondale, NY, USA

**Reconfigurable Matrix Multiplier Architecture and Extended Borrow Parallel Counter and Small-Multiplier Circuits**

Lin, R., Inventor; 23 Apr 05; 38 pp.; In English

Contract(s)/Grant(s): NSF-CCR-0073469

Patent Info.: Filed 23 Apr 05; US-Patent-Appl-SN-10-830 766

Report No.(s): PB2007-104096; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A dynamically or run-time reconfigurable matrix multiplier architecture with a reconfiguration mechanism for computing

the product of matrices  $X_p \times r$  and  $Y_r \times q$  for any integers  $p, q, r$  and any item precision  $b$ , i.e., bitwidth, ranging from 4 to 64 bits is described. The reconfigurable matrix multiplier uses borrow parallel counters with new circuits, 6 sub--0, and 6 sub--1 and the improved small multiplier library. The reconfigurable matrix multiplier architecture is based on a novel scheme of trading data bitwidth for processing array or matrix size. The matrix multiplier achieves an extra compact, low power, high speed design through the use of a borrow parallel counters and a library of small borrow parallel multiplier circuits. The matrix multiplying processor using area comparable with a single 64 times 64-b multiplier constructed of very large-scale integrated (VLSI) circuits, can be reconfigured to produce the product of two matrices  $X(4 \text{ times } 4)$  and  $Y(4 \text{ times } 4)$  of 8, 16, and 32-bit data items in every 1, 4, and 16 pipeline cycles, respectively, or the product of two 64-b numbers in every pipeline cycle.

NTIS

*Architecture (Computers); Circuits; Matrices (Mathematics); Multiplication; Multipliers*

**20070029492** Plovy and Howard, P.C., Fort Washington, PA, USA

**Photonic Device and Method for Making Same**

Kwakernaak, M. H., Inventor; 28 Feb 05; 19 pp.; In English

Contract(s)/Grant(s): ARL-F30602-00-C-0116; ARL-DMD-17-02-C-0094

Patent Info.: Filed 28 Feb 05; US-Patent-Appl-SN-11-068 477

Report No.(s): PB2007-104070; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A monolithic device for photonically coupling a first optical waveguide to a second optical waveguide, including: an input being optically coupled to the first waveguide; a first portion being optically coupled to the input; a second portion being optically coupled to the first portion; and, an output being optically coupled to the second portion and the second waveguide; wherein, when an optical signal is provided on the first waveguide, a given part of the signal is provided to the second waveguide dependently upon an angle between the first and second portions. At least one of the waveguides may have an amorphous silicon material coating.

NTIS

*Couplings; Optical Waveguides*

**20070029537** Air Force Research Lab., Rome, NY USA

**The Interactive DataWall**

Jedrysik, Peter A; Moore, Jason; Brykowsytc, Mark; Sweed, Richard; Jun 1999; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468670; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468670>

The increasingly complex battlefield environment drives the requirement for the presentation and interactive control of the endless stream of information arriving from a diverse collection of sensors deployed on a variety of platforms. At best, the situational awareness picture is fragmented without the benefit of data fusion and correlation to present a true picture of the battlespace from all information sources. Collaboration and interaction is also needed for operators within a control center and among remote geographic locations. The need to display and manipulate real-time multimedia data in a battlefield operations control center is critical to the Joint Commander directing air, land, naval and space assets. The Interactive DataWall being developed by the Advanced Displays and Intelligent Interfaces (ADII) technology team of the Information Directorate of the Air Force Research Laboratory (AFRL/IF) in Rome, New York is a strong contender for solving the information management problems facing the 21st century military commander. It provides an ultra high-resolution large screen display with wireless interaction. Commercial off-the-shelf technology has been combined with specialized hardware and software developed in-house to provide a unique capability for multimedia data display and control.

DTIC

*Display Devices; Information Systems; Multisensor Fusion; Situational Awareness; Walls*

**20070029546** Stanford Univ., Stanford, CA USA

**Toward Neural Control of Prosthetic Devices**

Shenoy, Krishna; May 21, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0976

Report No.(s): AD-A468691; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468691>

Our scientific objective is to advance our fundamental understanding of how the brain plans and executes arm movements.



Our technical objective is to design and build high-performance neural prostheses. Jointly, these objectives should provide a deeper understanding of the neural control of natural movement, and a better design of neural prostheses to restore movement to the disabled, including the disabled warfighter.

DTIC

*Control Equipment; Electro-Optics; Implantation; Neurology; Prosthetic Devices; Targets*

**20070029587** State Univ. of New York, Buffalo, NY USA

**New Generation Photonics Materials: Design, Development, Characterization, and Applications**

Prasad, Paras N; He, Guang S; Mar 31, 2007; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0158

Report No.(s): AD-A468817; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468817>

Significant research achievements have been accomplished in development of multi-photon active materials and applications as well as of novel nanocomposites materials for opt-electronic technology. The specific research progress achieved by this grant support can be summarized as follows. (I) Nonlinear optical limiting and stabilization of 1064-nm laser pulses using a novel two-photon absorbing liquid dye salt system. The major advantage of using a neat liquid dye salt as the two-photon absorbing medium is that the effective molar concentration can be increased by two orders of magnitude and it can withstand much higher input laser energy and intensity. (II) A new-type stimulated Rayleigh-Bragg scattering generated in a novel two-photon absorbing dye solution. It is a two-photon excitation enhanced backward stimulated Rayleigh scattering in a non linearly absorbing dye solution. This stimulated scattering shows no frequency shift and therefore is different from most of other known stimulated scattering processes. The principle of this effect can be highly useful for optical phase-conjugation technique and optical power limiting applications. (III) Synthesis, two- and three photon absorption, and optical limiting properties of fluorene containing ferrocene derivatives and novel dendritic structures. These newly designed and synthesized systems have provided a considerably improved two- and three photon absorption cross-section values, and demonstrated good optical power limiting behavior in fs-regime for both 775-nm and 1300-nm wavelengths.

DTIC

*Characterization; Electro-Optics; Nanocomposites; Optical Properties; Photoconductivity; Photonics; Photorefractivity; Quantum Dots*

**20070029592** California Univ., Los Angeles, CA USA

**High Performance Polymer Memory and Its Formation**

Yang, Yang; Apr 26, 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0215

Report No.(s): AD-A468825; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468825>

Under the major support from AFOSR (FA9550-04-1-0215) during the years of 2004, 2005 and 2006, we have done significant achievement on scientific research and invented very promising electronic and optoelectronic devices including (1) nano-composite polymer memory devices based on metal-nanoparticles and nano-structured virus biomaterials, (2) vertical organic transistors, (3) efficient polymer solar cells, and (4) high efficient polymer light emitting diodes. We totally published 32 papers in the first rated referee journals and filed 8 patents. Some of the developed technologies have been transferred to industry for commercialization (see the attached table).

DTIC

*Computer Storage Devices; Electro-Optics; High Polymers*

**20070029604** Rice Univ., Houston, TX USA

**Strategic Partnership for Research in Nanotechnology**

Natelson, Douglas; Adams, Wade; Apr 25, 2007; 4 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-05-1-0420

Report No.(s): AD-A468864; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468864>

Our SPRING III activities concentrated this year on mass spectrometry, a new MALDI system and an ESI-TOF system. We can now perform high resolution nanoparticle analysis along with protein analysis. We consolidated and rehabilitated the Rice X-ray facilities, spending \$140K to upgrade the computer controls, software, and adding attachments for temperature

control on powder and single crystal systems. An investment toward accessories to the JEOL 200KV FEG Model 2100F include a scanning attachment, coupled with energy filtering (GIF) and energy dispersive X-ray spectrometer to convert our high-resolution TEM to a fully analytical scanning transmission electron microscope.

DTIC

*Mass Spectroscopy; Nanotechnology; Scanning Electron Microscopy*

**20070029689** Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA

**The Basic Research Manager for the Air Force**

Agee, Forest; Feb 18, 2005; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468877; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468877>

Nanotechnology focus area at AFOSR: high performance materials, information processing, energetic materials, compact power generation and storage, bio-inspired concepts, predictive tools, materials processing and fabrication, nanoprobe tools, surface modification, and international programs. The Nanoscience and Technology Program is collaboratively planned by AFOSR Program Managers and AFRL In-House Researchers. The basic research effort is closely coordinated with applied research and demo efforts. NST basic research leverages extensive international investments.

DTIC

*Nanotechnology; Research; Research Management*

**20070029712** Defense Advanced Research Projects Agency, Arlington, VA USA

**Non-Electronic Radio Front-End (NERF)**

Jalali, Bahram; Apr 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-1-0101; Proj-N584

Report No.(s): AD-A468932; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468932>

Radio frequency (RF) communication systems are particularly vulnerable because the antenna provides a direct port of entry for electromagnetic radiation. This report describes a new type of RF receiver front-end that features a complete absence of electronic circuitry and metal interconnects the traditional soft spots of a conventional RF receiver. The device consists of a dielectric resonator antenna that concentrates and feeds the signal onto a resonant electro-optic field sensor. The absence of metallic interconnects and the charge isolation provided by the optics removes the soft spots in a traditional receiver. In the proof-of concept experiment, detection of C band electromagnetic signals at 7.38 GHz with a sensitivity of  $4.3 \times 10^{-3}$  V/m.Hz(exp 1/2) is demonstrated. The dielectric approach has an added benefit: it reduces physical size of the front end an important benefit in mobile applications. DIELECTRIC RESONATOR ANTENNA, PHOTONICALLY ISOLATED ANTENNA RECEIVER, ELECTRO-OPTIC DIELECTRIC ANTENNA, EMP ISOLATED ANTENNA

DTIC

*C Band; Dielectrics; Electromagnetic Pulses; Electromagnetic Radiation; Electro-Optics; Radio Frequencies; Resonators; Telecommunication*

**20070029746** Dayton Univ. Research Inst., OH USA

**Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint)**

Kuhr, Samuel J; Blackshire, James L; Mar 2007; 12 pp.; In English

Report No.(s): AD-A469019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469019>

Thermal protection systems (TPS) are frequently subjected to impacts from micrometeoroids and ground handling during refurbishment. The damage resulting from such impacts can greatly reduce the vehicle's overall ability to resist extreme temperatures. Therefore, it is essential to have a reliable method to detect and quantify the damage resulting from impacts. In this effort, the effectiveness of lightweight thin film piezoelectric sensors was evaluated for impact detection and quantification in CMC wrapped TPS. The sensors, which were adhered to the bottom of the TPS tile, were used to sense impact events occurring on the top of the tile, with the ultimate goal of quantifying the level of impact level and damage state based on the sensed signals. A reasonable correlation between impact load levels and sensed response were observed for load levels between 0.07-1.00 Joules. An increase in signal frequency content was also observed as impact levels were increased, with specific frequency bands occurring in the 2-16 kHz range. A preliminary nondestructive evaluation of the impact damage sites

was also accomplished, where a reasonable correlation between the gross damage features (i.e. impact crater dimensions) and signal response was observed.

DTIC

*Ceramic Matrix Composites; Damage; Detectors; Impact Damage; Impact Loads; Piezoelectricity; Thermal Protection; Thin Films*

**20070029754** Office of the Director of Defense Research and Engineering, Washington, DC USA

**Defense Nanotechnology Research and Development Program**

Apr 26, 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469040>

The Department of Defense (DoD) has a long history of successfully supporting innovative research and development efforts for the future advancement of war fighter and battle systems capabilities. Since the 1980s, DoD including the Defense Advanced Research Projects Agency (DARPA), Office of Naval Research (ONR), Army Research Office (ARO) and the Air Force Office of Scientific Research (AFOSR) initiated numerous research and development programs focusing on advancing science and technology below one micron in size. Scientific breakthroughs and advances in the last ten years demonstrate the potential for nanotechnology to impact a tremendous number of key capabilities for future war fighting: chemical and biological warfare defense; high performance materials for platforms and weapons; unprecedented information technology; revolutionary energy and energetic materials; and uninhabited vehicles and miniature satellites. In support of the National Nanotechnology Initiative, DoD is a member of the Nanoscale Science and Engineering Technology (NSET) subcommittee of the National Science and Technology Council's Committee on Technology. Twenty three federal departments and agencies are members of the NSET, including the Intelligence Community. The NSET meets bimonthly to coordinate the federal government's nanotechnology programs.

DTIC

*Defense Program; Military Technology; Nanotechnology; Research and Development*

**20070029779** Army Research Lab., Adelphi, MD USA

**Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode**

Schmid, Robert; Ngu, Yves; Litz, Marc; May 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469084; ARL-MR-0666; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469084>

This study analyzes how to efficiently create a storage circuit to charge a capacitor with a radioisotope power converter. Variables analyzed include capacitance and frequency of pulse/discharge. Virtual Test Bed was used to display the transient effects of the charging circuit. MATLAB was used to explore the efficiency of circuits. Results indicate efficient circuits need a capacitance that correlates to the number of times the capacitor is discharged in a day.

DTIC

*Circuits; Energy Storage; Isotopes; Schottky Diodes; Silicon Carbides; Storage Batteries*

**20070029822** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**The Costs of Not Using Green Design in the USAF: Would Using Green Building Design Have Resulted in Life Cycle Cost**

Osborne, J K; Mar 2007; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469170; AFIT/GCA/ENV/07-M8; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469170>

This study's purpose is to determine if using green building design would have resulted in life cycle costs savings for the USA Air Force. Green designs are those that employ steps to mitigate the impacts facilities have on the environment by using resources more efficiently than conventional design. The prevailing ranking system for green design in the USA is the Leadership in Energy and Environmental Design (LEED) which evaluates facilities on certain characteristics, assigning certain point values that translate to non-certified, certified, silver, gold, or platinum ratings. The author attempts here to show how previous studies indicated the presence of construction cost premiums, savings in operating costs and environmental benefits from green design. The literature review also shows the extent the Air Force and Department of Defense have incorporated green building standards into current policy. After performing an analysis of Air Force building data, this study

suggests that deciding to build green would not pay for itself based off of energy and environmental benefits alone.  
DTIC

*Cost Effectiveness; Costs; Design to Cost; Electricity; Experiment Design; Life Cycle Costs*

**20070029982** Woodcock Washburn, LLP, Philadelphia, PA, USA; Pennsylvania Univ., Philadelphia, PA, USA

**Electronic and Optoelectronic Devices and Methods for Preparing Same**

Bonnell, D. A., Inventor; Lei, X., Inventor; Conklin, D. J., Inventor; 12 May 05; 35 pp.; In English

Contract(s)/Grant(s): NSF DNR-03-04531

Patent Info.: Filed Filed 12 May 05; US-Patent-Appl-SN-11-128 462

Report No.(s): PB2007-108662; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed are electronic, plasmonic and opto-electronic components that are prepared using patterned photodeposited nanoparticles on a substrate surface. Also disclosed are ferroelectric nanolithography methods for preparing components, circuits and devices.

NTIS

*Electronic Equipment; Electro-Optics; Optoelectronic Devices*

**20070029983** Beyer Weaver and Thomas, LLP, Oakland, CA, USA; California Univ., Oakland, CA, USA

**Damascene Process for Use in Fabricating Semiconductor Structures Having Micro/Nano Gaps**

Takeuchi, H., Inventor; Quevy, E. P., Inventor; King, T. J., Inventor; Howe, R. T., Inventor; 3 May 05; 14 pp.; In English

Contract(s)/Grant(s): DARPA-N-66001-01-1-8967

Patent Info.: Filed Filed 3 May 05; US-Patent-Appl-SN-11-121 690

Report No.(s): PB2007-108661; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In fabricating a microelectromechanical structure (MEMS), a method of forming a narrow gap in the MEMS includes (1) depositing a layer of sacrificial material on the surface of a supporting substrate, (2) photoresist masking and at least partially etching the sacrificial material to form at least one blade of sacrificial material, (3) depositing a structural layer over the sacrificial layer, and (4) removing the sacrificial layer including the blade of the sacrificial material with a narrow gap remaining in the structural layer where the blade of sacrificial material was removed.

NTIS

*Fabrication; Semiconductor Devices*

**20070029986** Terminal Data Corp., Moorpark, CA, USA

**Electro-Optic Array Interface**

Sawin, R., Inventor; Fernandez, S. M., Inventor; 24 Jun 04; 16 pp.; In English

Contract(s)/Grant(s): DMI0215098

Patent Info.: Filed Filed 24 Jun 04; US-Patent-Appl-SN-10-875 707

Report No.(s): PB2007-108631; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A grating coupled surface plasmon resonance optical modulator is disclosed. A electro-optic polymer dielectric is deposited on the metallic surface of a diffraction grating to provide a metal/dielectric interface. A surface plasmon will propagate at the metal/dielectric interface in a resonant condition, e.g., when the metal surface is illuminated by transverse magnetic (TM) polarized light of the appropriate wavelength, angle of incidence and phase velocity. In the present invention, phase velocity is controlled by the diffraction grating. A transparent electrode deposited on the electro-optic layer allows an electrical potential to be applied across the electro-optic polymer. The applied electrical potential (voltage) changes the index of refraction of the electro-optic polymer, thereby disrupting the resonant condition to produce an optically detectable change in reflectance of incident light from the metal layer. The disclosed grating coupled surface plasmon resonance optical modulator may be configured as an electronically or optically addressable array.

NTIS

*Electro-Optics; Arrays; Gratings (Spectra); Plasmons*

**20070029987** Deinken, (John J.), Thousand Oaks, CA, USA

**Reversible Electrodeposition Optical Modulation Device with Conducting Polymer Counter Electrode**

Warren, L. F., Inventor; Tench, D. M., Inventor; 4 May 04; 11 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT-41951

Patent Info.: Filed 4 May 04; US-Patent-Appl-SN-10-839 060

Report No.(s): PB2007-108630; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An optical modulation device includes an electrolyte containing electrodepositable metal ions sandwiched between a conducting polymer counter electrode and an optical modulation electrode involving reversible metal electrodeposition. The conducting polymer counter electrode does not generate mobile reactive species, and avoids the light blocking associated with grid or dot matrix electrodes involving reversible metal electrodeposition. A polyaniline counter electrode in a smart window device employing a reversible electrochemical mirror modulation electrode provides high light transmission, fast switching, and coloration to mask the backside of the mirror electrode.

NTIS

*Conducting Polymers; Electrodeposition; Electrodes; Light Modulation; Optical Equipment*

**20070030032** Infinera Corp., Sunnyvale, CA, USA

**Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid**

Nagarajan, R. L., Inventor; Kish, F. A., Inventor; Welch, D. F., Inventor; Perkins, D. D., Inventor; Kato, M., Inventor; 14 Apr 05; 41 pp.; In English

Contract(s)/Grant(s): ARMY-W31P4Q-04-C-R074

Patent Info.: Filed 14 Apr 05; US-Patent-Appl-SN-11-106 875

Report No.(s): PB2007-108638; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A coolerless photonic integrated circuit (PIC), such as a semiconductor electro-absorption modulator/laser (EML) or a coolerless optical transmitter photonic integrated circuit (TxPIC), may be operated over a wide temperature range at temperatures higher than room temperature without the need for ambient cooling or hermetic packaging. Since there is large scale integration of N optical transmission signal WDM channels on a TxPIC chip, a new DWDM system approach with novel sensing schemes and adaptive algorithms provides intelligent control of the PIC to optimize its performance and to allow optical transmitter and receiver modules in DWDM systems to operate uncooled. Moreover, the wavelength grid of the on-chip channel laser sources may thermally float within a WDM wavelength band where the individual emission wavelengths of the laser sources are not fixed to wavelength peaks along a standardized wavelength grid but rather may move about with changes in ambient temperature. However, control is maintained such that the channel spectral spacing between channels across multiple signal channels, whether such spacing is periodic or aperiodic, between adjacent laser sources in the thermally floating wavelength grid are maintained in a fixed relationship. Means are then provided at an optical receiver to discover and lock onto floating wavelength grid of transmitted WDM signals and thereafter demultiplex the transmitted WDM signals for OE conversion.

NTIS

*Floating; Integrated Circuits; Patent Applications; Semiconductor Lasers; Spacing*

## 34

### FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

**20070026469** Scripps Institution of Oceanography, La Jolla, CA USA

**Characterization of VSW Environment for UUV-N Operations**

D'Spain, Gerald L; Jenkins, Scott A; Mar 11, 2007; 7 pp.; In English

Contract(s)/Grant(s): N00014-01-D-0043-D0015

Report No.(s): AD-A466212; MPL-TM-492; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466212>

A process-based, numerical, hydrodynamic model (VORTEX) was used to characterize the order-one geophysical fluid forcing that a UUV-N would be subjected to in the VSW environment at two canonical beach environments. The VORTEX model used for these simulations was developed under the ONR's Mine Burial Program. The beach environments were selected by NAVSURFWARCEN CSS Panama City and are representative of two of the five primary coastal types that characterize global coastal diversity.

DTIC

*Hydrodynamics; Mathematical Models; Neutralizers; Shallow Water; Underwater Vehicles*

**20070026527** Florida Univ., Gainesville, FL USA

**Low Dimensional Modeling of Zero-Net Mass-Flux Actuators**

Gallas, Quentin; Holman, Ryan; Raju, Reni; Mittal, Rajat; Sheplak, Mark; Cattafesta, Louis; Jul 1, 2004; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0135; F49620-01-1-0146

Report No.(s): AD-A466385; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466385>

The flow field generated by a zero-net mass-flux (ZNMf) actuator is investigated via both numerical simulations and experiments to augment the current understanding of the flow physics of the orifice. The results aid in improving the accuracy of low dimensional lumped element ZNMf models suitable for design. Dimensional analysis yields a number of key parameters that govern the characteristics of this flow. Among them, for a sharp rectangular slot or circular orifice, are the Reynolds number, the dimensionless stroke length, and the orifice height-to-diameter ratio. Variation of these parameters shows that the flow field differs appreciably from the exact linear solution of pipe flow driven by an oscillatory pressure gradient. In particular, depending on the stroke length and the orifice geometry, the pressure drop in the orifice may be dominated by nonlinear minor losses due to entrance/exit effects, or linear major losses associated with the presence of a nominally fully-developed region in the central region of the orifice/slot.

DTIC

*Actuators; Flow Distribution; Flow Velocity; Mathematical Models*

**20070026534** Florida Univ., Gainesville, FL USA

**Adaptive Identification of Fluid-Dynamic Systems**

Pillarsetti, Aravind; Cattafesta, III, Louis N; Jun 14, 2001; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-00-1-0284

Report No.(s): AD-A466403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466403>

Fluid-dynamic systems are inherently nonlinear and are subject to a combination of coherent and random unsteady disturbances. As a result, accurate low-order dynamic models are difficult to obtain for real-time control of such systems. Therefore, controllers implementing adaptive on-line system identification are ideally suited to flow control problems. Adaptive linear and nonlinear filters for real-time system identification are presented in this paper. The linear models studied are traditional FIR and IIR filters, and the nonlinear models include a 2nd-order Volterra filter and the Bilinear filter. The coefficients of the adaptive filter models are calculated and updated using two of the most popular recursive methods, the normalized LMS and RLS algorithms. The adaptive filters are tested offline in software and then implemented on real-time DSP hardware. The focus of this study is on model accuracy and viability in real-time applications. The real-time performance is measured in terms of achievable sampling frequency. Specific applications to relevant nonlinear systems, a spring-mass damper model and a drag-law problem, are also considered in detail.

DTIC

*Adaptive Filters; Fluid Dynamics*

**20070026719** United Technologies Research Center, East Hartford, CT USA

**High Temperature Heat Exchanger Development**

Sabatino, Daniel; Scott, David; Oct 2005; 74 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-C-0444

Report No.(s): AD-A466814; UTRC-R05-5.300.0022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466814>

Gas turbine engines have long used fuel on its way to the combustor as a coolant for engine components. Advanced aircraft and engine technologies are demanding more cooling capacity than conventional fuel delivery systems can offer. To meet these new cooling requirements, technologies are being pursued to allow fuel to reach significantly higher temperatures without the traditional limitations associated with coking. A compact fuel/air heat exchanger is a critical component in these new high-temperature fuel systems. Both tubular metal foam and hollow-truss cellular metal heat exchangers were examined for performance, size, and weight benefits as compared to conventional shell-tube technology. The tubular metal foam heat exchanger behavior was characterized with scaled laboratory and full-scale rig experiments. The data were used to calibrate an analytical model based on data in the open literature. The results indicate that sintered metal foam can provide as much as twice the heat transfer as a plain bank of staggered tubes. However, the corresponding 4X increase in pressure drop almost neutralizes the heat transfer benefit. Furthermore, it was determined that metal foam manufacturing constraints combined with

the small high pressure fuel tubes would result in a design which has no size/weight or performance benefit. However a 40 % reduction in the number of tubes may provide improved reliability. A preliminary investigation of a hollow-tube cellular metal heat exchanger found that when elliptical non-flowing rods are used to augment the tube-bank they can increase the heat transfer by as much as 1.5X over a plain staggered tube-bank without a significant increase in pressure drop. It is projected that 10 % weight and 30 % size reductions can be achieved with hollow-truss cellular metal as compared to shell-tube heat exchanger. However, realization of hollow-tub cellular metal may require a costly manufacturing process.

DTIC

*Heat Exchangers; High Temperature; Jet Engines*

**20070026857** Air Force Research Lab., Edwards AFB, CA USA

**Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors**

Lightfoot, Malissa D; Danczyk, Stephen A; Talley, Douglas G; Mar 16, 2007; 10 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A468183; AFRL-PR-ED-TP-2007-121; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468183>

The ability to predict injector performance can reduce the cost of rocket engine development. This paper details a new theory to predict the atomization efficiency and droplet diameter from the atomization of wall-bounded films with strong gas-phase influences. In this theory atomization occurs when a disturbance is created on the film surface then breaks down into droplets via stripping. The theory relates the mass of film lost via atomization to the mass of liquid introduced into the atomizer to predict atomization efficiency and offers some estimations of primary droplet diameter. A specific example involving a gas-centered swirl coaxial injector is discussed. The results of experiments and simulations are used to support assumptions and are successfully compared to some simple predictions from the theory. Despite the application to a specific injector efforts are made to keep the theory as general as possible so that it applies to many types of injectors and a wide range of operating conditions.

DTIC

*Atomizing; Computational Fluid Dynamics; Injectors; Performance Prediction; Walls*

**20070027271** Rutgers - The State Univ., Piscataway, NJ USA

**Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows**

Knight, Doyle; Yan, Hong; Elliott, Greg; Glumac, Nick; Candler, Graham; Zheltovodov, Alexander; Feb 16, 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0177

Report No.(s): AD-A466943; CCD-2007-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Achievement of the future US Air Force mission requires development of new high speed air vehicles. The aerodynamic performance of high speed air vehicles is sensitive to local flow phenomena which may adversely affect vehicle operation and possibly result in vehicle loss. An example is the Edney W shock-shock interaction which causes intense local surface heat transfer. New concepts in local flow control for high speed flows are needed to alleviate or eliminate adverse local flow phenomena. \* Recently, a promising new research field in local flow control for high speed flows has emerged - Electromagnetic Local Flow Control (ELFC). Examples include beamed energy addition (e.g, laser and/or microwave energy deposition) and DC discharge, with or without external magnetic fields. Recent conferences and workshops have emphasized the importance of ELFC and identified many promising opportunities. This report describes the research accomplishments of Rutgers - The State University of New Jersey, the University of Illinois Urbana-Champaign and the University of Minnesota in understanding the fundamental physics and practical applications of Electromagnetic Local Flow Control in high speed flows.

DTIC

*Electromagnets; Flow Distribution; High Speed*

**20070027500** Army Research Lab., Aberdeen Proving Ground, MD USA

**Structural Design and Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile Configurations**

Chen, Michael M; Aug 2006; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-622618.H80

Report No.(s): AD-A467745; ARL-TR-3866; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A mission program named Extended Area Protection and Survivability was initiated at the U.S. Army Research

Laboratory to demonstrate guided ammunition technologies to defend the battle space against any presented targets, such as mortars, rockets, and artillery. This report introduces the first step in the development of the guided ammunition system. It presents high-level physics-based simulations of a 60-mm projectile system. The topology of the initial projectile was developed on the basis of gun barrel specifications and certain aerodynamics characteristics. A three-dimensional finite element model was created to present the projectile system. Three different projectile configurations were analyzed with the LS-DYNA program and the results were compared. An acceptable design demonstrated that the muzzle velocity reached only 85% of target value mainly because the launch package exceeded the desired mass by 25%. In addition, a characteristic centerline variation of a gun barrel was taken into account in this report. The outcome of the in-bore vertical displacements and accelerations attributable to the variation was found to be significant. Note that the structural configuration of the initial projectile is not optimal. Rigorous optimization efforts will be made on the system, particularly on the sabot component, in order to meet performance requirements.

DTIC

*Aerodynamic Configurations; Design Analysis; Projectiles; Protection; Structural Design*

**20070027550** Air Force Research Lab., Edwards AFB, CA USA

**Code Validation of CFD Heat Transfer Models for Liquid Rocket Engine Combustion Devices**

Coy, E B; Mar 23, 2007; 44 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A467839; AFRL-PR-ED-TP-2007-157; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper reports on the development of a new heat transfer test rig for exploratory testing of new technologies for controlling chamber wall heat transfer. The design of the rig and its capabilities are described. A second objective of the test rig is to provide CFD validation data under conditions relevant to liquid rocket engine thrust chambers. The approach to validation that was adopted was to establish the minimum level of validation uncertainty that can be achieved for a fully-reacted, uniform flow. A method for characterizing the surface temperature and heat flux to the wall is described based on sensors embedded within the wall of the chamber.

DTIC

*Combustion; Computational Fluid Dynamics; Heat Transfer; Liquid Propellant Rocket Engines*

**20070027583** Pennsylvania State Univ., University Park, PA USA

**Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions**

Yang, Vigor; Feb 8, 2007; 84 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0014

Report No.(s): AD-A467900; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An integrated modeling and simulation program has been conducted to substantially improve the fundamental knowledge of supercritical combustion of liquid propellants under conditions representative of contemporary rocket engines. Both shear and swirl co-axial injectors were considered. The formulation was based on the complete conservation equations in three dimensions. In addition, general-fluid thermodynamics and transport theories were incorporated to allow for a unified treatment of fluid properties over the entire range of thermodynamic states. Turbulence closure was achieved by means of the large-eddy-simulation (LES) technique. Special attention was given to the fluid behavior in the two-phase and transcritical regimes in which rapid property variations occur. Various underlying physiochemical mechanisms associated with co-axial injector dynamics were studied in detail. These included flow evolution, flame stabilization and spreading, heat transfer, and acoustic response. The effects of design attributes and operating conditions on injector characteristics were assessed. Results have not only enhanced the basic understanding of the subject problem, but also provided a quantitative basis for identifying and prioritizing the key design parameters and flow variables that exert dominant influences on the injector behavior in different environments.

DTIC

*Combustion; Fluid Dynamics; Fluid Injection; Injection; Injectors; Liquid Rocket Propellants; Supercritical Fluids*



**20070027671** Air Force Research Lab., Edwards AFB, CA USA

**A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT)**

Davis, D W; Chehroudi, B; Talley, D G; May 3, 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A468072; AFRL-PR-ED-TP-2006-123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experimental investigation was undertaken under non-reacting condition to gain a physical understanding of the interaction of acoustic waves and a coaxial-jet injector similar to those used in cryogenic liquid rockets. Liquid nitrogen (the round inner jet) and gaseous nitrogen (the annular outer jet) were used under subcritical, near critical, and supercritical chamber pressures, with and without presence of an external acoustic field. High-speed imaging provided information on the dynamic behavior of the jet under a variety of conditions. It is found that when the jet is at the pressure node, an externally-imposed acoustic field excites the dark-core of the jet to a wavy-shaped structure consistent with the field's characteristics. Mean and root mean square (RMS) values of the dark-core length fluctuations were measured from images. It is found that when the outer-to-inner-jet velocity ratio increases, the RMS of the dark-core length fluctuations decreases both with and without the existence of the acoustic field. A connection to the rocket instability may be established from these data through examination of the RMS values. It is possible that decreases in the fluctuation levels, observed at higher velocity ratios, could weaken a key feedback mechanism for the self-excitation process that could be driving combustion instability in rocket engines. This can offer a possible explanation of the combustion stability improvements experienced in engines when a transition to higher values of the outer-to-inner-jet velocity ratio is made. Finally, after a careful review of relevant data taken here and elsewhere, there appears to be a good correlation between the dark-core length and the momentum flux ratio.

DTIC

*Acoustics; Atomizing; Injectors; Sound Fields; Supercritical Flow*

**20070027689** Air Force Research Lab., Edwards AFB, CA USA

**A Method to Predict Atomization Performance in Gas-Centered Swirl-Coaxial Injectors**

Lightfoot, M D; Danczyk, S A; Talley, D G; Mar 27, 2007; 11 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A468129; AFRL-PR-ED-TP-2007-125; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ability to predict atomizer performance can reduce the cost of system development in many areas. This paper investigates the atomization efficiency and droplet distribution from films with strong gas-phase influences. A prediction of atomization efficiency based on a general theory of the droplet creation process is given. In this process a disturbance is created on the film surface then broken down into droplets via stripping. The theory relates the mass of film lost via atomization to the mass of liquid introduced into the atomizer to predict atomization efficiency and offers some estimations of primary droplet diameter. A specific example involving a gas-centered swirl coaxial injector is given to illustrate how the theory would be applied; however, efforts are made to keep the model as general as possible so that it applies to many types of atomizers and a wide range of operating conditions.

DTIC

*Atomizing; Injectors; Performance Prediction*

**20070027706** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Comparison of Thermodynamic Equilibrium and Non-Equilibrium Representation of Materials**

Vanderhyde, Michael J; Mar 22, 2007; 135 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468308; AFIT/GAE/ENY/07-M25; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hydrocodes are valuable tools in the modeling of shock wave propagation through solids due to high speed impact phenomena. CTH is a hydrocode built with the ability to use multiple EOSs, including the semi-empirical Mie-Gruneisen EOS and tabular Sesame EOS. Modeling high speed impacts necessitates modeling the non-equilibrium thermodynamic states caused by these impacts. A discussion of the non-equilibrium thermodynamics that may be applied to the region directly behind a shock wave is presented, including details of recent attempts to model non-equilibrium impact phenomena in solids. Also, in order to better determine the applicability of the Mie-Gruneisen EOS and the two state PTRAN EOS and the Sesame EOS in situations that include non-equilibrium thermodynamics, the high speed, uniaxial impacts between two iron bars are modeled in CTH. The differences between the Mie-Gruneisen EOS and the Sesame EOS are established. A finite volume

uniaxial hydrocode is validated. Finally, CTH is shown to be able to model some irreversibilities occurring in impact phenomena.

DTIC

*Nonequilibrium Flow; Shock Waves; Thermodynamic Equilibrium; Thermodynamics; Wave Propagation*

**20070027721** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Quantifying Non-Equilibrium in Hypersonic Flows Using Entropy Generation**

Carr, Ryan W; Mar 2007; 127 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468381; AFIT/GAE/ENY/07-M07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The constitutive relations traditionally used for finding shear stress and heat flux in a fluid become invalid in non-equilibrium flow. Their derivation from kinetic theory only demonstrates they are valid only for small deviations from equilibrium. Because it is fundamentally linked to non-equilibrium, entropy generation is used to investigate the limits of the continuum constitutive relations. However, the continuum equations are inherently limited to near equilibrium conditions due to the constitutive relations; thus kinetic theory must be used as a basis for comparison. Direct Simulation Monte Carlo (DSMC), a particle method alternative to continuum methods, is based on kinetic theory and is used to develop a flow solution free from equilibrium assumptions. Solutions were obtained for hypersonic flow over two axisymmetric geometries using both a continuum solver and DSMC. Formulations for entropy generation are presented for each method, and the two solutions are compared. The continuum solver fails to capture regions of non-equilibrium as evidenced by thicker shocks in the DSMC solution. To extend the useful range of the continuum constitutive relations, the Lennard-Jones model is offered as an alternative to Sutherland's Law for calculating viscosity and thermal conductivity. The two are compared, and parameters offering a good fit for these flows are suggested for the Lennard-Jones model.

DTIC

*Computational Fluid Dynamics; Entropy; Equilibrium Flow; Hypersonic Flow; Nonequilibrium Flow*

**20070027737** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Experimental Characterization of Turbulent Flow Around Cylinder Arrays**

Harder, Adam D; Mar 2007; 74 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468435; AFIT/GAE/ENY/07-M12; XC-46TW; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research was done as part of an effort to develop alternative fire suppressant technologies for aircraft engine nacelles. A circular cylinder array was designed, built, and placed in the AFIT roll-around low speed wind tunnel to model generic clutter inside an engine nacelle. A turbulence grid was fabricated to enable measurements of the effects of turbulence level, independent of airspeed, on the flow over different model configurations. The wind tunnel test section was 12 inches wide x 12 inches high x 24 inches long. Pressure differential measurements were taken on various cylinder configurations. The configurations included one cylinder as well as one, two, and three arrays of cylinders. Half diameter spacing was used for two and three cylinder cases, as well as an additional case at a two-diameter spacing with the three array configuration. All conditions were tested with and without the turbulence grid placed at the front of the test section. Pressure differential measurements were taken at 15-degree increments from 0 degrees - 180 degrees on the circumference of an upstream cylinder, centered vertically on the array. Hot-wire measurements were taken with and without the turbulence grid to determine airspeed and the effect of turbulence intensity generated by the grid on the wake profile. Also, vertical traverse data was taken with the hot-wire to determine airflow characteristics behind two configurations, both with and without a turbulence grid. The first had only one cylinder installed while the second was done with three arrays spaced at a half-diameter length. Pressure and velocity measurements were used to investigate the effects caused by the upstream turbulence grid.

DTIC

*Aircraft Engines; Characterization; Fires; Nacelles; Turbulent Flow*

**20070028420** Naval Surface Warfare Center, Bethesda, MD USA

**Correcting the Response of an Albedo Neutron Dosimeter for Energy**

Riel, Gordon K; Winters, Patrick J; Cassata, James R; St John, Ted; Benevides, Luis A; Jan 2007; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468456; NSWCCD-63-TR-2006/36; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The neutron response of an albedo neutron dosimeter varies greatly with energy. For example, the dosimeter, calibrated

with moderated Californium fission neutrons, will read more than 30 times the dose from thermal neutrons and less than 3% of the dose from 14 MeV neutrons. To report a correct result, the measured dose equivalent is multiplied by a neutron energy correction factor (NECF). Two techniques for finding the NECF were developed through a cooperative effort among the Naval Research Laboratory, the Naval Surface Warfare Center, and the Naval Dosimetry Center. Data for the DT-702 (measured in 5 different neutron spectra) matched data for the DT-648 dosimeter from 15 spectra that included an SSBN and the NATO standard battlefield spectrum. NECFs calculated from count rate ratios of the AN/PDR-70 neutron remmeter (rem) to its internal parts (guts) or from the ratio of the inner to the outer neutron dosimeters in the DETECTOR RADIAC SS-20/S (NAM-5) make the DT-702 dosimeter about as accurate as the AN/PDR-70 neutron remmeter.

DTIC

*Albedo; Correction; Dosimeters; Neutrons; Radiation Dosage; Thermoluminescence*

**20070028911** NASA Johnson Space Center, Houston, TX, USA

### **Broken Symmetries and Magnetic Dynamos**

Shebalin, John V.; [2007]; 18 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.:

CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028911>

Phase space symmetries inherent in the statistical theory of ideal magnetohydrodynamic (MHD) turbulence are known to be broken dynamically to produce large-scale coherent magnetic structure. Here, results of a numerical study of decaying MHD turbulence are presented that show large-scale coherent structure also arises and persists in the presence of dissipation. Dynamically broken symmetries in MHD turbulence may thus play a fundamental role in the dynamo process.

Author

*Broken Symmetry; Magnetohydrodynamic Turbulence; Rotating Generators; Numerical Analysis*

**20070029224** Lawrence Livermore National Lab., Livermore, CA USA

### **Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling**

Burton, G.; Jan. 10, 2007; 8 pp.; In English

Report No.(s): DE2007-902263; UCRL-CONF-227154; No Copyright; Avail.: National Technical Information Service (NTIS)

The free round turbulent jet is perhaps the most extensively studied of the canonical free turbulent shear flows. Turbulent jets are important in a variety of industrial applications, such as fuel injectors, furnaces and rocket engines, as well as in high energy-density phenomena such as astrophysical jets and inertial confinement fusion. The enormous range of length and time scales generated by such flows, however, makes high-resolution laboratory or field study of most of them difficult or impossible. The multiplicity of scales also prevents direct numerical studies (DNS) of such flows, since fully resolving all dynamically-significant scales would require computational power well beyond present-day capabilities. Currently, therefore, the most promising method to study such flows on the computer is through large-eddy simulation (LES), in which only the larger turbulent scales are calculated explicitly, while the smaller, unresolved scales are modeled. However, most presently available modeling techniques lack the fidelity necessary for LES to become a more widely-accepted tool for scientific and engineering work.

NTIS

*Fluid Mechanics; Jet Flow; Large Eddy Simulation; Simulation; Turbulent Flow; Turbulent Jets; Vortices*

**20070029232** NASA Langley Research Center, Hampton, VA, USA

### **Nonequilibrium Stagnation-Line Radiative Heating for Fire II**

Johnston, Christopher O.; Hollis, Brian R.; Sutton, Kenneth; June 25, 2007; 17 pp.; In English; 39th AIAA Thermophysics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 732759.07.05; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029232>

This paper presents a detailed analysis of the shock-layer radiative heating to the Fire II vehicle using a new air radiation model and a viscous shock-layer flowfield model. This new air radiation model contains the most up-to-date properties for modeling the atomic-line, atomic photoionization, molecular band, and non-Boltzmann processes. The applied viscous shock-layer flowfield analysis contains the same thermophysical properties and nonequilibrium models as the LAURA Navier-Stokes code. Radiation-flowfield coupling, or radiation cooling, is accounted for in detail in this study. It is shown to

reduce the radiative heating by about 30% for the peak radiative heating points, while reducing the convective heating only slightly. A detailed review of past Fire II radiative heating studies is presented. It is observed that the scatter in the radiation predicted by these past studies is mostly a result of the different flowfield chemistry models and the treatment of the electronic state populations. The present predictions provide, on average throughout the trajectory, a better comparison with Fire II flight data than any previous study. The magnitude of the vacuum ultraviolet (VUV) contribution to the radiative flux is estimated from the calorimeter measurements. This is achieved using the radiometer measurements and the predicted convective heating. The VUV radiation predicted by the present model agrees well with the VUV contribution inferred from the Fire II calorimeter measurement, although only when radiation-flowfield coupling is accounted for. This agreement provides evidence that the present model accurately models the VUV radiation, which is shown to contribute significantly to the Fire II radiative heating.

Author

*Convective Heat Transfer; Thermophysical Properties; Flow Distribution; Radiant Cooling; Far Ultraviolet Radiation*

**20070029234** NASA Langley Research Center, Hampton, VA, USA

**Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet**

Shang, Joseph S.; Chang, Chau-Lyan; June 25, 2007; 11 pp.; In English; 37th AIAA Fluid Dynamics Conference and Exhibit, 25-28 Jun. 2007, Miami, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 599489; Copyright; Avail.: CASI: [A03](#), Hardcopy

Hypersonic magneto-fluid-dynamic interaction has been successfully performed as a virtual leading-edge strake and a virtual cowl of a cylindrical inlet. In a side-by-side experimental and computational study, the magnitude of the induced compression was found to be depended on configuration and electrode placement. To better understand the interacting phenomenon the present investigation is focused on a direct current discharge at the leading edge of a cylindrical inlet for which validating experimental data is available. The present computational result is obtained by solving the magneto-fluid-dynamics equations at the low magnetic Reynolds number limit and using a nonequilibrium weakly ionized gas model based on the drift-diffusion theory. The numerical simulation provides a detailed description of the intriguing physics. After validation with experimental measurements, the computed results further quantify the effectiveness of a magnet-fluid-dynamic compression for a hypersonic cylindrical inlet. At a minuscule power input to a direct current surface discharge of 8.14 watts per square centimeter of electrode area produces an additional compression of 6.7 percent for a constant cross-section cylindrical inlet.

Author

*Fluid Dynamics; Hypersonic Inlets; Cylindrical Bodies; Leading Edges; Strakes; Diffusion Theory*

**20070029694** Massachusetts Inst. of Tech., Cambridge, MA USA

**Studies on Three-Dimensional Slamming on Slender Ships**

Yue, Dick K; Liu, Yuming; May 10, 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0619

Report No.(s): AD-A468886; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468886>

The focus is on the understanding of the impact phenomenon at relatively low Froude number ( $Fr = O(1)$ ). In particular, our objectives are to quantify the range of validity of existing asymptotic theories (using the high Froude number assumption,  $Fr \gg 1$ ), and to understand the gravity effect upon the impact process. This study is of direct relevance to accurate prediction of hydrodynamic loads associated with ship slamming and breaking surface wave impact on offshore structures.

DTIC

*Hydrodynamics; Marine Technology; Offshore Platforms; Slamming*

**20070029811** Army Engineer Research and Development Center, Vicksburg, MS USA

**A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California**

Fong, Moira T; Downer, Charles W; Byrd, Aaron R; Jun 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469158; ERDC/CHL-CHETN-III-76; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469158>

This Coastal and Hydraulics Engineering Technical Note (CHETN) summarizes the results of the development and calibration of a Gridded Surface/Subsurface Hydrologic Analysis (GSSHA) (Downer et al 2005) model of the northwest

region of the San Jacinto River Basin in Riverside County, CA, by the U.S. Army Engineer Research and Development Center (ERDC), in collaboration with The U.S. Army Engineer District, Los Angeles.

DTIC

*California; Hydraulics; Rivers; Water Flow; Watersheds*

**20070030009** Science Applications International Corp., Alexandria, VA USA

**Effect of Atmospheric Background Aerosols on Biological Agent Detectors**

Jensen, Jerry G; Jun 1, 2007; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA7014-06-A2003

Report No.(s): AD-A468827; XC-A3SC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468827>

As part of the Kunsan Focused Effort (KFE), which was a project that sought to develop counter-biological warfare (C-BW) strategies and procedures designed to mitigate the impacts of BW attacks on Air Force operations, this technical report describes a project that examined both historic and contemporary studies related to background aerosol materials and biological weapon (BW) detection systems. The goal was to summarize how current BW detection systems are expected to behave in a non-laboratory environment. This report describes past monitoring programs and their key results. The programs described were selected because their data results were directly applicable to the background problems being analyzed, namely, the nature of background concentrations and fluctuations of aerosol materials that are known to adversely affect BW detection systems. This technical report illustrates the modeling effort that was undertaken to determine if it was possible to analytically reproduce aerosol concentrations observed by aerosol particle counter devices.

DTIC

*Aerosols; Biological Weapons; Detectors; Military Operations*

## 35

### INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

**20070026414** Lockheed Martin Fairchild Defense Systems, Syosset, NY USA

**Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array**

Mathews, Bruce; Zwicker, Theodore; Jan 1999; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-96-C-2077

Report No.(s): AD-A466117; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466117>

The details of the fabrication and results of laboratory testing of the Ultra High Resolution Framing Camera containing onchip forward image motion compensation were presented to the SPIE at Airborne Reconnaissance XXII in 1998. Three airborne flight tests of the Camera system have since been conducted with excellent results. This paper summarizes predicted performance for the Camera and presents some of the flight test imagery and data.

DTIC

*Aerial Reconnaissance; Cameras; Electro-Optics; Flight Tests; Focal Plane Devices; Framing Cameras; High Resolution; Photographs; Pixels; Reconnaissance; Wafers*

**20070026415** Lockheed Martin Fairchild Defense Systems, Syosset, NY USA

**An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array**

Mathews, Bruce; Jul 1998; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-96-C-2077

Report No.(s): AD-A466118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466118>

A framing camera incorporating an ultra high resolution CCD detector array comprised of 9,216 x 9,216 pixels is discussed. The detector array measures 8 x 8 centimeters and has been scaled to be fabricated in one piece on a 5inch diameter

silicon wafer. Pixel size is 8.75 x 8.75 microns which gives 57 lp/mm resolution. The detector array features a two frame per second readout capability which allows collection of stereo imagery from very high V/H platforms. Image Motion Compensation is achieved by operating the frame readout clocks during the exposure interval in typical TDI fashion. The high geometric accuracy of pixel placement on the array yields a camera suitable for mapping, reconnaissance, space and astronomy applications. In this paper, measured detector array performance, detector array yield and overall camera performance are presented.

DTIC

*Cameras; Electro-Optical Photography; Electro-Optics; Focal Plane Devices; Framing Cameras; High Resolution; Photographs; Pixels; Reconnaissance; Wafers*

**20070026452** Congressional Budget Office, Washington, DC USA

#### **Alternatives for Military Space Radar**

Jan 2007; 88 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466170>

The U.S. Air Force, National Reconnaissance Office, and National Geospatial-Intelligence Agency are developing a new radar reconnaissance satellite known as Space Radar to produce images of the Earth's surface using synthetic aperture radar (SAR) techniques and to detect moving targets on the ground, among other missions. The first launch of what would eventually be a constellation of Space Radar satellites is now planned for about 2015. Since the late 1970s, various nations have operated SAR imaging satellites for national security or scientific purposes. However, as currently envisioned, Space Radar would be more capable than existing systems or those likely to be launched in the next few years. In particular, the ability to identify moving targets from space would constitute a major improvement in capability. Fully realizing that and other advances, however, would require designers to meet numerous technical challenges.

DTIC

*Aerospace Systems; Alternatives; Detection; Moving Target Indicators; Radar Imagery; Reconnaissance; Synthetic Aperture Radar; Target Acquisition; Targets*

**20070026730** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

#### **Outlier Detection in Hyperspectral Imaging Using Closest Distance to Center with Ellipsoidal Multivariate Trimming**

Caulk, Ryan F; Mar 2007; 103 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466861; AFIT/GOR/ENS/07-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466861>

Many multivariate techniques are available to find outliers in a hyperspectral image. Among the algorithms one may utilize is a global anomaly detector called Ellipsoidal Multivariate Trimming (MVT). In this paper we tested the efficacy of using the Closest Distance to Center (CDC) algorithm in conjunction with MVT to find outliers among a hyperspectral image. Since MVT is a global anomaly detector the images were first clustered using a variety of techniques. Among the hyperspectral images used for evaluation in this study, only one of the images contained more than 5% outliers in any given cluster set. Based upon the assumption that this is normally the case for most images, the standard use of 50% retention within MVT does not perform as well as using a higher value such as 95% for retention in MVT. This use of a higher number of observations for the estimate of the mean and covariance is shown to decrease the effect of swamping seen when using 50% retention. Furthermore, the use of CDC to initialize the MVT iteration process did not have any effect on outlier determination, but did increase the time to compute significantly.

DTIC

*Ellipsoids; Imagery; Imaging Techniques; Infrared Detectors; Multivariate Statistical Analysis; Outliers (Statistics)*

**20070026773** Texas Univ., Austin, TX USA

#### **Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification**

Rogers, Robert L; Anderson, Michael G; Mar 2007; 99 pp.; In English

Contract(s)/Grant(s): N00039-96-D-0051; Proj-RG

Report No.(s): AD-A467353; DTRA-TR-05-15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467353>

This report presents the development of a multiple frequency continuous wave radar for target detection and classification. The radar design incorporates specifications germane to both basic research and personnel detection applications. An extensive

database of radar signatures is collected, processed, and analyzed. The radar signature database contains data from human, vehicle and animal subjects. The subjects undergo significant variation in velocity, range, approach angle, and posture to represent potential operational conditions. The radar's detection and ranging performance is predicted and Tested. Classification performance is experimentally quantified using the acquired database. wave

DTIC

*Classifications; Continuous Radiation; Continuous Wave Radar; Detection; Frequencies; Multispectral Radar; Radar Signatures; Radar Targets; Target Acquisition; Targets*

**20070026830** NATO Consultation, Command, and Control Agency, The Hague, Netherlands

**The Coalition Aerial Surveillance and Reconnaissance (CAESAR) Approach to Enhancing the Interoperability of Coalition Ground Surveillance Systems**

Ross, Joseph; Jun 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467632; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467632>

No abstract available

*Aerial Reconnaissance; Interoperability; Reconnaissance; Surveillance*

**20070026848** Villanova Univ., PA USA

**Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra**

Amin, Moeness G; Zhang, Yimin; Wang, Genyuan; Obeidat, Baha; Setlur, Pawan; Estephan, Habib; Apr 2007; 195 pp.; In English

Contract(s)/Grant(s): N00014-98-1-0176

Report No.(s): AD-A467998; 527616; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467998>

The research efforts proceeded on different fronts leading to advances in target detection, tracking, and characterization for over the Over-the-Horizon radar applications as well as for urban sensing and through-the-wall radar imaging applications. Improved characterizations of the targets are achieved using multiple OTHRs operating simultaneously as compared to a single OTHR operating alone. We have introduced the spatial polarimetric time-frequency distributions (SPTFDs) as a platform for processing polarized nonstationary signals incident on multiple dual-polarized double-feed antennas. For urban sensing applications two different techniques to provide high imaging quality of scenes behind walls when wall characteristic are unknown were proposed. When considering chirp radar signals or complex Doppler target signatures we have improved blind separation of signals with time-varying spectra using Multiple Hypothesis Testing. Further, we have enhanced the estimation of the phase parameters of mono- or multi-component frequency modulated signals from noisy observations using the Time-Frequency Hough Transform.

DTIC

*Classifications; Detection; Frequency Distribution; Spectra; Target Acquisition; Targets; Temporal Distribution; Time; Variations*

**20070027320** Naval Postgraduate School, Monterey, CA USA

**Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air**

Akar, Ali O; Mar 2007; 81 pp.; In English

Report No.(s): AD-A467126; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The parametric array exploits two highly collimated ultrasound beams interacting in a given volume producing a single beam with very high directivity and almost no side lobes. The high directivity of the difference frequency signal of the parametric array is due to the interaction of the waves in the volume effectively producing a virtual end fired array boosting pressure levels along the interaction region which is limited by the absorption coefficient. This thesis focuses on experiments conducted in an anechoic room using AS-18-B Audio Spotlight system from Holosonic(TradeMark). Furthermore, nonlinear theory was modeled by a linear discrete array. The beam pattern of the parametric loudspeaker, range dependence of primary and secondary signals and total harmonic distortion (THD) were measured and then compared to theory. Experimental data for the beam pattern of the parametric loudspeaker agreed with the theory. It was all shown that the parametric array had a very narrow beam width and almost no side lobes as opposed to conventional loudspeakers. Both primary waves and difference wave frequency signals were examined for their range dependence. Due to the complicated interference of the primary waves, it was impossible to compare experimental results with theoretical predictions. For the difference wave signals,

experimental data was verified by theory, which was modified in order to accommodate both wave generation and spreading region. Finally, THD of the parametric loudspeaker was measured for different amplitude modulation depths. Experimental results showed that preprocessing should be applied in order to decrease THD and achieve clean audio signal reproduction.

DTIC

*Absorptivity; Acoustics; Anechoic Chambers; Frequencies; Linear Arrays; Ultrasonics; Wave Interaction; Wave Propagation*

**20070027348** Naval Postgraduate School, Monterey, CA USA

**A Verification of Optical Depth Retrievals From High Resolution Satellite Imagery**

Evans, Jack R; Mar 2007; 94 pp.; In English

Report No.(s): AD-A467213; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new technique has been developed using high resolution satellite imagery to derive aerosol optical depths by measuring the difference of the radiances inside and outside of shaded regions Vincent (2006). This approach has shown promise as a new means of providing aerosol optical depth in regions that have proven difficult using more traditional means. Initial studies have been done primarily over desert/arid environments with some limited work over urban regions. This thesis takes the next step by focusing on the challenges that come along with using this technique in an urban environment and by exploring the relationship of how this technique is affected by different surface types. Four different surface types were examined, dirt, grass, pavement, and other which includes a random sampling of surfaces that are commonly found in urban environments. Three of these surface types act remarkably similar while grass surfaces deviate from the results seen with the other surfaces. Results from all the surfaces show a low bias which was not seen in the earlier study. This low bias can possibly be attributed to the aerosol model used when running the Shadow Method program, urban effects.

DTIC

*High Resolution; Optical Properties; Optical Thickness; Satellite Imagery*

**20070027400** Army Research Lab., Aberdeen Proving Ground, MD USA

**Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment**

Turner, Daniel D; Carstens, Christian B; Redden, Elizabeth S; Whalen, Joseph B; Oct 2003; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-H70

Report No.(s): AD-A467433; ARL-TR-3064; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Human Research and Engineering Directorate of the U.S. Army Research Laboratory conducted an experiment to determine what size breaching hole is necessary for a soldier with a fighting load to enter a building in a tactical and timely manner. The results from this experiment were used to determine requirements for wall breaching technology. The experiment was conducted at McKenna Military Operations in Urban Terrain (MOUT) site Ft. Benning, Georgia. Soldiers from the Ranger Training Brigade and Headquarters Company 3/11th Infantry participated in the experiment. The soldiers were divided into infantry squads and participated in an exercise that involved crossing a danger area, entering a building through the three different size holes, and clearing the initial room. After participating in each mission, the soldiers were given a questionnaire to solicit information about their capabilities and limitations to enter the building. Each event was also timed to determine a mean time for entry with each hole.

DTIC

*Field of View; Goggles; Kits; Military Operations; Night Vision; Walls*

**20070027407** Virginia Univ., Charlottesville, VA USA

**A Centripetal Acceleration Statistic for Tracking Maneuvering Targets with Radar**

Bizup, David; Sep 2002; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467466; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Maneuver tracking is complicated because radar cannot directly measure target acceleration. Radar measures a target's range and bearing, and its radial velocity with respect to radar position. Tracking algorithms use radial velocity to associate radar reports to tracks, but not to update track state estimates. In this paper, a new statistic of centripetal acceleration based on the radial velocity measurement is developed. A tracker using this statistic is developed and tested via simulation against three other tracking algorithms. Simulation results show that the new tracker outperforms trackers with switched noise levels and a two mode interacting multiple model.

DTIC

*Maneuvers; Radar Tracking; Targets*



**20070027654** Parma Univ., Italy

**Integrated Stereo Infrared and Color Human Detection on the ART platform**

Bertozzi, M; Broggi, A; Felisa, M; Ghidoni, S; Apr 1, 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N62558-07-P-0029

Report No.(s): AD-A468033; DII-VISLAB-TR005-2006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the research activities within the framework of N62558-05-P-0380 contract for the development of a Human Shape localization system by means of a 4-camera vision system consisting of 2 daylight and 2 far infrared cameras. The main idea is to exploit the advantages of both far infrared and visible cameras to develop a system that combines the advantages of using far infrared or daylight technologies. In particular, this report details a system for detecting pedestrians using histogram of oriented gradients by means of support vector machines.

DTIC

*Color Infrared Photography; Infrared Detectors*

**20070027670** National Optical Astronomy Observatories, Tucson, AZ USA

**Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview**

Elias, J H; Carr, J S; Richter, M J; Najita, J; Chun, M R; Tokunaga, A T; Liu, M; Lacy, J; Strom, S; Liang, M; Jan 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468071; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a discussion of the science drivers and design approach for a high-resolution, mid-infrared spectrograph for the Thirty-Meter Telescope. The instrument will be integrated with an adaptive optics system optimized for the mid-infrared; as a consequence it is not significantly larger or more complex than similar instruments designed for use on smaller telescopes. The high spatial and spectral resolution possible with such a design provides a unique scientific capability. The design provides spectral resolution of up to 120,000 for the 4.5-25 m region in a cross-dispersed format that provides continuous spectral coverage of up to 2% to 14 micrometers. The basic concept is derived from the successful TEXES mid-infrared spectrograph. To facilitate operation, there are separate imaging channels for the near-infrared and the mid-infrared; both can be used for acquisition and the mid-infrared imaging mode can be used for science imaging and for guiding. Because the spectrograph is matched to the diffraction limit of a 30-m telescope, gains in sensitivity are roughly proportional to the square of the telescope diameter, opening up a volume within the Galaxy a thousand times greater than existing instruments.

DTIC

*Infrared Instruments; Infrared Radiation; Instruments; Spectrographs; Telescopes*

**20070027718** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**CFD Investigation of Flow Past Idealized Engine Nacelle Clutter**

Casper, Matthew S; Mar 2007; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468376; AFIT/GAE/ENY/07-M08; XC-46OG/OGM/OL; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research modeled low-speed flow past idealized engine nacelle clutter in support of aircraft re suppression research. The idealized clutter was comprised of three vertical rows of staggered circular cylinders approximating typical nacelle obstructions such as fuel lines and wire bundles. Single-phase, Detached-Eddy Simulations (DES) were conducted using the commercial CFD solver, Fluent(TradeMark), to resolve the flow-field dynamics inside the clutter element and determine mechanisms accounting for the failure of suppressant spray droplets from traversing the array under low-speed, free-stream conditions ( $Re_D = 1,575$ ). The numerical models provided no evidence that span-wise vorticity or non-uniform shedding was responsible for transporting dispersed-phase particles towards the tunnel walls for deposition. However, the simulations demonstrated that suppressant droplets would likely follow a path governed by the vector sum of the local carrier fluid velocity and the velocity imposed by gravity. Additionally, the Stokes number was computed from time-accurate data to determine the ability of dispersed particles to negotiate the clutter element without impinging on a cylinder. For slower free-stream velocities,  $U(\infty) = 1$  m/s, suppressant droplets ( $D = 90$  m) will likely be entrained in vortices shed from the intermediate row of cylinders and subsequently deposited on the last row of cylinders as the Karman vortex directly collides with the clutter. At free-stream velocities,  $U(\infty) = 5$  m/s, the droplet particles will likely fail to track the carrier fluid streamlines in the cylinder wake and remain free of any shed vortices. Thus, the suppressant will conceivably transit the cylinder array

without impact. These findings imply that a bluff-body turbulent diffusion flame in a cylinder wake could be nearly impossible to extinguish under high-speed, co-flow conditions.

DTIC

*Clutter; Computational Fluid Dynamics; Cylindrical Bodies; Fires; Flow Distribution; Nacelles; Simulation; Vertical Orientation; Vortex Shedding; Vortices*

**20070028443** Defence Research and Development Canada, Ottawa, Ontario Canada

**Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture**

Dore, Steve; Helleur, Chris; Van Fong, C W; Sep 2002; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467068; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the area of command and control projects in which a surveillance sensor is being evaluated, project sponsors ask scientists to measure the operational utility and value of the sensor to assist in the decision making process. This paper puts forward a formal and consistent methodology of relating trial results to operational value-added by employing the Canadian Forces Force Planning Scenarios. The approach was applied within an Operational Evaluation (OPVAL) of a High Frequency Surface Wave Radar (HFSWR) system that is used for over-the-horizon coastal surveillance. The methodology was applied to data obtained during trials of the HFSWR system located off the east coast Newfoundland, Canada. For this OPVAL, four Vice Chief of the Defence Staff scenarios were selected that require significant Intelligence, Surveillance, and Reconnaissance (ISR) capability: (Search and Rescue (SAR), Surveillance, National Sovereignty, and Defence of North America). As these scenarios were too general in nature to provide a straightforward evaluation of the sensor system, maritime vignettes were produced for each of the four ISR scenarios and a set of ISR objectives was established for each vignette. The results of this OPVAL were assessed to determine HFSWR's contribution to surveillance-based Force Planning Scenarios. The primary contribution of this paper is to demonstrate the feasibility of relating OPVAL results directly to the scenarios in a quantifiable fashion. The main conclusion of the paper is that the approach presents the capabilities of the sensor system to the decision makers in a logical and intuitive way, and it provides a context to the results of the analysis that is easy to communicate to a larger audience.

DTIC

*Canada; Coasts; High Frequencies; Images; Over-the-Horizon Radar; Radar Tracking; Ships; Surface Waves; Surveillance; System Effectiveness*

**20070028528** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Systems Engineering for Rapid Prototyping: Friendly Marking Device**

Cannon, Monte; Buckner, Greg; Buttram, Greg; Jiru, Michael; Collazo, Arlene; Cobb, Rich; Colombi, John; Oct 2006; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468064; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This briefing asks the question 'Can a prototyping development effort be responsive enough to react to critical needs while still benefiting from the rigor of systems engineering?' The briefing looks at the problem of close air support with the stated objective: Develop, demonstrate and transition a marking solution that enables a Joint Terminal Attack Controller (JTAC) to establish a common point-of-reference with a Close Air Support (CAS) asset such that the CAS asset can attack an intended target while avoiding fratricide.

DTIC

*Accelerated Life Tests; Prototypes; Systems Engineering*

**20070028688** Military Environmental Technology Demonstration Center, Aberdeen Proving Ground, MD USA

**Operator Influence of Unexploded Ordnance Sensor Technologies**

Appelt, Christopher; Mar 2007; 384 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-8-CO-160-UXO-023

Report No.(s): AD-A466345; ATC-9360; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466345>

The U.S. Army Environmental Command (USAEC), through the Environmental Quality Technology (EQT) Program, requested Aberdeen Test Center's (ATC) Military Environmental Technology Demonstration Center (METDC) to develop and execute a plan to determine and document, if it exists, a level of influence that operators may have on unexploded ordnance (UXO) detection technology results. The primary objective of the test was to determine this level of influence and to perform an analysis of operator detection activities to identify factors that produce variations in operator performance. ATC tested a

total of ten operators (five novices and five experts), using a Schonstedt magnetometer. The experts had more experience with the geophysical detection than the novices. Overall, the results showed that the position and speed of the detector head impacted performance measurements. In addition, the data indicated that perhaps periodic refresher training would be beneficial to expert operators to improve their results in the field.

DTIC

*Ordnance; Operator Performance; Military Technology; Education; Air Traffic Control*

**20070028713** Seacom Technologies, Inc., Ottawa, Ontario, Canada

**Facial Recognition Evaluation Project Passport Office of Canada - The Methodology and Findings**

Pelletier, Paul; Enhancing Information Systems Security through Biometrics; December 2005, pp. 17-1; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A viewgraph presentation on the methodology and findings for facial recognition is shown. The contents include: 1) Project background; 2) Evaluation methodology; 3) Tools required; 4) Photo characteristics; 5) Identification results; 6) High volume results and extrapolation to very large galleries; 7) Manual vs automatic enrollment findings; and 8) Lessons learned for deployment.

CASI

*Face (Anatomy); Pattern Recognition; Photography; Methodology*

**20070028810** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Fusion of Imaging and Inertial Sensors for Navigation**

Veth, Michael J; Sep 2006; 207 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468382; AFIT/DS/ENG/06-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The motivation of this research is to address the limitations of satellite-based navigation by fusing imaging and inertial systems. The research begins by rigorously describing the imaging and navigation problem and developing practical models of the sensors, then presenting a transformation technique to detect features within an image. Given a set of features, a statistical feature projection technique is developed which utilizes inertial measurements to predict vectors in the feature space between images. This coupling of the imaging and inertial sensors at a deep level is then used to aid the statistical feature matching function. The feature matches and inertial measurements are then used to estimate the navigation trajectory using an extended Kalman filter. After accomplishing a proper calibration, the image-aided inertial navigation algorithm is then tested using a combination of simulation and ground tests using both tactical and consumer-grade inertial sensors. While limitations of the Kalman filter are identified, the experimental results demonstrate a navigation performance improvement of at least two orders of magnitude over the respective inertial-only solutions.

DTIC

*Imaging Techniques; Inertial Navigation; Kalman Filters; Sensors*

**20070029523** Florida Atlantic Univ., Boca Raton, FL USA

**Center for Coastline Security Technology, Year-2**

Glegg, Stewart; Glenn, William; Furht, Borko; Beaujean, P P; Frisk, G; Schock, S; VonEllenrieder, K; Ananthakrishnan, P; An, E; Granata, R; May 1, 2007; 280 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-C-0031

Report No.(s): AD-A468622; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468622>

The Center for Coastline Security Technology (CCST) focuses on research, simulation, and evaluation of coastal defense and marine domain awareness equipment, sensors, and components. It builds upon the existing efforts and expertise in coastal systems and sensor research at the Institute for Ocean and Systems Engineering (IOSE), the Imaging Technology Center, the Department of Computer Science and Engineering, and the University Consortium for Intermodal Transportation Safety and Security at Florida Atlantic University. This report describes a number of projects that were carried out during year two of this program. The following projects are described in the report: 1) Development of a Remotely Piloted, Unmanned, Untethered, Underwater Vehicle (RPUUV); 2) Development of Acoustic Piloting, Communications and Positioning systems; 3) Environmental Assessment and Modeling: Monitoring Turbidity in Ports; 4) Development of a High Resolution Imaging Sonar for Underwater Inspections; 5) Experimental determination of the hydrodynamic/dynamic characteristics of a small underwater vehicle for port security; 6) Hydrodynamic and Dynamic Investigations for the Development of a Small

Underwater Vehicle for Underwater Hull Inspection and Harbor Survey; 7) RPUUV Navigation and Control; 8) Development of a Chemical Sensor system for small underwater vehicles; 9) Development of HDMAX High-Resolution QUAD-HD Progressive Scan Electronic Camera Systems; 10) 3D Imaging and 3D Video Technologies for Coastline Security Applications DTIC

*Cameras; Coasts; Imaging Techniques; Security; Shorelines; Sonar; Underwater Vehicles*

**20070029575** National Defense Univ., Norfolk, VA USA

**Airborne Armed Full Motion Video: The Nexus of OPS/INTEL Integration in the Joint/Coalition Environment**

Cooter, Mark A; Apr 3, 2007; 73 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468804; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468804>

Operations and intelligence organizations continue to struggle with how to best plan and employ assets with a video capability. Many heated debates have occurred concerning manned and unmanned, as well as, armed and unarmed assets. This friction caused the less than optimum utilization of these assets. In today's Global War on Terrorism, timely, detailed intelligence is ever more critical to mission success. In many cases, operational commanders do not conduct their operations unless they are assured the availability of airborne full motion video (FMV) assets. The thesis of this paper argues the Department of Defense must adopt changes in joint doctrine, terms, organizations, and processes concerning armed, FMV capable platforms in order to employ FMV capabilities with greater operational effectiveness and efficiency.

DTIC

*Military Operations; System Effectiveness*

**20070029576** Draper (Charles Stark) Lab., Inc., Cambridge, MA USA

**Terahertz Fiber Laser for Explosives Detection**

Radojevic, Antonije; Jun 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0465

Report No.(s): AD-A468805; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468805>

The C.S. Draper Laboratory, with 30 years of experience in instrument and sensor research and development, and the University of Massachusetts Terahertz Laboratory, with 15 years of research in the development terahertz receivers and focal plane arrays, propose to develop and characterize a fundamentally new method for generating terahertz radiation. Our approach will enable the development of a class of high power ( $\geq 100$  mW), portable, coherent, terahertz radiation source devices not realizable using either conventional RF approaches such as Schottky Diodes, Transferred Electron Guns, or Resonant Tunneling Diodes or optical transition approaches such as cryogenically cooled Quantum Cascade Lasers. Consequently, our concept for a Terahertz Fiber Laser will enable a US Navy Advanced Explosives Detection system with significantly improved sensitivity, selectivity, and  $>20$ m stand-off operating range in a compact (shoebox size), man-portable package.

DTIC

*Detection; Explosives Detection; Fiber Lasers; Fiber Optics; Lasers*

**20070029585** Virginia Univ., Charlottesville, VA USA

**Fabrication of Nanoscaled Systems**

Hull, R; Harriott, L; Parrish, P; Snider, G; May 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-1039

Report No.(s): AD-A468815; GG10486-117591-RH; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468815>

The main goal of this project was to develop new lithographic and nanofabrication approaches for the assembly of novel nanoelectronic and nanomagnetic device structures. Our team's interests, expertise and facilities spanned materials synthesis, nanoscale characterization, nanoscale lithography and processing, and involved three institutions (University of Virginia, Notre Dame University, Lund University). To fabricate annular structures of giant magnetoresistive material for proposed vertical magnetic random access memory structures, we explored use of a novel negative inorganic resist, HSQ. Using electron and ion beam exposure of the resist (as well as direct focused ion beam sputtering of the GMR material) we were able to create structures at or close to the project goal of 75/225 nm internal/external annular diameter. It was found that electron beam exposure offered slightly higher resolution but substantially lower throughput than ion beam exposure of the resist. The

resultant exposed HSQ patterns offered good etch masks for physical sputtering of the underlying GMR material, an important consideration given the known challenges in reactive ion etching of these materials. Other studies focused on ultra rapid sputtering of PMMA using focused ion beams and exploring fabrication of inexpensive masks for electron projection lithography. We also explored nanoscale processing and contacting of nanowire structures with our collaborators at Lund University, with application to proposed quantum dot architectures such as quantum cellular automata.

DTIC

*Electron Beams; Fabrication; Lithography; Nanotechnology*

**20070029705** Photon Systems, Covina, CA USA

**Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents**

Hug, William F; Moustakas, T; Treece, R; Smith, J; Bhattacharyya, A; Reid, R; Pankove, J; Brown, C; Nelson, W; Mar 31, 2007; 215 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W31P4Q-04-C-R039

Report No.(s): AD-A468910; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468910>

This proposal addresses the need for deep UV semiconductor lasers for use in UV resonance enhanced Raman spectroscopic identification of biological agents. The proposed approach avoids the problems of p-doping and ohmic contacts by using subminiature direct electron injection excitation of an InAlGaN heterostructure. We have demonstrated strong stimulated emission at 274nm using this approach with measured linewidth reduction from 16nm to 4nm and five orders of magnitude non-linear increase in intensity. High levels of chemical specificity can be obtained using Raman spectroscopy without sample preparation, contact, or destruction. When Raman excitation occurs within the electronic resonance band of a material the scatter cross-sections can improve as much as eight orders of magnitude. For biochemical molecules such as nucleic and amino acids these absorption bands are very strong in the deep UV between about 220nm and 280nm. When Raman excitation is below about 250nm, there is a fluorescence-free region extending over 4000 wave numbers above the excitation wavelength providing very high detection sensitivities and low background noise. It is the goal of this proposed program to demonstrate deep UV emission from a semiconductor laser and the ability to obtain deep UV resonance Raman spectra of analogs of hazardous biological agents.

DTIC

*Semiconductor Lasers; Ultraviolet Lasers*

**20070029815** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Point Spread Function Characterization of a Radially Displaced Scatterer Using Circular Synthetic Aperture Radar**

Majunder, Uttam K; Mar 2007; 74 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469162; AFIT/GE/ENG/07-26; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469162>

This research effort investigated characterizing the point spread function (PSF) behavior of radially displaced point scatterers using circular synthetic aperture radar (CSAR). Thus far, research has been conducted to understand PSF of a scatterer located at the imaging scene center. An analytic closed-form solution has been derived assuming the scatterer is located at the origin of the CSAR imaging geometry. However, it is difficult to derive an analytic PSF solution for a scatterer that is radially displaced from the imaging scene center. Using the back projection image formation algorithm, PSF responses are generated at various point target locations. Consistent with previous studies, the three dimensional PSF for a point target located at the image center is cone shaped and serves as the basis for comparing and characterizing the PSFs of radially displaced scatterers. Simulated results show the impulse response of a radially displaced point scatterer is asymmetric and tends to exhibit increased ellipticity as it moves further from the scene center.

DTIC

*Scattering; Synthetic Aperture Radar; Target Recognition*

**20070030008** Illinois Univ., Urbana-Champaign, IL USA

**Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint)**

Oh, Ilwhan; Monty, Chelsea; Masel, Richard I; Shannon, Mark A; Nov 2006; 6 pp.; In English

Contract(s)/Grant(s): FA8650-04-01-7121; Proj-4H20

Report No.(s): AD-A468716; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468716>

For the last decade, interest in the organophosphate (OP) chemical warfare agents (CWA) sensor has multiplied, especially

after the tragic terrorist attack with sarin in Tokyo in 1995. The requirements for OP CWA sensors include: portability - small and light enough to be carried by a person; vapor detection - sample is gas phase, rather than liquid or solid phase; sensitivity - the vapor concentration of the target molecule is in the ppb or below; selectivity (reliability) - minimum false positives. Conventional methods for the detection of gas-phase OP CWA are gas chromatography/mass spectroscopy (GC/MS) and ion mobility spectrometry (IMS). GC/MS is in most cases not suitable for portable applications. IMS has a lower selectivity because the intrinsic detection mechanism of IMS is not based on the chemical nature of the target molecule. The objectives of this work are 1) to study the oxime-based electrochemical sensor in a beaker cell and 2) to fabricate a micro-scale gas-liquid interface so that the oxime-based sensor can be miniaturized into a small-sized device.

DTIC

*Chemical Warfare; Organic Phosphorus Compounds; Sensors; Fabrication; Electrochemistry*

**20070030034** NASA Goddard Space Flight Center, Greenbelt, MD, USA

### **GISMO**

Benford, Dominic; March 21, 2007; 1 pp.; In English; International Space Terahertz Symposium, 21-23 Mar. 2007, Pasadena, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The 2 mm (150 GHz) atmospheric window enables unparalleled ground-based observations of the earliest active dusty galaxies in the universe. We have undertaken the development of a bolometer camera, GISMO (the Goddard-IRAM Superconducting 2-Millimeter Observer), which will obtain large and sensitive sky maps at this wavelength. The instrument will be used at the IRAM 30 m telescope, where we hope to have a trial observing run in Spring of 2007. The innovative element in this camera is its 8x16 fully sampled planar array of multiplexed superconducting transition edge sensor bolometers. This array is based on our recently demonstrated Backshort Under Grid architecture, designed to be scaled to kilopixel arrays with high sensitivity (of around  $4 \times 10^{-17}$  W<sup>2</sup>/sqrt(Hz) at T(sub c) approximates 450mK). A compact cryogenic optical system provides a wide field of view, (almost 2'x4') enabling GISMO to be very efficient at detecting sources serendipitously in large sky surveys, while retaining diffraction-limited imaging performance. GISMO will provide significantly greater imaging sensitivity and mapping speed at this wavelength than has previously been possible. The major scientific driver for the instrument is to detect dust emission from high-z Ultraluminous Infrared Galaxies (ULIRGs) and quasars. The instrument provides an important portion of the spectrum of high redshift galaxies at the Rayleigh-Jeans part of the dust emission spectrum, even at the highest redshifts. Models of galaxy evolution predict that GISMO will serendipitously detect one galaxy in every four hours of observing blank sky, and that one quarter of these galaxies will be at a redshift of  $z > 6.5$ .

Author

*Bolometers; Cameras; Imaging Techniques; Radio Astronomy*

## **36**

### **LASERS AND MASERS**

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

**20070026398** Arizona Univ., Tucson, AZ USA

### **Exploiting Adaptive Optics with Deformable Secondary Mirrors**

Hart,; Mar 8, 2007; 18 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0383; Proj-2301

Report No.(s): AD-A466096; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466096>

The major thrust of our research program has been to start the development of multiple laser beacon systems for wavefront sensing, and to tie this new technology to the unique development of deformable secondary mirrors pioneered at the University of Arizona's Center for Astronomical Adaptive Optics (CAAO). The technology development funded by this award has resulted in the first practical solution for a multi-beacon laser system, enabling progress in tomographic wavefront sensing and altitude conjugated adaptive correction, and is a critical step forward for adaptive optics for future large telescopes proposed for very high resolution space situational awareness. This has been demonstrated by the first high resolution images

of geostationary satellites, captured at the 6.5 m MMT telescope, using the deformable secondary adaptive optics system.  
DTIC

*Adaptive Optics; Beacons; Deformable Mirrors; Lasers; Telescopes; Tomography*

**20070026515** National Dong Hwa Univ., Hualien, Taiwan, Province of China

**Novel Two- and Three-Photon Pumped Lasing Dyes: Design, Synthesis, and Characterization**

Lin, Tzu-Chau; Sep 1, 2006; 13 pp.; In English

Report No.(s): AD-A466361; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466361>

In this proposed research project, efforts have been focused on the synthesis and optical properties characterization of some multi-photon absorbing chromophores especially with frequency up-converted stimulated emission behavior. This research project was originally aimed to study some structural parameters that may affect the multi-photon pumped stimulated emission properties in dye molecules. The structural parameters that was attempted to investigate include the substituent effects (types and/or positions) and chromophoric unit number density effect. Significant amount of time and man-power was spent to accomplish the synthesis and characterization of some of the designed model compounds. Most of these compounds possess strong two- and three-photon absorption (2PA & 3PA) induced up-converted emission covering various spectral regions. One of the synthesized stilbazolium-type chromophore also shows strong 2PA-induced stimulated emission when pumped by femtosecond laser pulses at ~775 nm. Specifically, four stilbazolium chromophores have been stabilized for 2PP stimulated emission property studies. Only one of the synthesized compounds possesses 2PP-induced up-converted cavityless lasing when pumped by femtosecond laser pulses. To the best of author's knowledge, this compound is so far the only stilbazolium salt with symmetrical di-substitution in its molecular structure that exhibits 2PP-induced stimulated emission in femtosecond regime. Although the currently collected data could not provide any clear picture of the relationship between molecular structure and stimulated emission property, using thiophene unit(s) as part of pi-bridge in designing symmetrically di-substituted two-photon lasing dyes might be a direction that worthy to explore. On the other hand, the blueshifted forward lasing is an interesting phenomenon that worth to put more efforts on studying its origin.

DTIC

*Characterization; Dye Lasers; Lasing; Photons*

**20070026569** Crystal Fibre, Birkerod, Denmark

**Photonic Crystal Fibers**

Kristiansen, Rene E; Dec 2005; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-05-1-3046

Report No.(s): AD-A466488; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466488>

This report results from a contract tasking Crystal Fibre A/S as follows: Crystal Fibre will conduct research and development of large mode area, dual clad multi-core Yb-doped photonic crystal fiber. The fiber may be polarization maintaining (PM). Nominal fiber designs will include six and seven core fibers with nominal specifications of 400 micron 0.6 NA pump core, and 30-35 micron signal cores. Crystal Fibre shall fabricate 1 preform worth but not less than 50 meters of passive and active versions of each fiber designed under this task. Crystal Fibre shall provide characteristics of the fiber fabricated to include core and cladding diameters, core and cladding numerical apertures, Yb doping concentration, and pump absorption at 976nm. Passive multicore fiber versions without airclad will be available approximately 1-1/2 month after fiber design agreement. Active multicore airclad fiber versions will be available approximately 3 months after fiber design agreement. Within this project we will deliver a passive and active version of multicore fiber iteration 1 and a passive version of multicore fiber iteration 2.

DTIC

*Cores; Crystals; Lasers*

**20070026584** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**A Hybrid Nano-Imprinting Lithography Method for Nano-Patterning Based on Infrared Pulsed Laser Heating**

Lee, Yung-Chun; Sep 5, 2006; 14 pp.; In English

Report No.(s): AD-A466513; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466513>

In this research project we present a novel method of nano-imprinting which adopts important features of conventional

nano-imprinting lithography (NIL) and the newly developed laser-assisted direct imprinting (LADI) method. It utilizes an Nd-YAG pulsed laser of wavelength 1064 nm which can easily penetrate and also heat up a silicon mold which is pressed against a resist layer deposited on a substrate. The fast rising temperature in the silicon mold can momentarily melt the resist layer so that the mold is imprinting into the resist layer. After the pattern is transformed, standard nano-imprinting lithography processes can be applied to the substrate for nano-fabrication. This new method has several advantages over existing nano-imprinting methods mostly due to the fast heating-up of silicon mold by high intensity IR laser pulse and therefore has no thermal drifting problem. Both the theoretical modeling and experimental results of this novel IR-laser assisted imprinting method will be investigated.

DTIC

*Infrared Lasers; Laser Heating; Lithography; Nanotechnology; Pulsed Lasers*

**20070026610** Jackson (Henry M.) Foundation, Rockville, MD USA

**Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies**

Bower, Craig S; Apr 2007; 107 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-C-0109

Report No.(s): AD-A466560; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466560>

Despite the proven safety and efficacy of laser refractive surgery in improving uncorrected vision, several important issues require further analysis in the armed forces. Visual performance under low light illumination, cockpit performance in military aviators, ability to meet accession and retention standards, and resistance to trauma are among some of the unique considerations of the active duty military. The current study comprises a comprehensive evaluation of safety, efficacy and visual performance after laser refractive surgery. Initial studies cover surgical procedures and pre- and post-operative assessment of visual performance, refractive error and stability, and ocular integrity. Subsequent phases address military operational factors, including occupation-specific visual requirements and effects of various operational environments. Additional militarily relevant investigations will address emerging technologies, both military and medical, as they apply to refractive surgery in the US service men and women. To date, we have enrolled and treated over 500 subjects in one of 16 approved protocols (9 ongoing and 7 completed). We have published 15 peer-reviewed papers, and presented 8 papers and 22 abstracts at national or international meetings. We have research collaborations with a number of DoD and civilian academic institutions including the US Army Night Vision Laboratory and Electronic Sensor Directorate, the US Army Aviation Research Laboratory, the Naval Medical Center San Diego, Stanford Research Institute, the US Army Center for Health Promotion and Preventative Medicine, the Schepens Eye Research Institute, Harvard Medical School, University of Virginia, James Madison University, and Eastern Virginia Medical School. This report will cover the accomplishments of the program to date and outline future directions and goals for the program.

DTIC

*Excimer Lasers; Excimers; Eye (Anatomy); Health; Lasers; Medical Services; Military Operations; Safety; Surgery; Visual Perception*

**20070027269** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP<sub>2</sub>**

Zawilski, Kevin T; Setzler, Scott D; Schunemann, Peter G; Pollak, Thomas M; Mar 2006; 21 pp.; In English

Report No.(s): AD-A466914; AFRL-ML-WP-TP-2007-418; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The laser induced damage threshold (LIDT) of single crystal zinc germanium phosphide (ZGP), ZnGeP<sub>2</sub>, was increased to 2 J/cm<sup>2</sup> at 2.05 microns and 10 kHz pulse rate frequency (double the previously measured value of 1 J/cm<sup>2</sup>). This increased LIDT was achieved by improving the polishing of ZGP OPO crystals. The surface preparation of ZGP samples was determined to be of great importance because laser-induced damage has been observed to always initiate at the surface rather than in the bulk of the material. Two different polishing techniques were evaluated by comparing the surfaces of ZGP samples fabricated in the same manner apart from the polishing stage. Surfaces were characterized using scanning white light interferometry (SWLI) in order to determine RMS surface roughness and sample flatness. The photon backscatter technique (PBS) was used to determine the degree of surface and subsurface damage in the sample induced through the fabrication process. Both uncoated and anti-reflection coated samples were damage tested. The effect of subsurface damage in the samples was studied by removing different amounts of material during polishing for otherwise identical samples. The amount of material removed was correlated to the observed LIDT. Statistical LIDT was measured using a high-average-power, repetitively Q-switched



Tm,Ho:YLF 2.05-micron pump laser. On average, lower surface roughness and photon backscatter measurements was a good indicator of ZGP samples exhibiting higher LIDT. The removal of more material during polishing significantly improved the LIDT of otherwise identical samples, indicating the importance of subsurface damage defects in the LIDT of ZGP.

DTIC

*Germanium; Laser Damage; Phosphides; Single Crystals; Yield Point; Zinc*

**20070027454** Ben Gurion Univ. of the Negev, Beersheva, Israel

**Improving COIL Efficiency By Iodine Pre-Dissociation Via Corona Discharge In The Transonic Section Of The Secondary Flow**

Rosenwaks, Zamik; Barmashenko, Boris; Aug 1, 2006; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-05-1-3041

Report No.(s): AD-A467600; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report results from a contract tasking Ben-Gurion University of the Negev as follows: We intend to carry out a comprehensive experimental study of I<sub>2</sub> pre-dissociation, based on applying corona discharge in the transonic section of the secondary flow in the COIL supersonic nozzle. The main issues to be addressed are the following: 1. Determination of conditions for maximum dissociation fraction F of I<sub>2</sub> caused by the corona discharge. 2. Experimental measurements of the lasing power and small signal gain with and without the iodine predissociation caused by the corona discharge and determination of the power enhancement factor. There will be two stages in the proposed experimental study of I<sub>2</sub> pre-dissociation. Facilities: The equipment available at BGU includes a supersonic COIL setup with different mixing nozzles and three diode laser based diagnostic systems for H<sub>2</sub>O, O<sub>2</sub> and I atoms for probing the COIL active medium. Also available are a variety of optical, electronic and computing equipment, including He-Ne lasers, lock-in amplifiers, optical fibers, power supplies, optical windows, halogen lamps and an on-line laboratory computer. Schedule: Report will be delivered at the end of the contract.

DTIC

*Chemical Oxygen-Iodine Lasers; Dissociation; Electric Corona; Iodine; Secondary Flow*

**20070029803** United Defense Ltd. Partnership, Minneapolis, MN USA

**High-Energy Laser Weapon Integration with Ground Vehicles**

Hafften, Michael; Stratton, Robert; Jun 7, 2004; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469147>

No abstract available

*Combat; High Power Lasers; Laser Weapons*

**20070029821** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target**

Orth, David F; Jun 2007; 129 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469169; AFIT/GEO/ENP/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469169>

Airborne Laser testing and evaluation can be aided by developing a spectrally-based infrared camera simulation to explore how the target surface's specular and diffuse reflectivities affect the observed signal-to-noise ratio (SNR) and how the target's temperature in the laser spot can be estimated. This simulation provides for the observed irradiance, scaled by atmospheric absorption, to consist of the target's self-emission, reflected background emission, and the path emission from the observer to the target. The observed irradiance is scaled and distributed onto a focal plane array by way of a simulated optical system, whose effects are described by modulation transfer functions. The modeled detector response converts the observed irradiance to a current signal from which detector noise quantities are computed. Analyzing the simulated data shows that the observed SNR is dependent upon the target's reflectivity, and leads to a conclusion that the mid-wave infrared band is the best choice for observing the thermal emission. For estimating temperature, a least-squares optimization will not work because of the effects of the point spread function.

DTIC

*Airborne Lasers; Cameras; Estimating; Illuminating; Infrared Radiation; Laser Targets; Lasers; Signal to Noise Ratios; Simulation; Targets; Temperature Profiles; Thermal Radiation*

## MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

**20070026400** Johns Hopkins Univ., Laurel, MD USA

**SparkJet Actuators for Flow Control**

Cybyk, Bohdan Z; Simon, Daniel H; Land, III, H B; Wilkerson, Jordan T; Mar 2007; 27 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0095

Report No.(s): AD-A466100; JHU/APL-GED-L-07-0137; JHU/APL-GED-R-07-7606; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466100>

Effective manipulation of a flow field can lead to a number of significant benefits to aerospace vehicle systems, including enhanced performance, maneuverability, payload and range, as well as lowered overall cost. These macro benefits are directly achievable through the application of flow-control technology on the micro scale. Practical application of active flow control is dependent upon the development of robust actuators that are reliable, low cost, and responsive. An example of promising actuator technology for supersonic flow applications is the SparkJet actuator under development at The Johns Hopkins University Applied Physics Laboratory. The SparkJet has demonstrated the ability to produce a synthetic jet with high exhaust velocities, and hence holds the promise of manipulating high-speed flows without moving aerodynamic structures. Practical application of the SparkJet technology will require the development and demonstration of distributed actuator arrays.

DTIC

*Actuators; Flow Distribution*

**20070026488** Florida Univ., Gainesville, FL USA

**Optimization of Synthetic Jet Actuators**

Gallas, Quentin; Wang, Guiqin; Papila, Melih; Sheplak, Mark; Cattafesta, Louis; Jan 2003; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466310; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466310>

This paper describes the optimization of a piezoelectric-driven synthetic jet actuator based on a Lumped Element Modeling (LEM). To simplify the problem, this paper splits the optimization problem into two parts. First, a constrained optimization of the cavity volume and orifice dimensions of two baseline synthetic jets, each with a given piezoelectric diaphragm, is conducted using two different objective functions. One seeks to improve the centerline output velocity over a broad frequency range, and the other maximizes the centerline velocity at a prescribed resonant frequency of the device. Significant improvements are achieved using both objective functions for both synthetic jets. Second, the two baseline piezoelectric diaphragms have been optimized using two configurations. One uses the standard inner-disc piezoceramic patch bonded to a metal shim, while the other employs an outer piezoceramic ring. In each case, the objective is to maximize the achievable volume displacement of the diaphragm at the coercive electric field strength of the piezoceramic, while the natural frequency of the piezoelectric diaphragm is constrained to be greater than or equal to the baseline designs. Both configurations yield modest (~5%) improvements for one diaphragm and significant improvements for the other diaphragm (>50%).

DTIC

*Actuators; Optimization; Piezoelectricity*

**20070026507** Digital Fusion, Huntsville, AL USA

**Simulation and Analysis of Dart Dispense Events with Collisions**

Dietz, William E; Baltar, James Y; Losser, Kevin; Morell, Morris; Jan 2006; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-C-0011

Report No.(s): AD-A466347; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466347>

Current approaches to beach and surf zone mine clearance depend on the dispensing of large numbers of darts from a parent missile or projectile. The mine clearance mission requires a uniform distribution of darts over the target area. The dispersal pattern is affected by many factors, including the angle of attack, velocity, and rotational rate of the parent vehicle,

the aerodynamic design of the darts, dart collision, and the different aerodynamic regimes that exist in the vicinity of the dispenser. In the overall effort, computational modeling and simulation is used to provide insight and understanding of the dispense event. The primary long-term goal of the present effort is to understand and characterize, through simulation, analysis, and comparisons to wind tunnel and flight tests, the most important physical processes underlying the behavior of dispense events.

DTIC

*Aerodynamics; Clearances; Collisions; Dispensers; Simulation*

**20070027243** Department of the Navy, Washington, DC USA

**Thermally Compensated Fiber Bragg Grating Mount**

Ames, Gregory H, Inventor; Jan 25, 2007; 17 pp.; In English

Report No.(s): AD-D020286; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020286>

A thermally compensated fiber Bragg grating package is used with a fiber optic sensor. The package includes a Bragg grating mount connected at each end of a sensor mandrel. An optical fiber is wound around the sensor mandrel and a fiber portion having a Bragg grating therein is wound onto the mount. The mount is made of a rigid material having a negative coefficient of thermal expansion to minimize thermally induced spectral shifts. One example of the material includes zirconium tungstate. A coating material can be used to further adhere the optical fiber to the sensor mandrel and/or to the mount. The mount preferably includes a ramped groove to provide for a smooth transition from the sensor mandrel to the mount.

DTIC

*Bragg Gratings; Fiber Optics; Patent Applications; Supports*

**20070028576** California Univ., Riverside, CA, USA

**Evaluation of Portable Emissions Measurement Systems (PEMS) for Inventory Purposes and the Not-to-Exceed Heavy-Duty Diesel Engine Regulation**

Maldonado, H.; Miller, J. W.; Jun. 2006; 136 pp.; In English

Report No.(s): PB2007-109675; No Copyright; Avail.: National Technical Information Service (NTIS)

Diesel engines are significant contributors of emissions in air basins and diesel emissions have become increasingly scrutinized. This scrutiny has resulted in more regulation of diesel emissions and a desire to learn more about the actual in-use emissions from these engines rather than values measured with engine and chassis dynamometers. However, measuring on-board, in-use emissions is problematic, especially if current EPA reference methods must be used. This project was launched with a goal of measuring the performance of alternatives to EPA reference methods. Toward that end, the practical alternative to fixed laboratory measurements with EPA reference methods is the use of portable emissions measurement systems (PEMS) which became the focus of this research. The intent of this project was to test the PEMS over a wide range of engine operating conditions so the results would provide insight for PEMS use for emission inventories and for regulatory applications, especially compliance with the Not-To-Exceed (NTE) regulations. The specific project deliverables included quantifying both the accuracy and precision of commercially available PEMS relative to the federal reference methods (FRM) in the University of California, Riversides (UCRs) mobile emissions laboratory (MEL).

NTIS

*Diesel Engines; Inventories*

**20070028580** Desert Research Inst., Reno, NV, USA

**Southern Nevada Air Quality Study**

Watson, J. G.; Barber, P. W.; Chang, M. C. O.; Chow, J. C.; Etyemezian, V. R.; Feb. 2007; 54 pp.; In English

Contract(s)/Grant(s): FTA-26-7003; FTA-26-7003-01

Report No.(s): PB2007-109059; FTA-NV-26-7003-2006.01; No Copyright; Avail.: National Technical Information Service (NTIS)

The Southern Nevada Air Quality Study (SNAQS) created cross-plume and in-plume measurement systems to quantify emissions distributions and source profiles from transportation emissions, specifically gasoline and diesel powered vehicles. The cross-plume system measures backscattered ultraviolet radiation to estimate particulate emissions and infrared and ultraviolet absorption to measure gas concentrations in exhaust plumes. The in-plume system draws a portion of air from the plume and directs it to continuous monitors and filter samples that are analyzed in the laboratory. Both systems were applied

to on-road measurements in Las Vegas, Nevada. Results from both methods found that most of the particulate and gas pollutant emissions came from a small fraction of the vehicles. High carbon monoxide emitters were not always high particulate matter and oxide of nitrogen emitters, implying that smog checks must measure all of these pollutants to be effective. Receptor models were applied to ambient particulate samples taken in Las Vegas using source profiles obtained with the in-plume system. Gasoline engine exhaust was the largest contributor to the carbon component at all sites, and diesel exhaust was only a large contributor at commercial sites near major highways. Residential wood combustion was also an important contributor in residential areas, but not in the commercial areas.

NTIS

*Air Quality; Nevada; Plumes; Combustion Products*

**20070028863** NASA Langley Research Center, Hampton, VA, USA

**Characterization and Evaluation of a Mass Efficient Heat Storage Device.**

Splinter, Scott C.; Blosser, Max L.; Gifford, Andrew R.; June 21, 2007; 11 pp.; In English; 29th International Thermal Conductivity Conference (ITCC), 24-27 Jun. 2007, Birmingham, AL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.02.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

The heat sponge is a device for mass-efficient storage of heat. It was developed to be incorporated in the substructure of a reentry or hypersonic vehicle to reduce thermal protection system requirements. The heat sponge consists of a liquid-vapor mixture contained within a number of miniature pressure vessels that can be embedded within a variety of different types of structures. As temperature is increased, pressure in the miniature pressure vessels also increases so that heat absorbed through vaporization of the liquid is spread over a relatively large temperature range. Using water as a working fluid, the heat storage capacity of the liquid-vapor mixture is many times higher than that of typical structural materials and is well above that of common phase change materials over the temperature range of 660oR to 1160oR. Prototype heat sponges were fabricated and characterized. These heat sponges consisted of 1.0 inch diameter hollow stainless steel spheres with a wall thickness of 0.020 inches which had varying percentages of their interior volumes filled with water. An apparatus to measure the heat stored in these prototype heat sponges was designed, fabricated, and verified. The heat storage capacity calculated from measured temperature histories is compared to numerical predictions.

Author

*Heat Storage; Characterization; Hypersonic Vehicles; Mathematical Models; Fabrication; Mechanical Engineering; Aerothermodynamics*

**20070028884** Kansas State Univ., Manhattan, KS, USA

**Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006)**

Chapman, K. S.; Nuss-Warren, S. R.; Jan. 2007; 12 pp.; In English

Report No.(s): DE2007-901194; No Copyright; Avail.: National Technical Information Service (NTIS)

This report highlights work done on a project intended to lower the cost of environmental compliance and expedite project permitting for Exploration and Production (E&P) operators by identifying, developing, testing, and commercializing emissions control and monitoring technologies. Promising technologies have already been identified and developed. Current work focuses on testing these promising technologies. Specifically, several technologies are being tested in the laboratory for application to lean-burn engines or fully characterized on-site for use with rich-burn engines. Upon completion of these tests, the most cost-effective and robust technologies will be tested in the field and commercialization will ensue.

NTIS

*Combustion Products; Cost Effectiveness; Exhaust Emission; Exhaust Gases; Internal Combustion Engines; Natural Gas; Piston Engines*

**20070028885** Kansas State Univ., Manhattan, KS, USA

**Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines**

Chapman, K. S.; Nuss-Warren, S. R.; Feb. 2007; 39 pp.; In English

Contract(s)/Grant(s): DOE-FC26-02NT15464

Report No.(s): DE2007-901192; No Copyright; Avail.: Department of Energy Information Bridge

This topical report discusses work completed during Phase 1 of the project Cost Effective Reciprocating Engine

Emissions Control and Monitoring for E&P Field and Gathering Engines. In this report information, data, and results are compiled and summarized from quarterly reports 1 through 15. Results for each of the tasks in Phase 1 are presented.

NTIS

*Combustion Products; Cost Effectiveness; Exhaust Emission; Exhaust Gases; Internal Combustion Engines; Natural Gas; Piston Engines*

**20070029468** Southwest Research Inst., San Antonio, TX USA

**Diesel Particulate Measurement Research, 2007. Phase 3**

Khalek, I. A.; Jun. 12, 2007; 64 pp.; In English

Contract(s)/Grant(s): CRC-E-66; E-66-3

Report No.(s): PB2007-110019; CRC-E-66-3; No Copyright; Avail.: National Technical Information Service (NTIS)

Phase 3 of Project E-66 was conducted using the same engine and aftertreatment system used in Phase 1 and Phase 2, namely a 1998 DDC Series 60 heavy-duty diesel engine (HDDE) equipped with a continuously regenerative technology diesel particulate filter (CRT-DPF). Overall, Phase 3 of Project E-66 verified the greatly improved and now acceptable response time of the PFSS units tested in this program. It also showed that at a PM emission level below 10 percent of the 2007 standard, both the CVS as well as the PFSS units could be used interchangeably to produce similar results under steady-state and transient engine operation. Phase 3 of Project E-66 also highlighted the usefulness of using real time particle instruments to measure PM at near or well below the 2007 PM standard. The ease of use, high sensitivity, and fast response time (less than one second) of these instruments make them good candidates for particle measurement instead of using the filter collection technique. However, more work is needed to establish a standard protocol to calibrate and demonstrate the accuracy of these systems in measuring PM mass.

NTIS

*Diesel Engines; Exhaust Emission; Particulates*

**20070029975** Albion Coll., MI, USA; Wayne State Univ., Detroit, MI, USA

**Truck Driver Occupational Safety and Health. 2003 Conference Report and Selective Literature Review**

Saltzman, G. M.; Belzer, M. H.; Feb. 2007; 138 pp.; In English

Report No.(s): PB2007-110282; No Copyright; Avail.: CASI: [A07](#), Hardcopy

In 2003, NIOSH co-sponsored a conference that brought together researchers from around the world to discuss the safety and health of commercial truck drivers. NIOSH recognizes that these workers merit attention due to the difficult and dangerous nature of their trade. Truck drivers have an unusually high rate of occupational injury, and one of the highest rates of on-the-job fatality. NIOSH is actively working to improve the safety and health of truck drivers. Current Institute projects will increase our understanding of cause-specific mortality among owner-operator truck drivers, the health effects of diesel exhaust particles, and the influence of work organization on truck driver fatigue. Reducing occupational injury and illness among truck drivers is assisted by a coordinated effort, and this conference was an important step towards establishing a national research agenda. The following report and accompanying CD-ROM share the information, insight, and research of the professionals who participated in the conference. Together they provide an overview of the trucking industry, summarize the current state of knowledge regarding truck driver safety and health, and document the topics for future research suggested by the conference participants. NIOSH hopes that these proceedings will be valuable to researchers, industry representatives, policymakers, and the public.

NTIS

*Conferences; Health; Injuries; Safety; Trucks*

## 38

### QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

**20070028661** Westinghouse Savannah River Co., Aiken, SC, USA

**Type B Radioactive Material Package Failure Modes and Contents Compliance**

Hensel, S. J.; Watkins, R. W.; Smith, A. C.; January 2007; 5 pp.; In English

Report No.(s): DE2007-899959; WSRC-STI-2007-00090; No Copyright; Avail.: Department of Energy Information Bridge

Type B radioactive material package failures can occur due to any one of the following: inadequate design, manufacture, and maintenance of packages, load conditions beyond those anticipated in the regulations, and improper package loading and

operation. The rigorous package design evaluations performed in the certification process, robust package manufacture quality assurance programs, and demanding load conditions prescribed in the regulations are all well established. This paper focuses on the operational aspects of Type B package loading with respect to an overbatch which may cause a package failure.

NTIS

*Failure Modes; Packaging; Radioactive Materials*

## 39

### STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

**20070026745** Dames and Moore, Bethesda, MD USA

#### **Survey of Underground Storage Tanks and Other Subsurface Structures at the Umatilla Depot Activity, Hermiston, Oregon**

Jul 1990; 36 pp.; In English

Contract(s)/Grant(s): DAAA15-88-D-0008

Report No.(s): AD-A467010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467010>

This document is the Standard Operating Procedure (SOP) for the performance of a survey of underground storage tanks (UST) and other subsurface structures at the Umatilla Depot Activity (UMDA), Hermiston, Oregon This plan has been prepared under Contract No. DAAA15-88-D-0008, Delivery Order No. 3, for the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) in support of the U.S. Department of Defense (DOD) Base Realignment and Closure (BRAC) Program at UMDA. This project is being performed in conjunction with, though not as part of, the Remedial Investigation/Feasibility Study (RI/FS) of UMDA. The Army needs to determine--prior to base closure and property excessing--if any USTs are leaking or have leaked, thereby releasing contaminants to surrounding soils and possibly groundwater, and if other subsurface structures exist that may be potential contamination sources or potentially providing conduits for contaminant migration. This SOP presents the technical approach for performance of the UST/subsurface structure survey at UMD. It includes the methodologies and procedures that will be followed in identifying and locating USTs and other subsurface structures, performing leak testing of the tanks, and performing sampling investigations, as necessary. DTIC

*Storage Tanks; Surveys; Underground Storage; Underground Structures*

**20070027728** Army Construction Engineering Research Lab., Champaign, IL USA

#### **Seismic Response of a Half-Scale Masonry Building with Flexible Diaphragms**

Sweeney, Steven C; Horney, Matthew A; Orton, Sarah L; Sep 2005; 127 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-AT41-CFM-A001

Report No.(s): AD-A468395; ERDC/CERL-TR-05-25; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Unreinforced masonry (URM) buildings constructed on Army installations before the development of modern seismic codes may be susceptible to earthquake damage and therefore could benefit from seismic mitigation measures. Improved understanding of URM structural response under multidirectional loads is required to develop the most effective seismic structural retrofit strategies. This research used a half-scale structural model to investigate the seismic response of URM buildings with flexible diaphragms. The objectives were to determine failure mechanisms and deformation behaviors; examine amplification of ground motion acceleration by walls and diaphragms; approximate any strength effects that flange portions of out-of-plane walls may have on in-plane walls; investigate vertical distribution of lateral forces; and identify any combinational effects of multidirectional base motions. An unexpected level of out-of-plane wall flange contribution to in-plane wall strength indicates the need for experimental quantification using different pier layouts, URM wall combinations, and wall connection methods. Results also indicate the need to investigate the effect of overturning forces on the in-plane strength of piers and to determine critical ground motion characteristics that lead to the direct combination of response quantities due to orthogonal earthquake components. DTIC

DTIC

*Buildings; Earthquakes; Masonry*

**20070029414** Texas Univ., Austin, TX, USA

**Composite Action during Construction of Steel Trapezoidal Box Girder Bridges**

Topkaya, C.; Yura, J. A.; Williamson, E. B.; Frank, K. H.; Aug. 2005; 54 pp.; In English

Report No.(s): PB2007-110168; CTR-0-1898-2; No Copyright; Avail.: National Technical Information Service (NTIS)

In steel trapezoidal box girder bridge systems, the U-shaped steel girder is designed to act compositely with the concrete deck to form a closed box for live loading. During the construction stage, however, the behavior is not well understood. The usual practice of assuming the system to be non-composite during construction requires substantial top flange bracing to form a quasi-closed box section. Field studies have Composite box girders with live loading, and girders during construction, have to be evaluated during the design of curved steel trapezoidal box girder bridges. Considering both cases, the design for construction loading is the least understood and is the most important. Stresses due to construction loading can reach up to 60-70 percent of the total design stress for a given cross section. A three-phase study was undertaken to investigate the behavior of curved trapezoidal box girders during construction. In the first phase, laboratory tests were performed to investigate the shear transfer between the concrete deck and steel girder at early concrete ages (hours, not weeks). In the second phase, an easy-to-use finite element program, UTrAp, was developed for the analysis of these systems under construction loads and is documented in CTR Report 1898-3 (October 2002). The program has the capability of modeling the effects of semi-cured concrete. The third phase focused on the monitoring of two curved trapezoidal box bridges during construction. The measured forces and stresses in the field were compared with the analyses using the developed software. Findings from laboratory and field tests revealed that composite action develops at very early concrete ages. The developed software provides good correlation between measured field data and computed results.

NTIS

*Bridges (Structures); Construction; Girders; Steels; Structural Analysis*

**20070029417** Texas Univ., Austin, TX, USA

**Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges**

Wood, S. L.; Hagenberger, M. J.; Heller, B. E.; Wagener, P. J.; Jan. 2007; 200 pp.; In English

Report No.(s): PB2007-110167; CTR-0-1895-1; No Copyright; Avail.: National Technical Information Service (NTIS):

A09, Hardcopy

Within Texas, the procedures in the AASHTO Manual for Condition Evaluation of Bridges (MCEB) are used to determine the load rating of existing structures. A large number of prestressed concrete bridges that were constructed in the 1950s and 1960s have load ratings that fall below the minimum design vehicle specified in the MCEB. The load ratings for this group of are typically controlled by the serviceability limit state criterion related to the tensile stress in the concrete. A low load rating implies that these bridges have experienced damage under service loads. However, observations made by TxDOT personnel during routine inspections indicate that the condition of these bridges is very good, and that there are generally no signs of deterioration. Based on the results of the diagnostic load tests and laboratory fatigue tests, it was concluded that the tensile stress criterion in the MCEB should not be used to evaluate existing prestressed concrete bridges. The calculated tensile stress in the concrete is not a reliable indicator of the stresses induced in the strand due to live load. Conservative guidelines for considering the fatigue limit state explicitly in the load rating process were developed.

NTIS

*Concretes; Fatigue Life; Loads (Forces); Prestressing; Ratings*

**42**

**GEOSCIENCES (GENERAL)**

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

**20070028899** Massachusetts Inst. of Tech., Cambridge, MA, USA

**Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica**

Herring, Thomas A.; November 24, 2005; 5 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS5-99007; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2005GL024272>

We analyze ICESat derived heights collected between Feb. 03-Nov. 04 using a kriging/Kalman filtering approach to investigate height changes in East Antarctica. The model's parameters are height change to an a priori static digital height model, seasonal signal expressed as an amplitude Beta and phase Theta, and height-change rate  $dh/dt$  for each (100 km)(exp

2) block. From the Kalman filter results, dh/dt has a mean of -0.06 m/yr in the flat interior of East Antarctica. Spatially correlated pointing errors in the current data releases give uncertainties in the range 0.06 m/yr, making height change detection unreliable at this time. Our test shows that when using all available data with pointing knowledge equivalent to that of Laser 2a, height change detection with an accuracy level 0.02 m/yr can be achieved over flat terrains in East Antarctica.

Author

*Antarctic Regions; Height; Kalman Filters; Kriging; Static Models; Land Ice; Polar Caps*

## 43

### EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

**20070026842** Rust Environment and Infrastructure, Inc., Grand Junction, CO USA

**Jefferson Proving Ground, South of the Firing Line, Final Asbestos Survey Summary Report. Volume 3. Buildings 230 through 475**

Sep 1993; 808 pp.; In English

Contract(s)/Grant(s): DAAA15-90-D-0007

Report No.(s): AD-A467751; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467751>

This volume contains, for the following buildings, all or some of 1) a building summary, 2) a building drawing, 3) an Inspector's Room-by-Room Inventory of Suspect ACM, 4) an Inspector's Summary of Homogenous Areas of Suspect ACM, 5) a Report of Laboratory Analysis, 6) ACM Removal Expense and Response Action Recommendations, and 7) a Chain of Sample Custody form.

DTIC

*Asbestos; Buildings; Surveys*

**20070026845** Stollar (R. L.) and Associates, Inc., Denver, CO USA

**Asbestos Survey for Fort Point US Coast Guard Station. Presidio of San Francisco. Volume 2**

Sep 1991; 302 pp.; In English

Contract(s)/Grant(s): DAAA15-90-D-0018

Report No.(s): AD-A467908; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467908>

R. L. Stollar and Associates, Inc. (RLSA) conducted an asbestos survey and bulk sampling of materials at the Fort Point U.S. Coast Guard Station (FPUSCGS) buildings to delineate the location and extent of asbestos-containing materials (ACM) at the facility. The U.S. Coast Guard Station is located on Presidio of San Francisco property along the San Francisco Bay. The facility consists of nine buildings ranging in size from 108 square feet (sq ft) to 8,852 sq ft, totalling 20,905 square feet. The survey was conducted in accordance with procedures outlined in TM5-612, Asbestos Control. Assessment of friable ACM was made using the worksheets included in the Guide for Asbestos Hazard Assessment in U.S. Army Facilities. From damage/risk and exposure values obtained from these worksheets, recommended management corrective actions were determined.

DTIC

*Asbestos; Coasts; San Francisco (CA); Surveys*

**20070027792** Army War Coll., Carlisle Barracks, PA USA

**Oil Vulnerabilities and USA Strategy**

Walsh, Shawn P; Feb 8, 2007; 23 pp.; In English

Report No.(s): AD-A468533; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA, its industries, livelihood, and economy depend on oil. The USA is the world's largest consumer of oil, with daily usage of approximately 20 million barrels. Approximately 12.6 million barrels of oil per day is imported from foreign sources. Dependence on foreign oil leaves the American lifestyle, its freedoms, and its economy extremely vulnerable to risk, and exposed to factors outside the USA's immediate control. Foreign political or military action, acts of terrorism abroad, and the world's growing and competing demands for limited oil supplies are factors that could affect America's energy security.



Additionally, acts of terrorism on American soil directed at its vast petroleum distribution infrastructure could have a devastating impact on transportation and industry, bringing the nation and economy to a virtual stand still. These factors place the USA in a precarious position. As a new world order continues to take shape, oil remains a strategic commodity, critical to national strategies and international politics. Is the U.S. government promoting technology advances to find effective, efficient, and affordable solutions to fossil fuels? The author intends to explore vulnerabilities associated with the USA's dependence on foreign oil and reveal if the nation has an effective strategy to reduce its dependence on foreign oil.

DTIC

*Crude Oil; Industries; Oils; Supplying; United States; Vulnerability*

**20070029796** Army War Coll., Carlisle Barracks, PA USA

**European Security in the Wider Black Sea Area**

Stinga, Aurelian; Mar 12, 2007; 22 pp.; In English

Report No.(s): AD-A469122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469122>

At the beginning the third millennium, the world balance of power changed. The events of 9/11 necessitated a reorientation of U.S. foreign policy and a new approach to the wider Black Sea security environment. After a decade of decline due to its energy policies, the Russian Federation has recovered and is trying to regain its position as the World's second greatest power. To accomplish this goal, communist Russia uses dirty politics, blackmail, and sabotage to frighten its neighbors; these tactics are jeopardizing the international security environment. This project examines geopolitical, geo-economical, and geostrategic tendencies, vulnerabilities, risks, and threats in the wider Black Sea area. The research reveals the existence of a 'Soft War' that has set the USA and the European Union on one side against the Russian Federation and its allies in the Shanghai Cooperation Organization on the other. This Soft War could easily become the Second Cold War. This war involves access to energy resources and distribution; Russian efforts to maintain and extend its hegemony using regional instability, secessionist enclaves, sabotage, paramilitary violence, terrorism, and heavy criminality. The project also examines Western interests in the area and U.S. and European Union recommendations meant to improve regional security and to counteract Russian offensive actions.

DTIC

*Black Sea; Crude Oil; Earth Resources; Natural Gas; Security*

## 44

### ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

**20070026506** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Selection Process of a Non-Primary Power Source for a Combat Vehicle**

Herbert, Steven; Jun 15, 2006; 18 pp.; In English

Report No.(s): AD-A466343; 15901; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466343>

What is a non-primary power source? The capability to provide power from a source other than the main generator on a vehicle. It is used both when the main generator is not providing sufficient power or the main engine is not operating. Power source includes storage, conversion or any other means to provide power other than the main generator: battery, engine/generator, fuel cells, etc.

DTIC

*Combat; Supplying*

**20070026667** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Decision Model for Selecting Energy Efficient Technologies for Low-Sloping Roof Tops Using Value-Focused Thinking**

McCourt, Michael J; Mar 2007; 112 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466681; AFIT/GEM/ENS/07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466681>

The Air Force has a large inventory of low-sloping built up roofs (BURs) and millions of dollars are spent each year

retrofitting these systems. The DOD has been directed to reduce non-renewable energy consumption by using energy-efficient technologies. These two details present a great opportunity to use the open roof space to install energy-efficient roofing technologies. The purpose of this research is to provide Air Force decision makers with a tool to assist them in deciding what roofing technologies should be installed on facilities. Value Focused-Thinking is the methodology used to construct the model, in which values were used, instead of alternatives, to create the model. Data was collected from three different Air Force bases and values from three different Air Force Base Civil Engineers were used to evaluate the alternatives. The results show that based on current technologies these decision makers would be best served to retrofit BURs with standing seam metal roofs with some energy-efficient technologies added.

DTIC

*Decision Making; Decision Theory; Energy Policy; Roofs; Slopes; Value Engineering*

**20070027274** Logistics Management Inst., McLean, VA USA

**Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy**

Crowley, Thomas D; Corrie, Tanya D; Diamond, David B; Funk, Stuart D; Hansen, Wilhelm A; Stenhoff, Andrea D; Swift, Daniel C; Apr 2007; 138 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467003; FT602T1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In an environment of uncertainty about the price and availability of traditional energy sources, DoD is facing increasing energy demand and support requirements that it must meet if it is to achieve its broader strategic goals notably, establishment of a more mobile and agile force. However, recent technological advances in energy efficiency and alternative energy technologies offer a unique opportunity for DoD to make progress toward reconciling its strategic goals with its energy requirements through reduced consumption of fuel especially foreign fuel. To capitalize on this opportunity, DoD needs to implement an energy strategy that encompasses the development of innovative new concepts and capabilities to reduce energy dependence while maintaining or increasing overall warfighting effectiveness. Recognizing that DoD must change how it views, values, and uses energy a transformation that will challenge some of the department's most deeply held assumptions, interests, and processes the Office of Force Transformation and Resources, within the Office of the Under Secretary of Defense for Policy, asked LMI to develop an approach to establishing a DoD energy strategy.

DTIC

*Defense Program; Energy Consumption; Fuels*

**20070027325** Naval Postgraduate School, Monterey, CA USA

**Defending Electrical Power Grids**

Rose, Robert W; Mar 2007; 70 pp.; In English

Report No.(s): AD-A467137; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis considers the problem of protecting an electrical power grid against a potential attack on its physical infrastructure. We develop a mathematical model, called Defense of Known Interdictions (DKI), that identifies the optimal set of components to defend in an electrical power grid given limited defensive resources. For a small test network, we show that defending fewer than 10% of the buses reduces the possible disruption from an attack by over 20%. Previous research has developed optimization models, called I-DCOPF, to find optimal or near optimal interdiction plans for electrical power grids. DKI solution time is determined by I-DCOPF solution time. We develop a model, called the Network Dual Relaxation (NDR), to replace I-DCOPF and reduce solution times. NDR approximates electrical power grid behavior as a minimum cost network flow and uses this approximation to quickly estimate a lower bound for the exact interdiction model. We test NDR on a portion of the North American power grid with a computational limit of 6000 seconds. Results with ten buses defended show that NDR finds solutions that are, on average, 40% better than those of the exact I-DCOPF model with a significant reduction in computational time.

DTIC

*Network Analysis; Protection*

**20070027369** Army War Coll., Carlisle Barracks, PA USA

**Army Facility Energy Demand and the Impact on National Security**

Clapp, Isabella; Mar 30, 2007; 25 pp.; In English

Report No.(s): AD-A467293; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sustaining the Army base ensures soldiers and their families have adequate resources to live and work. The focus of this paper is current and future energy demand for Army facilities and how demand will be met in the face of global resource

shortages. Utility services for facilities on Army installations include: purchased electricity, steam, hot water and other utilities, and operation of electrical, heating, air conditioning, refrigeration, water distribution, and wastewater collection and treatment systems worldwide. In recent years, facility energy costs have escalated and demand has increased due to higher wartime operating tempo. This paper examines the impact this trend has on national security and the Army budget. This includes a survey of the Energy Policy Act of 2005 (EPACT 2005) and other defense relevant directives and an assessment of their impact on resulting Army energy strategy (e.g., Army Energy Strategy for Installations, Army Energy and Water Campaign Plan for Installations, etc.). This paper also addresses what the Army has accomplished to meet energy goals. Lastly, it considers the effect of energy efficiencies and employment of alternative sources of energy as well as the implications of failing to invest sufficient resources today to meet future energy demand.

DTIC

*Energy Policy; Security*

**20070027390** Library of Congress, Washington, DC USA

**Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress**

O'Rourke, Ronald; Dec 11, 2006; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467382; No Copyright; Avail.: Defense Technical Information Center (DTIC)

General strategies for reducing the Navy's dependence on oil for its ships include reducing energy use on Navy ships; shifting to alternative hydrocarbon fuels; shifting to more reliance on nuclear propulsion; and using sail and solar power. Reducing energy use on Navy ships. A 2001 study concluded that fitting a Navy cruiser with more energy-efficient electrical equipment could reduce the ship's fuel use by 10% to 25%. The Navy has installed fuel-saving bulbous bows and stern flaps on many of its ships. Ship fuel use could be reduced by shifting to advanced turbine designs such as an intercooled recuperated (ICR) turbine. Shifting to integrated electric-drive propulsion can reduce a ship's fuel use by 10% to 25%; some Navy ships are to use integrated electric drive. Fuel cell technology, if successfully developed, could reduce Navy ship fuel use substantially. Alternative hydrocarbon fuels. Potential alternative hydrocarbon fuels for Navy ships include biodiesel and liquid hydrocarbon fuels made from coal using the Fischer-Tropsch (FT) process. A 2005 Naval Research Advisory Committee (NRAC) study and a 2006 Air Force Scientific Advisory Board both discussed FT fuels. Nuclear propulsion. Oil-fueled ship types that might be shifted to nuclear propulsion include large-deck amphibious assault ships and large surface combatants (i.e., cruisers and destroyers). A 2005 'quick look' analysis by the Naval Nuclear Propulsion Program concluded that total life-cycle costs for nuclear-powered versions of these ships would equal those of oil-fueled versions when oil reaches about \$70 and \$ 178 per barrel, respectively. Sail and solar propulsion. Kite-assisted propulsion might be an option for reducing fuels use on Navy auxiliaries and DOD sea lift ships. Two firms are now offering kite-assist systems to commercial ship operators.

DTIC

*Energy Conservation; Fuel Cells; Fuel Consumption; Marine Propulsion; Navy; Nuclear Propulsion; Oils; Ships; Solar Energy*

**20070027467** Army Nuclear and Chemical Agency, Springfield, VA USA

**Emerging Energy Requirements for Future C4ISR**

Pfeffer, R A; Macon, Jr , W A; Sep 2002; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467640; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Command, control, communication, computers, intelligence, surveillance, and reconnaissance (C4ISR) systems already play a fundamental role in today's military operations. Modern C4ISR nodes now process enormous quantities of digital data in real time, allowing all levels of Command to better control the battle space. In future C4ISR, even more sophisticated electronics will be used to acquire, process and distribute information in manned and unmanned platforms and systems. In every case, from the more fixed sites at higher echelons to the very mobile battle space sensors and nodes, C4ISR will have to depend upon an energy source that is safe, reliable, and readily available/transported worldwide. Desert Storm and the low intensity war in Afghanistan clearly illustrate the enormous logistics costs required to provide readily available hydrocarbon-based fuel to military C4ISR and front line shooters. It would be preferable for the military to carry with them the capability to create all their fuel requirements. Even better, the new energy source should be based upon an inexhaustible natural resource and it should be compatible with current, oil-driven internal combustion engine technology, thus making the transition to the new fuel evolutionary, not revolutionary. The purpose of this article is to identify future military energy requirements, describe how they are driven by fundamental changes in the nation's energy policy, and show how the next generation of mobile nuclear power reactors could be used to generate the future energy transfer medium, hydrogen (H<sub>2</sub>), from seawater.

DTIC

*Energy Requirements; Energy Transfer; Hydrogen; Military Operations; Nuclear Reactors; Reactor Safety; Sea Water*

**20070027634** Army Construction Engineering Research Lab., Champaign, IL USA

**Proceedings of the 1st Army Installation Energy Security and Independence Conference**

Hartranft, Thomas J; Yeboah, Frank; Grady, Dennis; Ducey, Roch; Mar 2007; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467999; ERDC/CERL-TR-07-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is about energy security and for mission accomplishment. Is energy security assured by backup generator sets dedicated to individual buildings that are pre-identified as critical assets with fuel for 3-5 days? Suppose a utility power grid outage occurs. Today it is impossible to locally wheel power from dispersed individual on site fossil-fueled or renewable power sources to facilities or other power loads & anywhere at any time. Each power source is stranded; powering only one load. Relocating generator sets and engineering their electrical connections to other power loads are not speedy or trivial tasks. There are many mission aspects that go unpowered in a blackout because Army cannot afford backup generator sets for every building, training range, sewer treatment plant, warehouse, motor pool, etc. Even if everything has dedicated backup generators, experience shows that 50 percent will not operate right anyway & and they will run out of gas after 3-5 days. Mission priorities are dynamic; power outages are unpredictable. Commanders must have the ability to wheel dispersed and finite on-installation power anywhere at anytime and to allocate stored fuels for extended outages. A new vision of energy security is needed for the asymmetrical threats and dynamics of the GWOT era.

DTIC

*Conferences; Energy Policy; Installing; Security; Supplying*

**20070028424** National Renewable Energy Lab., Golden, CO USA

**Experience Scaling-Up Manufacturing and Emerging Photovoltaic Technologies**

Braun, G. W.; Skinner, D. E.; Jan. 2007; 59 pp.; In English

Report No.(s): DE2007-899800; NREL/SR-640-39165; No Copyright; Avail.: National Technical Information Service (NTIS)

This report examines two important generic photovoltaic technologies at particularly revealing stages of development, i.e., the stages between R&D and stable commercial production and profitable sales. Based on two historical cases, it attempts to shed light on the difference between: (1) costs and schedules validated by actual manufacturing and market experience, and (2) estimated costs and schedules that rely on technology forecasts and engineering estimates. The amorphous Silicon case also identifies some of the costs that are incurred in meeting specific market requirements, while the Cadmium Telluride case identifies many of the operational challenges involved in transferring R&D results to production. The transition between R&D and commercial success takes a great deal of time and money for emerging energy conversion technologies in general. The experience reported here can be instructive to those managing comparable efforts, and to their investors. It can also be instructive to R&D managers responsible for positioning such new technologies for commercial success.

NTIS

*Manufacturing; Photovoltaic Conversion; Solar Energy*

**20070028578** National Renewable Energy Lab., Golden, CO USA; Midwest Research Inst., Golden, CO, USA

**National Solar Radiation Data Base 1991-2005 Update: User's Manual**

Wilcox, S.; Apr. 2007; 472 pp.; In English

Contract(s)/Grant(s): DE-AC36-99-GO-10337

Report No.(s): PB2007-109060; NREL/TP-581-41364; No Copyright; Avail.: National Technical Information Service (NTIS)

This manual describes how to obtain and interpret the data products from the updated 1991-2005 National Solar Radiation Database (NSRDB). This is an update of the original 19611990 NSRDB released in 1992. In 2003, the National Renewable Energy Laboratory (NREL) investigated the feasibility of updating the NSRDB and began collaborative work with several agencies, including the National Aeronautics and Space Administration (NASA), the National Climatic Data Center (NCDC), the Northeast Regional Climate Center, the State University of New York at Albany (SUNY), the University of Oregon, the University of Wisconsin, and the private firm Solar Consulting Services. The original NSRDB held a serially complete data set for all sun-up hours for 239 stations. Because of expected changes in the roster of National Weather Service (NWS) sites, as well as the potential for adding NSRDB sites, the updated list of stations was not restricted to those same 239. Instead, it included as many stations and as much data as possible to increase the usefulness of the data set. This update therefore provides data for 1,454 stations. Users are encouraged to carefully consider the sections on modeled data and data uncertainty to better understand the applicability of the NSRDB for specific work.

NTIS

*Data Bases; Solar Radiation; User Manuals (Computer Programs); Data Products*

**20070028590** Foley and Lardner, LLP, Milwaukee, WI, USA

**Battery System**

Dougherty, T. J., Inventor; Symans, J. S., Inventor; Kochler, U., Inventor; Miles, R. C., Inventor; Kuempers, J. A., Inventor; 28 Oct 04; 30 pp.; In English

Contract(s)/Grant(s): DE-FC26-95EE50425

Patent Info.: Filed Filed 28 Oct 04; US-Patent-Appl-SN-10-976-169

Report No.(s): PB2007-104591; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A lithium battery for use in a vehicle includes a container, a plurality of positive terminals extending from a first end of the lithium battery, and a plurality of negative terminals extending from a second end of the lithium battery. The plurality of positive terminals are provided in a first configuration and the plurality of negative terminals are provided in a second configuration, the first configuration differing from the second configuration. A battery system for use in a vehicle may include a plurality of electrically connected lithium cells or batteries.

NTIS

*Electric Batteries; Lithium*

**20070028607** Massachusetts Inst. of Tech., Cambridge, MA, USA

**Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries**

Ceder, G., Inventor; Chiang, Y. M., Inventor; Sadoway, D. R., Inventor; Aydinoi, M. K., Inventor; Jang, Y. I., Inventor; 8 Apr 05; 38 pp.; In English

Contract(s)/Grant(s): DEFC07-941D113223; NIH-5P30-ES02109

Patent Info.: Filed Filed 8 Apr 05; US-Patent-Appl-SN-11-101-723

Report No.(s): PB2007-104584; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Solid battery components are provided. A block copolymeric electrolyte is non-crosslinked and non-glassy through the entire range of typical battery service temperatures, that is, through the entire range of at least from about 0 degrees C to about 70 degrees C. The chains of which the copolymer is made each include at least one ionically-conductive block and at least one second block immiscible with the ionically-conductive block. The chains form an amorphous association and are arranged in an ordered nanostructure including a continuous matrix of amorphous ionically-conductive domains and amorphous second domains that are immiscible with the ionically-conductive domains. A compound is provided that has a formula of  $\text{Li}(\text{sub } x)\text{M}(\text{sub } y)\text{N}(\text{sub } z)\text{O}(\text{sub } 2)\text{M}$  and N are each metal atoms or a main group elements, and x, y and z are each numbers from about 0 to about 1. y and z are chosen such that a formal charge on the  $\text{M}(\text{sub } y)\text{N}(\text{sub } z)$  portion of the compound is (4-x). In certain embodiments, these compounds are used in the cathodes of rechargeable batteries. The present invention also includes methods of predicting the potential utility of metal dichalcogenide compounds for use in lithium intercalation compounds. It also provides methods for processing lithium intercalation oxides with the structure and compositional homogeneity necessary to realize the increased formation energies of said compounds. An article is made of a dimensionally-stable, interpenetrating microstructure of a first phase including a first component and a second phase, immiscible with the first phase, including a second component.

NTIS

*Electric Batteries; Electrodes; Electrolytes; Intercalation*

**20070028616** Colorado School of Mines, Golden, CO USA; National Renewable Energy Lab., Golden, CO USA

**Studies of Basic Electronic Properties of CdTe-Based Solar Cells and Their Evolution During Processing and Stress. Final Technical Report October 16, 2001-August 31, 2005**

Kaydanov, V. I.; Ohno, T. R.; Feb. 2007; 132 pp.; In English

Report No.(s): DE2007-899988; NREL/SR-520-41129; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes basic issues behind CdTe/CdS cell performance and stability, such as the nature and electronic properties of impurities and defects that control the majority carrier concentration, mechanisms of dopant compensation, recombination processes, their nature and properties, migration and transformation of defects under various processing, stress, and operating conditions. We believe that a better basic understanding of the specific influence of grain boundaries, especially for fine-grain materials such as those making up CdTe-based cells, is now one of the most important issues we must address. We need to clarify the role of grain boundaries in forming the film electronic properties, as well as those of the p-n junction.

NTIS

*Cadmium Tellurides; Electrical Properties; Electron States; Solar Cells*

**20070029305** Department of Energy, Washington, DC, USA

**Report to Congress on Assessment of Potential Impact of Concentrating Solar Power for Electricity Generation (EPACT 2005 - Section 934 (c))**

Feb. 2007; 33 pp.; In English

Report No.(s): DE2007-900713; DOE/GO-12007-2400; No Copyright; Avail.: National Technical Information Service (NTIS)

Summary of DOE's assessment of issues regarding EPAct 2005, which requires the Secretary of Energy to assess conflicting guidance on the economic potential of concentrating solar power for electricity production.

NTIS

*Congressional Reports; Electricity; Energy Conservation; Solar Energy; Solar Generators*

**20070029334** Lawrence Livermore National Lab., Livermore, CA USA

**Impedance Analysis of Electrochemical NO<sub>x</sub> Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell**

Woo, L. Y.; Martin, L. P.; Glass, R. S.; Grote, R. J.; Nov. 21, 2006; 8 pp.; In English

Report No.(s): DE2007-900174; UCRL-PROC-226274; No Copyright; Avail.: Department of Energy Information Bridge

An electrochemical cell employing a YSZ electrolyte and two Au electrodes was utilized as a model system for investigating the mechanisms responsible for impedancemetric NO<sub>x</sub> (NO and NO<sub>2</sub>) sensing. The cell consists of two dense Au electrodes on top of a porous/dense YSZ bilayer structure (with the additional porous layer present only under the Au electrodes). Both electrodes were co-located on the same side of the cell, resulting in an in-plane geometry for the current path. The porous YSZ appears to extend the triple phase boundary and allows for enhanced NO<sub>x</sub> sensing performance, although the exact role of the porous layer is not completely understood. Impedance data were obtained over the frequency range of 0.1 Hz to 1 MHz, and over a range of oxygen (2 to 18.9%) and NO<sub>x</sub> (10 to 100 ppm) concentrations, and temperatures (600 to 700 degrees C). Data were fit with an equivalent circuit, and the values of the circuit elements were obtained for different concentrations and temperatures. Changes in a single low-frequency arc were found to correlate with concentration changes, and to be temperature dependent. In the absence of NO<sub>x</sub>, the effect of O<sub>2</sub> on the low-frequency resistance could be described by a power law, and the temperature dependence described by a single apparent activation energy at all O<sub>2</sub> concentrations. When both O<sub>2</sub> and NO<sub>x</sub> were present, however, the power law exponent varied as a function of both temperature and concentration, and the apparent activation energy also showed dual dependence. Adsorption mechanisms are discussed as possibilities for the rate-limiting steps.

NTIS

*Electrochemical Cells; Impedance; Nitrogen Oxides; Oxides; Yttria-Stabilized Zirconia; Yttrium Oxides; Zirconium Oxides*

**20070029521** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

**Standard-Cell, Open-Architecture Power Conversion Systems**

Boroyevich, D; Wang, F; Lee, F C; Odendaal, W G; Edwards, S; Oct 2005; 273 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468619; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468619>

This Final Report compiles all the work carried out at the Center for Power Electronics Systems (CPES), corresponding to the 'Standard-Cell, Open-Architecture Power Conversion Systems' project sponsored by the Office of Naval Research (ONR). This project was purposefully aimed to develop a standardized hierarchical design and analysis methodology for modular power electronics conversion systems using as basis the ISO/OSI seven-layer reference model. The foundational ideas of this engineering vision came from the Power Electronics Building Block (PEBB), seeking to expand the usage of this concept while exploiting the numerous advantages offered by it, namely modularity, scalability, reconfiguration and reduced design cycles. The means to the end chosen was the actual embracing of the hierarchical nature of PEBB-based converters by applying it to the modeling approach, control software, and energy processing characterization of power electronics systems. The resultant two-dimensional hierarchical reference model pursues the complete analysis and design of power electronics systems, covering not only the electromagnetic, thermal and mechanical interactions from semiconductors up to complete power systems, but also their associated controls, modeling and communications at every hierarchy level. In order to achieve these objectives several tasks were identified and undertaken in this project. Specifically, several studies were conducted in order to fully characterize the energy processing functions observed in shipboard power systems, individually addressing the PEBB, power converter and power system levels. The PEBB level -- using a CPES built 33 kW PEBB -- was subjected to a complete study describing it across all defined hierarchies, i.e., energy processing, controls and modeling.

Further, the complete design and evaluation of its digital controller (Hardware Manager) is also presented, thus fully characterizing the controls hierarchy at this level.

DTIC

*Architecture (Computers); Energy Conversion*

**20070029601** National Defense Univ., Norfolk, VA USA

**China's Energy Security and Its Military Modernization Efforts: How China Plans to Dominate the World**

Larson, Christopher; May 23, 2007; 70 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468854; JFSC-25789; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468854>

This report examines China's increasing demand for energy and how that demand has the potential to threaten the stability of China's Communist Party regime. It illustrates that China's demand for energy will continue to grow and that China will become increasingly reliant on oil imports to meet its energy needs. This reliance on oil imports has forced China, in the short term to adopt an energy security strategy that seeks to protect its access to oil by adopting a non-threatening military posture complemented by use of its economic bargaining power. At the same, China has adopted a long range strategy, that runs side-by-side with the short-term strategy, of 'Bide our time and build up our capabilities.' This long-term strategy consists of a 'String of Pearls' approach to gain the necessary forward bases to secure its energy lifeline and the development of asymmetric military capabilities. The ultimate goal of this long-term strategy is to develop sufficient military capability to challenge the West and achieve great power status.

DTIC

*China; Energy Policy; Oils; Security*

**20070029747** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Servicing Hawker Vehicle Batteries with Standard Battery Charging and Test Equipment**

Krestik, Fred; Apr 25, 2007; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469021; TARDEC-17040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469021>

The technical information presented is taken from Technical Bulletin TB 0-6140-252-13 titled: Field and Sustainment Maintenance and Recovery Procedures For Automotive HAWKER ARMASAFE Plus Battery NSN 6140-01-485-1472.

DTIC

*Battery Chargers; Electric Batteries; Storage Batteries; Test Equipment*

**20070029757** Army Tank-Automotive and Armaments Command, Warren, MI USA

**Heat Generation during Overcharge in Sealed Cells**

Catherino, Henry A; Aug 9, 2006; 16 pp.; In English

Report No.(s): AD-A469043; TACOM-16088; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469043>

A popular explanation for the heat generated when a sealed cell is overcharged is that the oxygen recombination taking place at the negative electrode is an exothermic process. Although it is a fact that this recombination reaction is exothermic, the first law of thermodynamics mandates that the net enthalpy of the closed cycle oxygen recombination process is exactly zero (also known as Hess's Law). Since the closed oxygen cycle cannot produce any enthalpic heat, the heat generated must be entirely of Joule origin. The alternative mechanism discussed in this paper is that the gas evolution process displaces the electrolyte in the intercell gap and by doing that, causes a substantial increase in the internal resistance of the cell. The consequence of this resistance increase in the presence of current passing through the cell is a significant contributor to the observed heat generation. This paper presents data and discussions that support this interpretation. This mechanistic interpretation has some notable implications. That is, the heat generation process is largely chemistry independent (i.e., it is common to all sealed cell designs), is the consequence of the ability of the separator to manage the electrolyte distribution within the cell and can thermally accelerate thermodynamically spontaneous processes that have slow kinetics under normal ambient conditions.

DTIC

*Heat Generation; Lead Acid Batteries; Separators*

**20070029795** Army War Coll., Carlisle Barracks, PA USA

**Building Alternative-Energy Partnerships with Latin America**

Bernreuther, David; Mar 30, 2007; 22 pp.; In English

Report No.(s): AD-A469121; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469121>

The world faces a significant energy problem with global demand rising and reserves declining. As both the largest consumer of energy and a major promoter of global economic stability, the USA is obviously affected by these developments. Beyond their direct economic consequences, high energy prices and potential shortages provide a pretext for unstable regimes to develop nuclear power (and potentially weapons), foster terrorism, impede global economic growth, and endanger stability. Concurrently, the U.S. faces a range of strategic challenges in Latin America including poor economic environments which promote problems including illegal immigration, drug trafficking, and instability. This project examines a concept to help mitigate both challenges - strengthening partnerships between the U.S. and its Latin American neighbors so they can become viable sources of alternative energy. This initiative would simultaneously help mitigate both America's energy concerns and improve relations with our Latin American neighbors.

DTIC

*Central America; Energy Consumption; Foreign Policy; Oils; South America*

**20070029939** Army Communications-Electronics Command, Fort Belvoir, VA USA

**Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER**

Fomin, Pavel; Bostic, Elizabeth; Bolton, Christopher; Cristiani, Jonathan H; Coombe, Scott; DuBois, Terry; Kowal, J J; Nov 27, 2006; 10 pp.; In English

Report No.(s): AD-A469013; APPT-TR-06-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469013>

In response to the growing need for lightweight - high energy density power sources on the battlefield, the US Army Communications Electronic Research Development Engineering Center (CERDEC) Fuel Cell Technology Team initiated several development contracts to address multiple areas where fuel cell technologies have the potential to offer increased capability to the Warfighter. Two of those areas are Soldier and Man Portable Power. Soldier Power fuel cell technology focuses specifically on Soldier worn power equipment, mainly from the sub to 100 Watt range. Man Portable Power fuel cell technology focuses on larger up to 500 Watt systems that could be carried by one or multiple Soldiers and provide power in remote locations. These two focus areas will serve as the basis of this paper discussing development status as well as testing results.

DTIC

*Conferences; Fuel Cells; Portable Equipment; Technology Assessment*

**20070029940** Army Communications-Electronics Command, Fort Belvoir, VA USA

**Smart Fuel Cell C20-MP Hybrid Fuel Cell Power Source**

Fomin, Pavel; Bostic, Elizabeth; Jun 12, 2006; 6 pp.; In English

Report No.(s): AD-A469072; APPT-TR-06-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469072>

The SFC C20-MP now utilizes fourth-generation conductive membrane technology in order to both increase system power density and mitigate the effects of methanol crossover across the DMFC membranes. Upon delivery of the upgraded units, CERDEC performed a series of test regimes to determine the operational capabilities of the C20-MP including fuel efficiency and power energy density. These tests confirmed that the C20-MP units are capable of achieving net system efficiencies as high as 21% based on the LHV of methanol. Testing also showed that the SFC systems were capable of providing upwards of 20 Watts of net continuous power at a power density of 10.25 Watts/kg. The calculated system energy density is 420W hrs/kg for a 72 hour, 20 Watt mission. The rest of this paper will discuss the results and findings in greater detail.

DTIC

*Flux Density; Fuel Cells; Methyl Alcohol*



**20070029972** National Renewable Energy Lab., Golden, CO USA  
**Solar Buildings. Transpired Air Collectors Ventilation Preheating**

Jun. 2006; 2 pp.; In English

Contract(s)/Grant(s): DOE/GO-102001-1288

Report No.(s): DE2007-783413; No Copyright; Avail.: National Technical Information Service (NTIS)

Many commercial and industrial buildings have high ventilation rates. Although all that fresh air is great for indoor air quality, heating it can be very expensive. This short (2-page) fact sheet describes a technology available to use solar energy to preheat ventilation air and dramatically reduce utility bills.

NTIS

*Accumulators; Aerosols; Air Flow; Buildings; Heating; Samplers; Solar Heating; Space Cooling (Buildings); Space Heating (Buildings); Ventilation*

**20070030005** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Joint Light Tactical Vehicle Power Requirements**

Hitchcock, Jennifer; Apr 24, 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469024; TARDEC-17045; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469024>

Briefing on the power and energy needs of three categories of Joint Light Tactical Vehicles.

DTIC

*Military Vehicles; Electric Power*

## 45

### ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

**20070026459** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

**Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities**

Guelta, Mark A; Balbach, Harold E; Feb 2007; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466185; ECBC-TR-487; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466185>

The Gopher tortoise (*Gopherus polyhemus*) and the Indiana Bat (*Myotis sodalists*) are species found on many military installations. The Indiana bat is endangered throughout its range, and the Gopher tortoise is threatened in its westernmost distributions and at risk everywhere else. On installations where troop readiness training is conducted, an important component of realistic troop readiness training is the generation of obscurant material and the conduct of maneuvers under obscurant cover. Fog oil (FO) has long been deployed for visual obscurant training, and the effects of such obscurants on these species are unknown. As a preliminary step prior to instituting toxicological studies, a laboratory simulation was performed on the capability of FO to penetrate the living space of these species: the tortoise burrow and the hollow-tree location of a bat maternity colony. The FO smoke did not enter the simulated tortoise burrow in significant concentrations, but the smoke concentrations in the simulated tree cavity approached ambient levels under some test conditions. This suggests that tortoise burrows do not need to be studied in-situ, and that the tortoise may be considered protected while in the burrow. Bat maternal colony sites, however, should not be considered protected from smoke entry to any significant degree.

DTIC

*Bats; Cavities; Fog; Habitats; Oils; Penetration; Reptiles; Smoke; Turtles*

**20070027327** Library of Congress, Washington, DC USA

**Terrorist 'Dirty Bombs': A Brief Primer**

Medalia, Jonathan; Apr 1, 2004; 7 pp.; In English

Report No.(s): AD-A467145; CRS-RS21528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many fear a terrorist attack with a radiological dispersal device (RDD). RDDs may scatter radioactive material with an explosive (a 'dirty bomb') or other means. Radioactive atoms are unstable; as they decay, they emit electromagnetic radiation or subatomic particles that can damage cells. Many legitimate activities worldwide use radioactive materials. This congressional report examines the following aspects of RDDs: differences between RDDs and nuclear weapons; the process by which RDDs decay and release their radioactivity; the meaning of the term 'half-life'; biological effects of radiation;

sources of radioactive materials, including medical equipment, oil well gauges, research labs, etc.; the effectiveness of RDDs; preventing an RDD attack by securing and controlling radioactive sources; detection of RDDs; advance steps the government can take to minimize the effects of an RDD attack; and how the government would respond to an RDD attack. This report will be updated. 'Nuclear and Radiological Terrorism,' in the CRS electronic briefing book on terrorism, tracks developments. This report does not address nuclear power-related issues. For information on that subject, see CRS Report RS21131, 'Nuclear Powerplants: Vulnerability to Terrorist Attack.'

DTIC

*Civil Defense; Dispersing; Electromagnetic Radiation; Radioactive Materials; Radiology; Scattering; Security*

**20070027596** Science Applications International Corp., Shalimar, FL USA

**Final Environmental Assessment for Construction of an Addition to Support the Joint Strike Fighter Reprogramming Facility, Building 614, on Eglin Air Force Base, Florida**

Jan 2007; 111 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F41624-03-D-8614

Report No.(s): AD-A467930; XC-96CEG/FL; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of the Air Force has conducted an Environmental Assessment (EA) of the potential environmental consequences associated with the Construction of an Addition to Support the Joint Strike Fighter (JSF) Reprogramming Facility (JRF), Building 614, on Eglin Air Force Base (AFB), Florida. Analysis was conducted to determine the potential impacts to the human and natural environment resulting from the Proposed Action and the No Action Alternative. No significant impacts to resources have been identified.

DTIC

*Construction; Military Air Facilities*

**20070027631** Army Construction Engineering Research Lab., Champaign, IL USA

**Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species**

Von Stackleberg, Katherine; Amos, Craig; Butler, C; Smith, Thomas; Famely, J; McArdle, M; Southworth, B; Steevens, Jeffrey; Oct 2006; 255 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467991; ERDC-TR-06-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Preparation for anticipated, unknown, and invariably adverse battlefield conditions requires military training activities involving military smokes and obscurants (S&Os) and related chemical compounds, and can result in the release of other chemical agents and military unique compounds (MUCs) associated with munitions. This study evaluates the potential long-term impacts on selected threatened and endangered species resulting from dispersion and deposition of vapors and particles found in the fog oils, hexachloroethane smoke, colored smokes, white phosphorus, and obscurants such as brass flakes and graphite flakes used during training. Residue from these constituents can deposit directly on plants and prey species favored by higher vertebrates and other species or can be taken up by plants and prey species from the soil. From the literature and installation use reports, the authors develop estimates of toxicity and exposure to calculate installation-specific screening-level risk for selected threatened and endangered species.

DTIC

*Air Pollution; Ammunition; Chemical Composition; Endangered Species; Risk*

**20070028483** Ecology and Environment, Inc., Arlington, VA, USA

**Work Plan and Field Sampling Plan Site Investigations Fort Devens, Massachusetts**

Feb 1992; 301 pp.; In English

Contract(s)/Grant(s): DAAA15-90-D-0012

Report No.(s): AD-A467971; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467971>

No abstract available

*Reclamation; Sampling*

**20070028503** Weston (Roy F.), Inc., West Chester, PA USA

**Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area**

Nov 27, 1991; 369 pp.; In English

Report No.(s): AD-A466962; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466962>

Appendices for the Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area.

DTIC

*Air Pollution; Contaminants; Grasslands; Incinerators; Installing; Lagoons; Pollution Control; Restoration; Water Pollution*

**20070028573** National Inst. for Occupational Safety and Health, Washington, DC, USA

**NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007**

May 2007; 20 pp.; In English

Report No.(s): PB2007-108765; HETA-2007-0068-3042; No Copyright; Avail.: CASI: [A03](#), Hardcopy

On December 1, 2006, NIOSH received a management request for an HHE from the LA/SPCA in Algiers, Louisiana. The HHE request asked NIOSH to assess the noise levels experienced by workers in the kennel area from barking dogs. On December 16-17, 2006, a NIOSH investigator measured noise exposure levels for workers in the kennel area. NIOSH investigators returned to the facility on February 6-8, 2007, to conduct hearing tests on all LA/SPCA employees. Thirteen kennel workers, two veterinary staff, and three client care workers provided 22 personal noise dosimetry measures over the 2- day evaluation. One of the measures collected on a kennel worker was invalid because of equipment malfunction. Sixteen of the 21 measures exceeded the daily allowable noise dose of 100% as calculated by the NIOSH criterion. Five measures also exceeded the OSHA AL. The OSHA PEL was not exceeded. Hearing tests were performed on 33 employees. Three employees showed some degree of hearing loss (> 25 decibel hearing loss) at one or more test frequencies in one or both ears on the NIOSH-administered audiogram. Twenty-one employees with normal hearing showed notches (hearing levels worsen over test frequencies before improving in the highest frequencies, forming a 'notch' configuration) in one or both ears between 3000-6000 Hz, indicating early signs of hearing loss. In addition to noise, the NIOSH investigator observed other hazards. Kennel workers without gloves and without proper eye protection (safety goggles) were cleaning cages. A constituent of one of the disinfectants used to clean the cages is a known eye irritant. In addition, kennel workers were required to wear back braces in case there was a need to lift heavy animals; NIOSH has determined back braces to be ineffective in preventing back injury.

NTIS

*Animals; Auditory Defects; Exposure; Hazards; Health; Noise (Sound); Personnel; Prevention; Safety; Shelters*

**20070028574** Environmental Protection Agency, Washington, DC, USA

**Guidelines for Oxygenated Gasoline Credit Programs under Section 211(m) of the Clean Air Act as Amended**

January 1992; 94 pp.; In English

Report No.(s): PB2007-109823; EPA/420/B-92/002; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Section 221(m) of the Clean Air Act as Amended by the Clean Air Act Amendments of 1990 ('the Act') requires that various states submit revisions to their State Implementation Plans (SIPs), and implement oxygenated gasoline programs. The requirements applies to all states with carbon monoxide (CO) nonattainment areas with design values of 9.5 parts per million or more based generally on 1988 and 1989 data. The oxygenated gasoline program must require gasoline in the specified control areas to contain at least 2.7% oxygen by weight during that portion of the year in which the areas are prone to high ambient concentrations of carbon monoxide. Section 211(m)(5) of the Act requires that EPA promulgate guidelines for state credit programs, allowing the use of marketable oxygen credits for baselines with a higher oxygen content than required to offset the sale or use of gasolines with a lower oxygen content than required.

NTIS

*Air Quality; Gasoline; Oxygenation*

**20070028667** Bechtel SAIC Company, LLC, Las Vegas, NV, USA

**Technical Work Plan for: Near-Field Environment: Engineered Barrier System: Radionuclide Transport Abstraction Model Report**

Sep. 2006; 64 pp.; In English

Contract(s)/Grant(s): DE-AC28-01RW12101

Report No.(s): DE2007-899270; No Copyright; Avail.: Department of Energy Information Bridge

The objective of the work scope covered by this TWP is to generate Revision 03 of EBS Radionuclide Transport Abstraction, referred to herein as the radionuclide transport abstraction (RTA) report. The RTA report is being revised primarily to address condition reports (CRs), to address issues identified by the Independent Validation Review Team (IVRT), to address the potential impact of transport, aging, and disposal (TAD) canister design on transport models, and to ensure integration with other models that are closely associated with the RTA report and being developed or revised in other analysis/model reports in response to IVRT comments. The RTA report will be developed in accordance with the most current version of LP-SIII.10Q-BSC and will reflect current administrative procedures (LP-3.15Q-BSC, Managing Technical Product Inputs; LP-SIII.2Q-BSC, Qualification of Unqualified Data; etc.), and will develop related Document Input Reference System (DIRS) reports and data qualifications as applicable in accordance with prevailing procedures.

NTIS

*Migration; Near Fields; Radioactive Isotopes; Radioactive Wastes; Waste Disposal*

**20070028887** Pacific Northwest National Lab., Richland, WA, USA

**Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report**

Rishel, J. P.; Cahpman, E. G.; Rutz, F. C.; Allwine, K. J.; Dec. 2006; 45 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2007-901189; PNNL-16321; No Copyright; Avail.: National Technical Information Service (NTIS)

Smokes and obscurants (S&O) are important screening agents used during military training exercises on many military installations. Although the use of S&O is subject to environmental laws, the fate and effects of S&O on natural habitats are not well documented. One particular concern is the impact S&O may have on local insect populations, which can be important components of terrestrial food chains of endangered species. Fog-oil (FO) is an S&O that is of particular concern. An important part of assessing potential ecosystem impacts is the ability to predict downwind FO concentrations. This report documents the use of the comprehensive atmospheric dispersion modeling system DUST TRANsport (DUSTRAN) to simulate the downwind transport and diffusion of a hypothetical FO release on the U.S. Army installation at Ft. Hood, TX.

NTIS

*Atmospheric Models; Dust; Fog; Insects; Oils; Populations*

**20070028908** Lawrence Livermore National Lab., Livermore, CA USA

**Environmental Consequences of Large-Scale Deployment of New Energy Systems**

Phillips, T. J.; Mar. 05, 2007; 23 pp.; In English

Report No.(s): DE2007-902268; UCRL-TR-228651; No Copyright; Avail.: National Technical Information Service (NTIS)

This project's scientific goal was to achieve better understanding of where land cover change may mitigate climate change, accounting for both direct climate effects as well as the impacts on the global carbon cycle. As tools for investigating this problem, several models of different complexities were used: an offline land model, a standard coupled climate model, and a model in which coupled carbon-climate interactions were explicitly represented. Results from all model simulations were qualitatively similar: climate mitigation projects involving large-scale re-growth of forests are predicted to be beneficial in mitigating future CO<sub>2</sub>-induced global warming if these are carried out in the tropical latitudes, to be largely ineffectual if conducted in temperate latitudes, and to be counterproductive if implemented at high latitudes. Details of the quantitative differences in these predictions which are exhibited by the chosen climate models also are discussed.

NTIS

*Deployment; Climate Change; Carbon Cycle; Climate Models*

**20070029242** Lawrence Livermore National Lab., Livermore, CA USA

**LLNL 10(a)(1)(A) Annual Report (TE-053672-2)-2006**

Woollett, J.; Jan. 31, 2007; 12 pp.; In English

Report No.(s): DE2007-900871; UCRL-TR-227623; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes research related to Lawrence Livermore National Laboratorys (LLNL) Experimental Test Site,

Site 300 (S300), located within Alameda and San Joaquin Counties and conducted under the 10(a)(1)(A) (Recovery) permit TE-053672- 2. The U.S. Department of Energy/National Nuclear Security Administration (NNSA) holds this property in ownership. The 2006 recovery research at S300 involved fieldwork associated with two species: the California whipsnake (*Masticophis lateralis*) (MALA) and the California red-legged frog (*Rana aurora draytonii*) (CRLF).

NTIS

*Air Pollution; Pollution Monitoring*

**20070029254** California Inst. of Tech., Pasadena, CA USA

**Infrared Spectroscopy and Stable Isotope Geochemistry of Hydrous Silicate Glasses**

Stolper, E.; January 2006; 19 pp.; In English

Contract(s)/Grant(s): DE-FG02-85ER13445

Report No.(s): DE2007-900289; No Copyright; Avail.: National Technical Information Service (NTIS)

The focus of this DOE-funded project has been the study of volatile components in magmas and the atmosphere. Over the twenty-one year period of this project, we have used experimental petrology and stable isotope geochemistry to study the behavior and properties of volatile components dissolved in silicate minerals and melts and glasses. More recently, we have also studied the concentration and isotopic composition of CO<sub>2</sub> in the atmosphere, especially in relation to air quality issues in the Los Angeles basin.

NTIS

*Geochemistry; Glass; Infrared Spectroscopy; Isotopes; Silicates*

**20070029314** Mississippi State Univ., Starkville, MS, USA

**Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006)**

Tao, S.; Feb. 01, 2007; 96 pp.; In English

Contract(s)/Grant(s): DE-FC26-04NT42230

Report No.(s): DE2007-901089; No Copyright; Avail.: National Technical Information Service (NTIS)

The chemistry of sol-gel derived silica and refractive metal oxide has been systematically studied. Sol-gel processes have been developed for preparing porous silica and semiconductor metal oxide materials. Micelle/reversed micelle techniques have been developed for preparing nanometer sized semiconductor metal oxides and noble metal particles. Techniques for doping metal ions, metal oxides and nanosized metal particles into porous sol-gel material have also been developed. Optical properties of sol-gel derived materials in ambient and high temperature gases have been studied by using fiber optic spectroscopic techniques, such as fiber optic ultraviolet/visible absorption spectrometry, fiber optic near infrared absorption spectrometry and fiber optic fluorescence spectrometry. Fiber optic spectrometric techniques have been developed for investigating the optical properties of these sol-gel derived materials prepared as porous optical fibers or as coatings on the surface of silica optical fibers. Optical and electron microscopic techniques have been used to observe the microstructure, such as pore size, pore shape, sensing agent distribution, of sol-gel derived material, as well as the size and morphology of nanometer metal particle doped in sol-gel derived porous silica, the nature of coating of sol-gel derived materials on silica optical fiber surface.

NTIS

*Air Pollution; Coal; Gas Analysis; High Temperature Gases; Metal Oxides; Optical Fibers; Pollution Control; Refractivity; Sol-Gel Processes; Sorbents; Temperature Sensors; Transducers*

**20070029362** Lawrence Livermore National Lab., Livermore, CA USA

**AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review**

Rice, D.; Armstrong, D.; Campbell, C.; Lamont, A.; Gallegos, G.; Feb. 06, 2007; 16 pp.; In English

Report No.(s): DE2007-902313; UCRL-TR-227813; No Copyright; Avail.: Department of Energy Information Bridge

The general topics the full/fuel cycle analysis (FFCA) peer review want to cover although we expect to prioritize them, and perhaps prune the list by the time of the meeting: Vehicle emissions; Fuel economy; Production issues for specific fuels; Agricultural impacts related to ethanol and biodiesel production; Petroleum refinery impacts; Synthetic fuels and Hydrogen; Electric Power Generation; Criteria Pollutant assumptions for fuel production equipment; TIAX's California Post Processor

Use in the FFCA (The CA Post Processor is TIAX's modified version of GREET treating CA conditions not in the general GREET model.); Treatment and presentation of the FFCA assumptions; and General modeling approach.

NTIS

*Energy Policy; Synthetic Fuels; Ethyl Alcohol; Combustion Products*

**20070029369** Harris, Miller, Miller and Hanson, Inc., Burlington, MA, USA

**Development and Implementation of Noise Analysis Standards for ACSA Airports**

Baldwin, T.; Hass, A.; Breen, T.; Alverson, S.; Reindal, E.; Apr. 2003; 288 pp.; In English

Report No.(s): PB2004-104577; HMMH-298610; No Copyright; Avail.: National Technical Information Service (NTIS)

The national government of South Africa has published, or is in the processing of developing several policy statements related to the measurement, analysis, reporting, and abatement of aircraft noise. In recognition of this national initiative, the Airports Company South Africa ('ACSA') is developing noise analysis standards for the air carrier airports that it operates. ACSA retained the acoustical consulting firm of Harris Miller Miller & Hanson Inc. (HMMH) to provide technical assistance in the following areas: development of standards for noise measurement, modeling, analysis, reporting, and related functions; performance of noise analyses and impact assessments, and recommendations of mitigation options for Johannesburg International Airport and Cape Town International Airport; Development of an investment plan for noise and flight track monitoring systems for ACSA's airports, including a comparative cost assessment of centralized and decentralized monitoring approaches, and recommendation of a preferred configuration to serve South African airports; preparation of tender specifications for a non-airport-specific noise and flight track monitoring system; preparation of tender specifications for noise and flight track monitoring system for Johannesburg International Airport; and Recommendation of appropriate permanent noise monitoring locations in the environs of Johannesburg International Airport and Cape Town International Airport.

NTIS

*Airports; Noise Reduction; Noise Measurement*

**20070029395** Westinghouse Savannah River Co., Aiken, SC, USA

**Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State**

Jannik, G. T.; Lee, P. L.; Farfan, E. B.; Roach, J. L.; Feb. 08, 2007; 8 pp.; In English

Report No.(s): DE2007-900559; WSRC-STI-2001-00074; No Copyright; Avail.: Department of Energy Information Bridge

The U.S. Department of Energy's (DOE) Savannah River Site (SRS) is decommissioning many of its excess facilities through removal of the facility structures leaving only the concrete slab foundations in place. Site-specific, risk-based derived concentration guideline levels (DCGLs) for radionuclides have been determined for a future industrial worker potentially exposed to residual contamination on these concrete slabs as described in Jannik. These risk-based DCGLs were estimated for an exposure area of 100 m<sup>2</sup>. During deactivation and decommissioning (D&D) operations at SRS, the need for area factors for larger and smaller contaminated areas arose. This paper compares the area factors determined for an industrial worker exposed to a concrete slab end-state for several radionuclides of concern at SRS with (1) the illustrative area factors provided in MARSSIM, (2) the area correction factors provided in the U.S. Environmental Protection Agency's (EPA) Soil Screening Guidance, and (3) the hot spot criterion for field application provided in the RESRAD User's Manual.

NTIS

*Concretes; Decommissioning; Exposure; Health; Slabs*

**20070029408** Texas Univ., Austin, TX, USA

**Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS)**

Webb, A.; Spinhirne, J.; Kimura, Y.; Gonzalez, L.; Durrenberger, D.; Oct. 2006; 141 pp.; In English

Report No.(s): PB2007-110174; CTR-0-5191-1; No Copyright; Avail.: National Technical Information Service (NTIS)

Emissions that lead to the formation of ozone have distinctive temporal patterns, and the chemistry of ozone formation is non-linear and introduces time lags between emissions and ozone formation. As the transition is made between the 1-hour ozone National Ambient Air Quality Standard (NAAQS) and the 8-hour NAAQS, critical questions arise about the effectiveness of potential new mobile source control strategies for reducing 8-hour averaged ozone concentrations in Texas non-attainment areas. This project had two primary objectives. The first objective was to examine the relative effectiveness of potential new emission control measures, primarily from mobile sources, on 1-hour and 8-hour ozone concentrations and population exposure metrics in the Houston and Dallas areas. The second objective was to conduct a pilot-scale study to

examine how portable emissions monitoring system (PEMS) technology can be used to characterize exhaust emissions from heavy-duty diesel vehicles and equipment during real-world driving conditions. The overall goal of the research was to provide a foundation for effective transportation and air quality policy decisions in eastern Texas. A total of thirty-eight modeling simulations were conducted to examine a range of emission control strategies. This modeling indicated that even with reductions in on-road and non-road mobile source emissions greater than 40 percent, at least one monitor in each area is still predicted to remain in non-attainment. Given these challenges, it is recommended that TxDOT continue to investigate eligibility for Texas Emission Reduction Program (TERP) funding to reduce NO<sub>x</sub> emissions from on-road heavy-duty diesel vehicles and non-road equipment (particularly diesel construction equipment) and continue to pursue effective emission control strategies that can be adopted both locally and statewide to assist in obtaining regional NO<sub>x</sub> reductions. The pilot-scale PEMS study demonstrated the successful deployment of the Sensors, Inc. SEMTECH-D PEMS on single-axle and tandem-axle dump trucks during typical TXDOT operations. Idling accounted for the most significant fraction (20 percent) of the duty cycle and had the highest average and median fuel-specific emission factors for all pollutants.

NTIS

*Air Quality; Diesel Engines; Houston (TX); Ozone; Trucks*

**20070029419** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

**Review of the Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper**

Jan. 2007; 603 pp.; In English

Report No.(s): PB2007-110162; EPA/452/R-07-003; No Copyright; Avail.: National Technical Information Service (NTIS)

This Staff Paper, prepared by staff in the U.S. Environmental Protection Agency's (EPA) Office of Air Quality Planning and Standards (OAQPS), evaluates the policy implications of the key studies and scientific information contained in the document, Air Quality Criteria for Ozone and Related Photochemical Oxidants (USEPA, 2006; henceforth referred to as the CD), prepared by EPA's National Center for Environmental Assessment (NCEA). This document also presents and interprets results from several quantitative analyses (e.g., air quality analyses, human exposure analyses, human health risk assessments, and an environmental assessment of vegetation-related impacts) that we believe should also be considered in EPA's current review of the national ambient air quality standards (NAAQS) for ozone (O<sub>3</sub>), and presents factors relevant to the evaluation of current primary and secondary O<sub>3</sub> standards. Finally, this document presents staff conclusions and recommendations on a range of policy options that we believe are appropriate for the Administrator to consider concerning whether, and if so how, to revise the primary (health-based) and secondary (welfare-based) O<sub>3</sub> NAAQS. The policy assessment presented in this Staff Paper is intended to help 'bridge the gap' between the scientific assessment contained in the CD and the judgments required of the EPA Administrator in determining whether it is appropriate to retain or revise the NAAQS for O<sub>3</sub>. This policy assessment considers the available scientific evidence and quantitative risk-based analyses, together with related limitations and uncertainties, and focuses on the basic elements of air quality standards: indicator, averaging times, forms, and levels. These elements, which serve to define each standard, must be considered collectively in evaluating the health and welfare protection afforded by the O<sub>3</sub> standards. Our conclusions and policy recommendations on whether, and if so how, to revise these standard elements are based on the assessment and integrative synthesis of information presented in the CD and on staff analyses and evaluations presented in this document, and are further informed by comments and advice received from an independent scientific review committee, the Clean Air Scientific Advisory Committee (CASAC), in their review of earlier drafts of this document, as well as comments on earlier drafts submitted by public commenters.

NTIS

*Air Pollution; Air Quality; Ambience; Ozone; Policies*

**20070029433** National Defence Research Establishment, Umea, Sweden

**Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air**

Edlund, C.; Eriksson, H.; Leffler, P.; Liljedahl, B.; Waesterby, P.; Jun. 2006; 18 pp.; In Swedish

Report No.(s): PB2007-106485; FOI-R-1995-SE; No Copyright; Avail.: National Technical Information Service (NTIS)

The variety of chemicals posing a threat for personnel on international missions is very wide and looks different depending on mission. Based on what level the industrial development has reached in an area, the threat will vary considerably. In this report a prioritizing of chemicals posing a threat has been made. Focus is set on air dispersion of chemicals transported on roads and stored or handled in industrial context. A list of chemicals is presented based on identification of relevant chemicals performed by different authorities and organizations (e.g. USACHPPM and SRV). In order to illustrate the

differences between mission areas, two examples are given in the report. One from Kosovo, where NBC-personnel made an inventory of used industrial chemicals in the province. The other example is a region where the industrial production has not yet reached the large scale of production, seen on the Balkans, like Africa or Afghanistan.

NTIS

*Air Pollution; Chemical Warfare; Personnel; Pollution Control; Priorities; Toxicity*

**20070029435** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

**Guidance for Estimating VOC and NO<sub>x</sub> Emission Changes from MACT Rules**

May 2007; 58 pp.; In English

Report No.(s): PB2007-109920; EPA/457/B-07-001; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This document is intended to help States prepare their emission projections by providing the information needed to determine the level of VOC and NO<sub>x</sub> reductions expected with the implementation of post-2002 MACT standards where source-specific estimates are not practical for a source category in an 8-hour ozone nonattainment area. The States can assume the national average percent reduction provided in this document to estimate emission reductions for a given MACT standard. Although the MACT standards address hazardous air pollutants (HAPs), and indirectly affect criteria pollutants such as particulate matter (PM), this document only addresses the ozone precursor pollutants VOC and NO<sub>x</sub>.

NTIS

*Air Pollution; Air Quality; Estimating; Exhaust Emission; Nitrogen Oxides; Nitrous Oxides; Ozone; Volatile Organic Compounds*

**20070029437** Agency for Toxic Substances and Disease Registry, Atlanta, GA USA

**Public Health Assessment for Galena Airport (A.K.A. USAF Galena Air Force Station), Galena, Yukon-Koyukuk County, Alaska, May 21, 2007. EPA Facility ID: AK9570028655**

May 21, 2007; 122 pp.; In English

Report No.(s): PB2007-109917; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The report presents conclusions about the public health threat posed by a site. Ways to stop or reduce exposure will then be recommended in the public health action plan. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA or other responsible parties. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also recommend health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

NTIS

*Air Pollution; Airports; Alaska; Health; Public Health*

**20070029454** SGS Germany G.m.b.H, Speyer, Germany

**Summary of the Study of E85 Fuel in the USA, Winter 2006-2007**

May 31, 2007; 16 pp.; In English

Contract(s)/Grant(s): CRC-E-79

Report No.(s): PB2007-111363; CRC-E-79-2; No Copyright; Avail.: National Technical Information Service (NTIS)

In the spring of 2006, SGS Germany GmbH conducted a survey of E85 fuels (nominally 70 to 85 percent denatured ethanol + 30 to 15 percent gasoline or other hydrocarbons) in the U.S. Samples were purchased at retail outlets and shipped to SGS laboratories in Germany for analysis. This summary of the results was prepared for the Coordinating Research Council, Inc. (CRC) for use in planning vehicle test programs. This survey did not include winter fuels. Therefore, SGS conducted a second survey of E85 fuels in the U.S. in January and February 2007 to determine the properties of winter fuels. This report is a summary of the results.

NTIS

*Fuels; Winter*

**20070029459** National Cancer Inst., Bethesda, MD, USA

**What's in a Name. Examination of Light and Intermittent Smokers. Helping to Set the Tobacco Control Research Agenda.**

Aug. 2005; 15 pp.; In English

Report No.(s): PB2007-110293; No Copyright; Avail.: National Technical Information Service (NTIS)

What defines a smoker. On national surveys, a smoker used to be defined as someone who smoked every day. In 1992,



the Centers for Disease Control and Prevention changed the definition of a smoker on the National Health Interview Survey to include those who indicated that they smoke some days. The meaning of smoker now encompasses a variety of smoking patterns, including the notion of light and occasional smoking. However, research and public health efforts aimed at reducing light smoking have been obscured by the broad perception among researchers and the public that smoking a few cigarettes per day is less harmful than smoking many cigarettes per day. Smoking at any level is harmful. Light and intermittent tobacco smokers (LITS) comprise a significant proportion of the smoking population, and several studies show that they are at increased risk for heart disease and cancer. The majority of African Americans and Hispanics who smoke often fall into the category of light smokers, and the prevalence of intermittent smokers is increasing in both the USA and Finland. To reduce smoking and create a smoke-free society, it is important that we create an open dialogue and begin to raise the appropriate research questions to address smoking behavior among light and intermittent smokers.

NTIS

*Conferences; Tobacco; Public Health*

**20070029460** USA Climate Change Science Program, Washington, DC, USA

**U.S. Climate Change Technology Program: Vision and Framework for Strategy and Planning**

January 2007; 52 pp.; In English

Report No.(s): PB2007-110372; DOE/PI-003; No Copyright; Avail.: National Technical Information Service (NTIS)

This Vision and Framework provides overall planning guidance and strategic direction, with goals, for Federal agencies contributing to climate change-related technology research and development. It establishes a framework of principles and approaches to be employed toward goal attainment. It defines criteria for inclusion of applicable research, development, demonstration and deployment (collectively referred to here as R and D) of GHG-related activities, identifies the current R and D portfolio of such activities, and establishes criteria for future portfolio planning and investment prioritization. Finally, it outlines a series of next steps that will guide future Federal activities in this area over the coming years.

NTIS

*Climate Change; Greenhouse Effect; Strategy; Management Planning*

**20070029504** Western Research Inst., Laramie, WY, USA

**Removal of Elemental Mercury from a Gas Stream Facilitated by a Non-Thermal Plasma Device. Final Report**

Mones, C.; Dec. 2006; 37 pp.; In English

Contract(s)/Grant(s): DE-FC26-98FT40323

Report No.(s): DE2007-900188; WRI-06-R016R; No Copyright; Avail.: National Technical Information Service (NTIS)

Mercury generated from anthropogenic sources presents a difficult environmental problem. In comparison to other toxic metals, mercury has a low vaporization temperature. Mercury and mercury compounds are highly toxic, and organic forms such as methyl mercury can be bio-accumulated. Exposure pathways include inhalation and transport to surface waters. Mercury poisoning can result in both acute and chronic effects. Most commonly, chronic exposure to mercury vapor affects the central nervous system and brain, resulting in neurological damage. The CRE technology employs a series of non-thermal, plasma-jet devices to provide a method for elemental mercury removal from a gas phase by targeting relevant chemical reactions. The technology couples the known chemistry of converting elemental mercury to ionic compounds by mercury-chlorine-oxygen reactions with the generation of highly reactive species in a non-thermal, atmospheric, plasma device. The generation of highly reactive metastable species in a non-thermal plasma device is well known. The introduction of plasma using a jet-injection device provides a means to contact highly reactive species with elemental mercury in a manner to overcome the kinetic and mass-transfer limitations encountered by previous researchers. To demonstrate this technology, WRI has constructed a plasma test facility that includes plasma reactors capable of using up to four plasma jets, flow control instrumentation, an integrated control panel to operate the facility, a mercury generation system that employs a temperature controlled oven and permeation tube, combustible and mercury gas analyzers, and a ductless fume hood designed to capture fugitive mercury emissions. Continental Research and Engineering (CR&E) and Western Research Institute (WRI) successfully demonstrated that non-thermal plasma containing oxygen and chlorine-oxygen reagents could completely convert elemental mercury to an ionic form. These results demonstrate potential the application of this technology for removing elemental mercury from flue gas streams generated by utility boilers. On an absolute basis, the quantity of reagent required to accomplish the oxidation was small.

NTIS

*Air Pollution; Flue Gases; Gas Streams; Pollution Control; Thermal Plasmas*

**20070029931** Texas Univ., Austin, TX, USA

**Research Plan for Measuring Noise Levels in Highway Pavements in Texas**

Trevino, M.; Dossey, T.; Nov. 2006; 132 pp.; In English

Report No.(s): PB2007-110189; CTR-0-5185-1; No Copyright; Avail.: National Technical Information Service (NTIS)

This report evaluates available technology for measuring pavement noise, and gives recommendations for equipment, protocols, and test sections in Texas.

NTIS

*Highways; Noise Intensity; Pavements; Traffic*

**20070029959** Environmental Protection Agency, Washington, DC, USA

**Smog: Who Does it Hurt. What You Need to Know about Ozone and Your Health**

Jul. 1999; 10 pp.; In English

Report No.(s): PB2007-110736; EPA-452/K-99-001; No Copyright; Avail.: National Technical Information Service (NTIS)

This publication will tell you what kinds of health effects ozone can cause, when you should be concerned, and what you can do to avoid dangerous exposures.

NTIS

*Health; Ozone; Smog*

**20070029962** Rogers Engineering Co., Inc., San Francisco, CA, USA

**Feasibility Study of H(sub 2)S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California**

Aug. 25, 1981; 75 pp.; In English

Report No.(s): DE2007-884807; No Copyright; Avail.: Department of Energy Information Bridge

Determine feasibility of using an incineration-type device to accomplish the required reduction in vent steam H(sub 2)S content to meet ICAPCO rules. This approach is to be the only method considered in this feasibility study.

NTIS

*Air Pollution; Feasibility; Geysers; Incinerators; Lakes; Noncondensable Gases; Pollution Control; Steam Flow*

**20070029965** Environmental Protection Agency, Washington, DC USA

**Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005**

Apr. 15, 2007; 458 pp.; In English

Report No.(s): PB2007-110344; EPA/430/R-07/002; No Copyright; Avail.: CASI: [A20](#), Hardcopy

An emissions inventory that identifies and quantifies a country's primary anthropogenic sources and sinks of greenhouse gases is essential for addressing climate change. This inventory adheres to both (1) a comprehensive and detailed set of methodologies for estimating sources and sinks of anthropogenic greenhouse gases, and (2) a common and consistent mechanism that enables Parties to the United Nations Framework Convention on Climate Change (UNFCCC) to compare the relative contribution of different emission sources and greenhouse gases to climate changes. This chapter summarizes the latest information on U.S. anthropogenic greenhouse gas emission trends from 1990 through 2005. To ensure that the U.S. emissions inventory is comparable to those of other UNFCCC Parties, the estimates presented here were calculated using methodologies consistent with those recommended in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC/UNEP/OECD/IEA 1997), the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC 2000), and the IPCC Good Practice Guidance for Land Use, Land-Use Change, and Forestry (IPCC 2003). Additionally, the U.S. emission inventory has begun to incorporate new methodologies and data from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006). The structure of this report is consistent with the UNFCCC guidelines for inventory reporting. For most source categories, the Intergovernmental Panel on Climate Change (IPCC) methodologies were expanded, resulting in a more comprehensive and detailed estimate of emissions.

NTIS

*Climate Change; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Inventories*

**20070029968** Environmental Protection Agency, Washington, DC, USA

**IAQ Tools for Schools. Managing Asthma in the School Environment**

Aug. 2005; 23 pp.; In English

Report No.(s): PB2007-110294; EPA 402-K-05-002; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Asthma has reached epidemic proportions in the USA affecting millions of people of all ages and races. An average of

one out of every 13 school-age children has asthma, and the percentage of children with asthma is rising more rapidly in preschool-age children than in any other age group. Asthma is the leading cause of school absenteeism due to a chronic condition, accounting for more than 14.7 million missed school days per year. Asthma also accounts for many nights of interrupted sleep, limitation of activity, and disruption of family and care-giver routines. Asthma symptoms that are not severe enough to require a visit to an emergency room or to a physician can still be serious enough to prevent a child with asthma from living a fully active life.

NTIS

*Air Quality; Asthma; Indoor Air Pollution; Schools*

**20070029980** Texas Univ., Austin, TX, USA

**Preliminary Findings from Noise Testing on PFC Pavements in Texas**

Trevino-Frias, M.; Dossey, T.; Apr. 2007; 121 pp.; In English

Report No.(s): PB2007-110190; CTR-0-5185-2; No Copyright; Avail.: National Technical Information Service (NTIS)

This report documents noise testing performed on Texas pavements in the summer and fall of 2006. Test methods include roadside noise measurement with SPL meters and on-vehicle sound intensity measurement of noise at the pavement tire interface. Comparisons are made between the levels of vehicular noise at the roadside and directly on the source vehicle. The FHWA Traffic Noise Model (TNM) computer program was then used to predict the noise levels at roadside based on the observed traffic and geometry of the roadway, and subsequently compared to the noise as actually measured with precision test equipment. The pavements tested were primarily of the New Generation Open Graded Friction Course type, a permeable asphalt design with air voids in the area of 17 percent, also known as Permeable Friction Course (PFC) in Texas. Preliminary findings indicate that roadside noise levels experienced along PFC pavements are significantly lower than predicted by TNM using either the 'Average' or 'Open Graded' pavement models included in the program. This suggests that further study is warranted to determine whether these pavements retain their acoustic properties over time and wear and, thus, can be reliably used for noise impact avoidance and abatement.

NTIS

*Pavements; Tires; Permeability; Noise (Sound)*

**20070030027** Army Construction Engineering Research Lab., Champaign, IL USA

**Resuspension Physics of Fine Particles**

Sohn, Chang W; May 2006; 51 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468671; ERDC/CERL-SR-06-18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468671>

Different release models can yield significantly different dynamic concentration profiles in a room depending on the release rates chosen. Results from two different cases demonstrated significantly different concentration profiles in the room of interest. This work was undertaken to: (1) Critically review the current model, (2) formulate a new, 1st order Algebraic model, and (3) use experimental data to validate the modeled theory. This report documents preliminary work that was suspended after Fiscal year 2005 (FY05). No follow-on research is currently funded.

DTIC

*Mathematical Models; Particles; Fine Structure*

## 46

### GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

**20070026499** La Trobe Univ., Victoria, Australia

**Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere**

Dyson, Peter L; Aug 17, 2006; 56 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0278

Report No.(s): AD-A466333; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466333>

Novel solution methods are investigated for electromagnetic ray-tracing models and validation with data from the

advanced TIGER (Tasman International Geospace Environment Radar) OTHR (Over-the-Horizon-Radar) Facility.  
DTIC

*Atmospheric Models; Backscattering; Computational Grids; Earth Ionosphere; Inversions; Radar; Radar Data*

**20070026513** Naval Research Lab., Washington, DC USA

**Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere**

Ganguli, Gurudas; Rudakov, Leonid; Mithaiwala, Manish; Papadopoulos, Konstantinos; Apr 20, 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-67-8546-07; Proj-7-8992-05

Report No.(s): AD-A466358; NRL/MR/6750--07-9034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466358>

The possibility of strong diffusion by driving intense Alfvénic turbulence in the radiation belts is examined. Intense Alfvénic turbulence is artificially induced by the release of neutral gas in the equatorial plane perpendicular to the ambient magnetic field. The free energy associated with the orbital motion of the released neutral atoms is the energy source of the Alfvénic turbulence. Ions resulting from the photo-ionized neutrals form a ring-type distribution in velocity that is highly unstable to shear Alfvén waves near the ion cyclotron harmonics of the released species. The nonlinear evolution of the primary waves leads to redistribution of the wave energy in k-space and to excitation of secondary waves with characteristics appropriate for electron cyclotron resonance with the energetic electrons in the radiation belts that can induce intense pitch angle scattering of the trapped electrons. Release types and requirements to achieve the strong scattering limit are presented.

DTIC

*Angular Distribution; Cyclotron Resonance; Diffusion; Magnetospheres; Pitch (Inclination)*

**20070026561** Defense Threat Reduction Agency, Fort Belvoir, VA USA

**Grid-Search Techniques for Seismic Event Location and Phase Association**

Toksoz, Nafi; Rodi, William; Sarkar, Sudipta; Mar 2007; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DTRA01-00-C-0102; Proj-463D

Report No.(s): AD-A466474; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466474>

The objectives of this project are to develop improved methods for locating seismic events and to develop new approaches to analyzing the seismic event location uncertainty. Our efforts are focused on the problems of both single and multiple event location. For a single event, we have formulated a statistical approach based on maximum-likelihood estimation and implemented it with grid-search and Monte Carlo techniques to yield an algorithm called 'Grid-Search Single Event Location' (GSEL), which computes non-elliptical confidence regions on event locations for a wide class of assumed probability distributions (Gaussian and non-Gaussian) and for data picking errors. We have applied GSEL to regional arrival data from the 1991 Racha earthquake sequence and from the 1998 Adana (Turkey) earthquake sequence. Our multiple-event grid-search location algorithm (called GMEL) is also based on a maximum likelihood formulation of the location problem and it solves jointly for the location parameters (hypocenters and origin times) of seismic events in a cluster and travel-time corrections at the stations recording the events, GMEL accommodates non-Gaussian as well as Gaussian models of picking errors. We test this GMEL with clusters of 1999 Izmit/Duzce (Turkey) earthquake sequence. The approach we developed is based on the maximum-likelihood framework determines confidence regions on event locations under a general class of picking error models (Gaussian and non-Gaussian).

DTIC

*Monte Carlo Method; Position (Location); Search Profiles; Seismic Waves; Seismology*

**20070027264** Hawaii Univ., Honolulu, HI USA

**Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion**

Brooks, Benjamin A; Gomez, Francisco; Sandvol, Eric; Frazer, L N; Oct 5, 2006; 80 pp.; In English

Contract(s)/Grant(s): F19628-03-C-0107; Proj-1010

Report No.(s): AD-A466900; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We evaluate the use of Synthetic Aperture Radar Interferometry (InSAR) to provide GT5 or better locations for shallow earthquakes of moderate size (Mw 5 - 6.5) in primarily Africa and the Middle East, although we also included some events

from Asia. We find that InSAR is capable of routine detection of surface displacements associated with small (<Mw 5.5) seismic events. Additionally, we find that, in some cases, inversion of the surface displacement field alone can meet GT5 criteria. In many cases, however, although CIT location criteria appear to be met by The inversion, the overall solution (including strike, rake, and dip of the fault plane) is not consistent with additional information such as focal mechanism and so there may be some question to its overall accuracy. This suggests that in order to start to properly create an InSAR/CIT catalog, the next level inversion should incorporate prior information (properly propagating errors) such as the focal mechanism. We provide 2 new GT5 events for the existing catalog. We were successful in collecting seismic data from which we were able to measure origin times for all sixteen events. Collected waveforms for the Sultan Dagi, Turkey event help us identify the likely existence of a small foreshock.

DTIC

*Africa; Asia; Calibrating; Earthquakes; Ground Truth; Interferometry; Inversions; Middle East; Position (Location); Sampling; Seismology; Synthetic Aperture Radar*

**20070027265** Arcon Corp., Waltham, MA USA

**Observation of Tidal Effects on LWIR Radiance Above the Mesopause**

Wintersteiner, Peter; Mar 7, 2007; 18 pp.; In English

Contract(s)/Grant(s): FA8718-04-C-0031; Proj-2301

Report No.(s): AD-A466901; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An examination of CO<sub>2</sub> infrared limb radiance, directly measured by the SABER instrument aboard the TIMED satellite, reveals unusual structure in the region just above the mesopause, at tangent heights of -95-110 km. Global coverage afforded by SABER makes it possible to investigate this behavior, which includes prominent regions with positive radiance gradients, as a function of latitude, local time, and season. The local-time dependence, in particular, suggests a role for atmospheric tides. Using a tidal model, Global Scale Wave Model, and our non-LTE ARC code, we modeled the 15 micrometers radiance. These calculations reproduced the main features of the global radiance structure, including the heights where positive gradients occur, and its variation with local time for different latitudes and seasons. The conclusion is that tidal perturbation of the temperature field in the lower thermosphere is directly responsible for the observed variability of the long-wave infrared limb radiance.

DTIC

*Atmospheric Tides; Infrared Radiation; Long Wave Radiation; Mesopause; Radiance; Tides*

**20070027267** Columbia Univ., Palisades, NY USA

**Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves**

Gaherty, James; Lerner-Lam, Arthur; Feb 5, 2007; 62 pp.; In English

Contract(s)/Grant(s): F19628-03-C-0122; Proj-1010

Report No.(s): AD-A466910; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have mapped lateral variations in seismic Q in eastern Eurasia, including continental China, central Asia, Mongolia and Siberia, using high-frequency regional phases L<sub>g</sub> and P<sub>n</sub>, as well as long-period Rayleigh waves. We measured Q of crustal L<sub>g</sub> waves in eastern Eurasia using two-station methods. Over 5,000 spectral ratios from 594 interstation paths were used to estimate L<sub>g</sub> Q Omicron and Eta(Q at 1 Hz and its frequency dependence). These path averages were used to derive tomographic models of Q Omicron and Eta with resolutions between 4 and 10 degrees. The Q Omicron model contains values that vary between 100 and 900. Q Omicron are the lowest in the Tibetan plateau, increase to moderate levels towards the east and north, and reach maxima in the Siberian and eastern Europe Cratons. Q Omicron values correlate well with regional tectonics. Most Eta values are between 0.14 and 0.50, with a mean of 0.18. These values are lower than those obtained previously. P<sub>n</sub> spectra were collected from three seismic experiments in the Tibetan Plateau (TP) over four path groups to study P<sub>n</sub> attenuation. A comparison of P<sub>n</sub> spectra from these events reveal that mantle lid under north central TP attenuates P<sub>n</sub> more severely than under central Asia. Over paths that sample either a mixture of northern and southern Tibet or eastern Tibet, Q Omicron and Eta are between about 250-270 and 0.0-0.1, respectively. Over the path group that samples easternmost TP the respective estimates are 374 +/- 51 and 0.3 +/- 0.1. Lateral variation of P<sub>n</sub> attenuation inversely correlates with that of the P<sub>n</sub> velocity. Possible causes of this variation include (1) a thermally driven mantle Q Rho, and (2) region-specific velocity structures. We utilized Rayleigh waves with periods longer than -15 s, derived from regional and near-telesismic earthquakes, to map lateral variations in crustal and upper mantle shear velocity and attenuation across eastern Eurasia.

DTIC

*Asia; Crusts; Earthquakes; Europe; Mapping; Position (Location); Rayleigh Waves*

**20070027428** Naval Research Lab., Washington, DC USA

**On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent**

Siskind, David E; Eckermann, Stephen D; Coy, Lawrence; McCormack, John P; Randall, Cora E; Jan 2007; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467553; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Observations from the Sounding of the Atmosphere with Broadband Emission Radiometry (SABER) experiment on the NASA/Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) satellite show an unusual vertical displacement of the winter Arctic stratopause in 2006 with zonal mean temperatures at 0.01 hPa (~78 km) exceeding 250 K. By contrast, at the conventional stratopause location near 0.7 hPa (~50 km), temperatures were unusually cold. Simulations with the NOGAPS-ALPHA model suggest that these are coupled to an unusually warm and disturbed lower stratosphere that filtered out many of the gravity waves that normally break at and above 50 km. The model also shows that downward transport in the 2006 Arctic vortex was enhanced relative to 2005. These results might explain observations of enhanced upper atmospheric NO descending to the upper stratosphere in 2006 and highlights the importance of gravity waves in modulating the coupling of the upper atmosphere with the stratosphere.

DTIC

*Arctic Regions; Atmospheric Sounding; Broadband; Descent; Gravity Waves; Mesosphere; Radiometers; Variability; Winter*

**20070027686** Library of Congress, Washington, DC USA

**The Supreme Court's Climate Change Decision: Massachusetts v. EPA**

Meltz, Robert; May 18, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468114; CRS-RS22665; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On April 2, 2007, the Supreme Court handed down 'Massachusetts v. EPA,' its first pronouncement on climate change. By 5-4, the Court held the following: (1) Massachusetts had standing to sue, (2) Section 202 of the Clean Air Act authorizes the Environmental Protection Agency (EPA) to regulate emissions from new motor vehicles on the basis of their possible climate change impacts, and (3) Section 202 does not authorize EPA to inject policy considerations into its decision whether to so regulate. The Court's decision leaves EPA with three options under Section 202: find that motor vehicle greenhouse gas emissions may 'endanger public health or welfare' and issue emission standards, find that they do not satisfy that prerequisite, or decide that climate change science is so uncertain as to preclude making a finding either way. The decision also has implications for other climate-change-related litigation, particularly a pending suit seeking to compel EPA regulation of greenhouse gas emissions from stationary sources of emissions.

DTIC

*Automobiles; Climate Change; Exhaust Emission; Greenhouse Effect; Legal Liability; Motor Vehicles; Regulations; United States*

**20070027693** Air Force Research Lab., Hanscom AFB, MA USA

**On the Relationship of SAPS to Storm-Enhanced Density**

Foster, J C; Rideout, W; Sandel, B; Forrester, W T; Rich, F J; Jan 2007; 12 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): F19628-00-C-0002; NAS5-96020; Proj-2311

Report No.(s): AD-A468139; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We use magnetic field-aligned mapping between the ionosphere and the magnetosphere to intercompare ground-based observations of storm enhanced density (SED), and plasmasphere drainage plumes imaged from space by the IMAGE EUV imager, with the enhanced inner-magnetosphere/ionosphere SAPS electric field which develops during large storms. We find that the inner edge of the SAPS electric field overlaps the erosion plume and that plume material is carried sunward in the SAPS overlap region. The two phenomena, SED in the ionosphere and the erosion plume at magnetospheric heights, define a common trajectory for upward-propagating cold plasma fluxes in the midnight-desk-post noon sector. The SAPS channel at ionospheric heights and its projection into the equatorial plane serve to define the sharp outer boundary of the erosion plume. The SAPS electric field abuts and overlaps both the plasmasphere boundary layer and the plasmasphere erosion plume from pre-midnight through post-noon local times.

DTIC

*Ionospheres; Magnetic Fields; Meteorological Parameters; Storms*

**20070027732** Massachusetts Inst. of Tech., Cambridge, MA USA

**Gravity-Wave Dynamics in the Atmosphere**

Akylas, Triantaphyllos R; May 1, 2007; 35 pp.; In English

Contract(s)/Grant(s): FA9950-04-1-0125

Report No.(s): AD-A468407; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The flow of wind over mountain ranges is believed to be one of the primary generation mechanisms of atmospheric gravity waves. Mountain gravity waves contribute to the production of stratospheric turbulence, a potential cause of accidents in high-altitude aircraft flights. In an effort to advance the current capabilities of forecasting stratospheric turbulence, theoretical models have been developed for the generation and breakdown of mountain gravity waves under realistic conditions, including effects not captured by existing forecasting tools. Specifically, short-scale oscillations in the background buoyancy-frequency profile, often seen in balloon measurements, but normally ignored in theoretical models, are found to cause significantly increased gravity-wave activity, resulting in wave breaking above and upstream of the mountain. The effect of temporal variations in the wind velocity is also studied for a range of amplitudes and periods typical of those encountered in the field. Transient gravity waves resulting from such variations can be significant, and steady flow states predicted on the assumption of uniform wind may not be attainable. Finally, a study is made of the nonlinear evolution of a gravity-wave packet as it propagates upwards in the atmosphere, generating low-frequency inertial-gravity waves of the type seen in recent field observations.

DTIC

*Earth Atmosphere; Fluid Dynamics; Gravity Waves; Mountains; Stratosphere; Turbulence*

**20070028534** Executive Office of the President, Washington, DC USA

**Tsunami Risk Reduction for the USA: A Framework for Action**

Dec 2005; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467981; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Following the Indian Ocean tsunami on December 26, 2004, the President moved to protect lives and property by launching an initiative to improve domestic tsunami warning capabilities. This plan, developed under the auspices of the National Science and Technology Council, places the President's initiative in the context of a broad national effort of tsunami risk reduction and USA participation in international efforts to reduce tsunami risk worldwide. Although the frequency of damaging tsunami in the USA is low compared to many other natural hazards, the Indian Ocean event was a reminder that the impacts can be extremely high. Recognizing the potential geographic links to other hazards such as hurricanes, volcanoes, and earthquakes, the framework for tsunami risk reduction incorporates an all-hazards approach and builds upon existing hazard programs.

DTIC

*Risk; Threat Evaluation; Tsunami Waves; Warning Systems*

**20070029485** Lawrence Livermore National Lab., Livermore, CA USA

**Review of the Stability Analysis for the LANL BSL-3 Building Foundation**

Heuze, F. E.; Wagoner, J. L.; Nov. 02, 2006; 18 pp.; In English

Report No.(s): DE2007-900444; UCRL-TR-226737; No Copyright; Avail.: National Technical Information Service (NTIS)

This work was performed upon request from Dr. Richard Thorpe from NNSA after his review of the LANL report on BSL-3 seismic stability. The authors also reviewed report (1) and concluded, as did Dr. Thorpe, that the stability analysis was inappropriate. There are several reasons for that conclusion: the assumption of a circular failure surface through the combined fill-and-rock foundation does not recognize the geologic structure involved; the assumption of an equivalent static force to an earthquake loading does not represent the multiple cycles of shear loads created by a seismic event that can engender a substantial degradation of shear modulus and shear strength of the soil under the building (2); and there was no credible in-situ strength of the foundation materials (fill and rock mass) available for input into the stability analysis. Following that review, on September 26 the authors made a site visit and held discussions with LANL personnel connected to the BSL-3 building project.

NTIS

*Seismic Waves; Stability Tests; Seismology*

**20070029536** Army Engineer Research and Development Center, Vicksburg, MS USA

**Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions**

Ebeling, Robert M; White, Barry C; Dec 2006; 343 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468663; ERDC/ITL-TR-06-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468663>

This research report describes the engineering formulation and corresponding software developed for the rotational response of rock-founded, toe-restrained Corps retaining walls to earthquake ground motions. The PC software CorpsWallRotate (sometimes referred to as CWRotate) was developed to perform an analysis of permanent wall rotation for each proposed retaining wall section to a user-specified earthquake acceleration time-history. A particular formulation of the permanent sliding (i.e., translational) displacement response of retaining walls is also described. The resulting engineering methodology and corresponding software are applicable to a variety of retaining walls that are buttressed at their toes by a structural feature (e.g., navigation walls retaining earth, spillway chute walls, spillway discharge channel walls, approach channel walls to outlet works structures, highway and railway relocation retaining walls, and floodwall channels). CorpsWallRotate is particularly applicable to L-walls and T-walls (cantilever retaining walls) and may also be used to predict permanent, seismically induced displacements on retaining walls with or without a toe restraint.

DTIC

*Computer Programs; Displacement; Earth Movements; Earthquakes; Retaining; Walls*

**20070029593** Saint Louis Univ. School of Medicine, Saint Louis, MO USA

**Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence**

Cong, Lianli; Mitchell, Brian J; Sep 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-04-C-0021; Proj-1010

Report No.(s): AD-A468833; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468833>

The crust of southern Eurasia is characterised by low Q values (200-450) for 1-Hz Lg coda everywhere from Spain to China. The north-south extent of that low-Q zone varies from being relatively narrow in western Europe to being very broad from the Middle East to China. Those variations in both magnitude and width first became apparent with the development of continent-wide tomographic maps of Lg coda Q. The most recent mappings of Lg coda Q values at 1 Hz, completed over the past year, show that the four regions of lowest Q values occur in regions marked by high levels of seismicity. Q instable regions of Eurasia varies between about 450 and 900 with the highest values occurring in the Indian shield, the East European Craton, the Siberian Craton, and the Khasakh Platform. The maps reveal relatively, and unexpectedly, low values of Q in the Siberian Trap region of Siberia.

DTIC

*Asia; Attenuation; Europe; Frequencies; Maps; Rayleigh Waves; S Waves; Seismic Waves; Seismology; Wave Attenuation*

**20070029594** Australian National Univ., Canberra, Australia

**Detection of Atmospheric Explosions at IMS Monitoring Stations using Infrasonic Techniques**

Christie, Douglas R; Kennett, Brian L; Tarlowski, Chris; Sep 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-04-C-0032; Proj-1010

Report No.(s): AD-A468834; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468834>

Work is continuing on the development of infrasonic techniques that can be used to improve detection, location and discrimination capability for atmospheric nuclear explosions at International Monitoring System (IMS) infrasonic monitoring stations. In particular, we are continuing to focus on the detection of atmospheric explosions in the distance range from about 500 to 4500 km. We note that good detection capability in this distance range is essential to ensure that the global IMS infrasonic network has acceptable monitoring capability, including good capability for the detection of explosions that occur over the vast open ocean areas in the Pacific, Indian and Southern Oceans. This investigation has therefore been primarily concerned with a detailed study of the properties of infrasonic generated by regional and distant atmospheric explosions and the development of techniques that can improve detection capability for regional and distant sources at infrasonic monitoring stations.

DTIC

*Aerial Explosions; Infrasonic Frequencies; Nuclear Explosions*



**20070029706** Arizona Univ., Tucson, AZ USA

**Computational Nonlinear Optics: Femtosecond Atmospheric Light String Applications**

Moloney, Jerome V; Wright, E M; Diels, J C; Brio, M; Kolesik, M; Sep 20, 2006; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0194

Report No.(s): AD-A468911; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468911>

The main technical achievement of the project was the development of a comprehensive vector Maxwell unidirectional laser pulse propagator to accurately simulate intense ultra-short atmospheric light strings, white-light super-continuum generation across a broad landscape of applications, short range THz emission from plasma channels left in the wake of critically-collapsing light strings, nonlinear X- and O-wave generation in air, water and condensed matter and super-continuum shaping in sub-micron diameter fiber cores and photonic crystal fibers. The propagator model is broadly inclusive, allowing for the first time the capability to propagate optical carrier resolved, 3D space and time laser pulses over many meter distances. Furthermore it allows seamless transition to all know prior ultra-short pulse propagators in the literature thereby clearly identifying the physical limitations of each. Funding from the project also enabled the initial development of a full 3D FDTD vector Maxwell space and time grid refinement algorithm. It is anticipated that the propagator developed in this project will need to be fully interfaced to a Maxwell solver in anticipation of future extreme nonlinear optics applications.

DTIC

*Nonlinearity; Strings*

**47**

**METEOROLOGY AND CLIMATOLOGY**

Includes weather observation forecasting and modification.

**20070026465** Air Force Weather Technical Library, Asheville, NC USA

**Catalog of Air Force Weather Technical Documents, 1941-2006**

Swanson, Gary; May 19, 2006; 182 pp.; In English

Report No.(s): AD-A466195; AFWTL/TC-06/001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466195>

This catalog lists unclassified technical documents produced by of for the Air Force Weather Agency and its subordinate units from 1941 through 2006. Documents listed include technical reports, technical notes, data summaries, project reports, special studies and forecaster memos along with availability data and ordering instructions.

DTIC

*Catalogs (Publications); Meteorology*

**20070026604** Army War Coll., Carlisle Barracks, PA USA

**Global Climate Change: National Security Implications**

Johnson, II, Douglas V; Jan 2007; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466551; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466551>

Climate change is underway. The effects will vary according to a broad variety of circumstances and interactions, some of which are not well-understood. Likewise, mitigation is not wellunderstood, and will not take place quickly. The national security implications of climate change are proportional both to the speed of change and the extent. Public awareness should follow a coordinated strategic communication plan that focuses on maintaining credibility. Threats to national survival stemming from catastrophic change must be anticipated, evaluated, and neutralized to the greatest degree possible. The entire range of plausible threats needs to be delineated, then analyzed and early warning criteria established. The alternative approaches and cost-benefit analyses must be run to establish what can be done, when, and at what cost. While military forces have roles in disaster relief, the broader impact of serious climate change will require multinational, multi-agency cooperation on a scale heretofore unimaginable and could provide no-fault ground for global cooperation. ' Effective interagency action may require new legislation and better definition of Department of Homeland Security authority. Should global cooperative measures fail, the first impact will likely come from large numbers of displaced people who, by the very nature of their

displacement, will become subject to malnutrition and disease; agricultural dislocation could aggravate or spark displacement and border security issues could arise as well.

DTIC

*Climate; Climatology; Global Positioning System; Security*

**20070026622** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**The Chaos of Katrina**

Morris, Jr, Gerald W; Mar 2007; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466576; AFIT/GLM/ENS/07-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466576>

This thesis presents a case study of federal logistics support during Hurricane Katrina disaster relief operations. Data from federal contracts covering the first 10 weeks of Katrina are used to measure federal logistics activity. The study investigates whether chaos theory, part of complexity science, can extract information from Katrina contracting data to help managers make better logistics decisions during disaster relief operations. The study uses three analytical techniques: embedding, fitting the data to a logistic equation, and plotting the limit-cycle. Embedding and fitting a logistic equation to the data were used to test for deterministic chaos. The logistic equation and two versions of the limit-cycle model developed by Priesmeyer, Baik, and Cole were also tested as potential management tools. The study found that deterministic chaos was present during the first week of disaster relief, but that results for subsequent weeks were inconclusive, possibly due to internal changes to the relief dynamics. The thesis concludes that initial conditions and early actions will have a significant affect on disaster relief outcomes. Furthermore, many events that appear to be uncontrollable and random may actually be controllable. Therefore, managers play a critical role in preparing for and providing guidance in the early stages of disaster relief.

DTIC

*Chaos; Disasters; Emergencies; Hurricanes; Logistics Management; Management Methods; United States*

**20070027296** Naval Postgraduate School, Monterey, CA USA

**Downstream Impacts Due to the Extratropical Transition of Tropical Cyclones Over the Western North Pacific**

Dea, Jonathan M; Mar 2007; 119 pp.; In English

Report No.(s): AD-A467082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Analysis of the eddy kinetic energy budget for four cases of extratropical transition (ET) with North Pacific tropical cyclones (TCs) is conducted. The cases compare varying ET and midlatitude flow characteristics. Each case was examined to determine the impacts of eddy kinetic energy generation and/or transfer on downstream development in the midlatitude circulation. Typhoon Tokage (October 2004) was a large TC that moved into a high-amplitude midlatitude circulation. Energetics analysis revealed that the ET of Tokage influenced the development of a deep trough over the central North Pacific before Tokage moved poleward and weakened transfer. Typhoon Banyan (July 2005) was a mid-summer case that influenced downstream development ultimately over the Aleutian Islands. Typhoon Guchol (August 2005) was a small TC that was dominated by midlatitude flow. However, the merger of Guchol with a midlatitude trough enabled development downstream of a separate trough. Typhoon Nabi was an intense TC that injected significant EKE into the midlatitude circulation during ET. Through downstream development, Nabi changed a zonal pattern over the North Pacific into an amplified pattern. These cases indicate that the ET process over the western North Pacific impacts the midlatitude circulation across the entire North Pacific basin.

DTIC

*Cyclones; Kinetic Energy; Pacific Ocean; Tropical Storms; Typhoons*

**20070027310** Naval Postgraduate School, Monterey, CA USA

**Severe Weather Forecasting for Laughlin AFB, TX**

Cercone, Eric J; Mar 2007; 99 pp.; In English

Report No.(s): AD-A467110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A sounding climatology of a variety of parameters commonly used to forecast deep, moist convection using upper-air observations is developed. The data set includes 0000 and 1200 UTC rawinsonde data (approximately 3629 soundings) from Laughlin AFB, TX from April September 1995 2004. Cloud-to-ground lightning data, surface observations, and severe weather reports from the Storm Prediction Center (SPC) SeverePlot2 Program were used to categorize soundings as representative of conditions for no convection, light convection, convection within vicinity, moderate severe convection, or severe convection. Indices, including convective available potential energy (CAPE) and mean layer CAPE (MLCAPE), along

with sounding parameters and combinations of such as 0-2 and 0-6 km bulk shear, 700-500 mb lapse rate, lifted condensation level (LCL) and mean layer LCL (MLLCL) heights, are examined in an attempt to distinguish between moderate and severe convection. The results show that the 0-6 km bulk shear along with the MLCAPE and LCL height indicate some discrimination between the moderate and severe categories. The best discrimination comes from the significant severe parameter, calculated by taking the product of the 0-6 km bulk shear and MLCAPE, and the 0-6 km bulk shear versus MLCAPE, and the 700-500 mb lapse rate.

DTIC

*Climatology; Forecasting*

**20070027319** Naval Postgraduate School, Monterey, CA USA

**A Detailed Study of Advection Sea Fog Formation to Reduce the Operational Impacts Along the Northern Gulf of Mexico**

King, Jason M; Mar 2007; 112 pp.; In English

Report No.(s): AD-A467125; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study creates rules of thumb for forecasting advection sea fog development and dissipation along the northern Gulf of Mexico for the months of December through March. Surface observations from Tyndall AFB, Destin- Fort Walton Beach Airport, Eglin AFB, Hurlburt Field and Keesler AFB were used in conjunction with the National Data Buoy Center's marine sensors to determine the low-level atmospheric state and the sea surface temperatures during advection sea fog events at the five locations listed above. Forecasting rules of thumb were created and then modified to maximize forecasting effectiveness. The criteria examined include: sea surface temperature, wind speed and direction, air temperature and dewpoint spread, dewpoint and sea surface temperature spread. Data from December 1999 to March 2004 and from December 2005 to March 2006 was used for the Keesler AFB analysis. Data from February 2005 to March 2006 was used for the Tyndall AFB, Eglin AFB, Hurlburt Field and Destin-Fort Walton Beach analysis. Missing sea surface temperatures limited the amount of winter time advection sea fog seasons that could be examined.

DTIC

*Advection; Fog; Forecasting; Gulf of Mexico; Sea Water; Seas*

**20070027332** Naval Postgraduate School, Monterey, CA USA

**Evaluation of High Density Surface Observations in Complex Terrain and Their Contribution to the MM5 Model**

Homan, Paul B; Mar 2007; 95 pp.; In English

Report No.(s): AD-A467164; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study evaluates the data assimilation capabilities of Three Dimensional Multiquadric Interpolation (3DMQ) and the MM5 model when incorporating mesoscale observations from the USA Air Force Academy (USAFA) High Wind Alert system (HWAS). These mesoscale observations are incorporated into a triple nested (12, 4, and 1.33 km) high resolution model simulation and evaluated for their impact upon analyzed and forecasted wind values at USAFA during a severe down slope wind event that occurred on 6 March 2004. This evaluation is the first step in developing future forecasting and analysis tools for use by the military in various operations in complex terrain. The development of deployable automated tactical weather sensors in forward deployed locations requires an evaluation of the impact and usefulness these sensors would have on analysis forecast tools and mesoscale Numerical Weather Prediction (NWP) models. The juxtaposition of the HWAS network in complex terrain and the aviation training operations at USAFA provides an ideal set of data, mission and location for testing and evaluating a high resolution nested grid mesoscale NWP model. This study shows that incorporating HWAS observations into the 3DMQ data assimilation process has a significant impact upon verification of analyzed wind fields with the biggest impact occurring at the 1.33 km grid scale. Using these analyzed fields as initial conditions for MM5 model simulations, this study shows the ability of the 1.33 km model forecast wind fields to verify significantly better than either the 4 or 12 km through 18, 24, and 30 hour forecasts. Additionally, this study shows the limited, yet discernable impact HWAS observations have upon forecasted winds in the first several hours of MM5 model runs during a severe down slope wind event at USAFA.

DTIC

*Forecasting; Interpolation; Mesoscale Phenomena; Terrain; Warning Systems*

**20070027333** Naval Postgraduate School, Monterey, CA USA

**A Weighted Consensus Approach to Tropical Cyclone 96-H and 120-H Track Forecasting**

Hughes, James R; Mar 2007; 107 pp.; In English

Report No.(s): AD-A467166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A long-range (96 h-120 h) weighted position consensus for tropical cyclone tracks is evaluated for 24 western North

Pacific storms in 2006. The first weighted position technique simply weights the 96-h, 108-h, and 120-h dynamical model positions inversely to their distances from the 60-h, 66-h, and 72-h consensus positions. The second weighted consensus technique uses the same weighting factors but is applied to the forecast motion vectors to assess 96 h-120 h track errors. The weighted position consensus yields modest reductions in error relative to an unweighted position consensus at 96 h 120 h and produces smoother track forecasts. Weighted position consensus errors are reduced when the COAMPS model and the Air Force Weather Agency MM5 model are removed from the unweighted consensus used to form the weighting factors. Including the Japan and ECMWF model tracks also improves the weighted position consensus performance. The weighted motion vector consensus achieves dramatic improvements over an unweighted position consensus (9.9% at 96 h and 5.6% at 120 h). Most of the improvement over an unweighted position consensus is from using a motion vector consensus rather than a position consensus since large improvements are also achieved with an unweighted motion vector consensus.

DTIC

*Cyclones; Forecasting; Meteorology; Tropical Regions; Tropical Storms*

**20070027342** Naval Postgraduate School, Monterey, CA USA

**Study of the Utility of NWP Forecast Guidance and Simple Ocean Modeling as a Tool for Planning During Reactive Situations**

Jones, Robert D; Mar 2007; 137 pp.; In English

Report No.(s): AD-A467191; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The utility of using a numerical weather prediction (NWP) forecast model as an input to a simple ocean model for planning during reactive situations is studied. An oceanographic experiment called the Maud Rise Nonlinear Equation of State Study (MaudNESS) was conducted from June to September of 2005 over the Maud Rise in the eastern Weddell Sea. Archived Antarctic Mesoscale Prediction System (AMPS) Polar MM5 forecast fields from MaudNESS were compared to observed conditions during MaudNESS. AMPS was found to have problems with cloud and moisture parameters, but represented the overall synoptic situation. AMPS forecast and observed forcing fields (as well as increased values for both) were input into a simple one dimensional ocean model at three locations in the Maud Rise area of differing stability. The ocean model was found to have good utility as a planning tool for short term reactive situations where a high degree of accuracy is not needed.

DTIC

*Forecasting; Ocean Models; Oceans; Reactivity*

**20070027354** Naval Postgraduate School, Monterey, CA USA

**Long-Range Operational Military Forecasts for Iraq**

Hanson, Christopher M; Mar 2007; 77 pp.; In English

Report No.(s): AD-A467246; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The military weather community is mandated by the Department of Defense (DoD) to provide accurate, timely, and reliable meteorological information necessary for commanders to exploit the best windows of opportunity for operations. In order to meet this mandate, the military must apply state-of-the-art longrange forecasting techniques. This study was motivated by the need for long-range forecasts for mission planning in Iraq. To develop these forecasts, we tested and adapted composite analysis and forecasting techniques used by the National Oceanographic and Atmospheric Association (NOAA) for forecasts in the continental U.S. Using these techniques, we conducted seasonal composite analyses for Iraq surface temperature and precipitation rate, with the compositing based on the observed occurrence of the North Atlantic Oscillation (NAO) and El Nino La Nina (ENLN) climate variations. We then used composite analysis results to produce long range forecasts of Iraq surface temperature and precipitation rate based on the predicted occurrence of the NAO and ENLN. These forecasts outperformed forecasts based on long-term means (LTMs). Forecasts based on LTMs are currently the best available long range forecasts available from DoD. Thus, the composite analysis forecasts developed and tested in this study are a clear improvement over presently available DoD long range guidance products. The outcome of this study is a vector for the DoD weather community to expand out from the almost exclusive use of LTM based climatological products, and to invest in modern state-of-the-art methods for to supporting the global mission of the DoD.

DTIC

*Forecasting; Iraq; Organizations*

**20070027355** Naval Postgraduate School, Monterey, CA USA

**Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska**

Harbaugh, Bradley J; Mar 2007; 105 pp.; In English

Report No.(s): AD-A467247; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have examined four complex freezing fog events at Elmendorf Air Force Base, Alaska, to determine the root cause of the fog. These events have drastically impacted operations in the region for years, and are still a mystery to forecasters. The primary goal was to provide a detailed analysis of conditions within the boundary layer that contributed to freezing fog formation within the supercooled liquid water boundary layer. The data sets used to accomplish this goal were surface observations, upper air soundings, satellite images and water level data. In the end, the fog was identified to be the result moisture flux at the surface during high tide, which interacts with cold air from valleys northeast of the base. The interaction causes spontaneous condensation, and fog drains towards the base due to thermal gradients established from differential cooling from diurnal radiative properties. A correlation exists between water levels and moisture flux, which is strong enough that forecasters should focus on water level data and wind speed and direction. Armed with this knowledge, the Air Force and the Department of Defense will reap the benefits of much more timely and accurate fog forecasts.

DTIC

*Boundaries; Boundary Layers; Fog; Forecasting; Freezing; Supercooling; Temperature Gradients; Winter*

**20070027366** Naval Postgraduate School, Monterey, CA USA

**The Forcing of 25-Knot Winds at Hickam and Andersen AFB**

Smith, Scott G; Mar 2007; 83 pp.; In English

Report No.(s): AD-A467286; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study investigates synoptic scale regimes in the forcing of 25 knot winds at Hickam and Andersen AFB. Ten years of data from January 1996 through December 2005, as well as case studies from June, July and August of 2006 were considered for this study. Days were grouped together to isolate the events of trade wind flow only and to alleviate days where trade wind flow was interrupted by synoptic scale weather events or local weather phenomena. Of the approximately 3,650 days of observations, Hickam AFB had 258 days in which the winds gusted to or above 25 knots and 1,077 days in which the winds remained between 15 and 24 knots. Similarly, Andersen AFB had 99 days where the winds gusted to or above 25 knots and 448 days where the winds remained between 15 and 25 knots. These days were then combined in their respective lists and were compiled to create composite sea level pressure surface analyses, winds, temperature, dew point, and geopotential height for each list of days. Upon examination of the compiled charts, identifiable climatological regimes became evident for days in which the winds gust to or above 25 knots and when the winds remained between 15 and 24 knots. The climatological average for Hickam AFB for winds gusting to or above 25 knots consisted of the subtropical high located 894 miles almost due north of Hawaii and the strength of the high at 1024 mb. The subsequent gradient across Hawaii produced an average geostrophic flow of 15 m s<sup>-1</sup> across. North to South cross sections of potential temperature and winds across Hawaii indicated low static stability and analyzed winds of 7-9 m s<sup>-1</sup>. The climatological average when the winds remained between 15 and 24 knots consisted of the subtropical high located much further east and with a strength of 1022 mb. This reduced the gradient across Hawaii and produced an average geostrophic flow of 11 m s<sup>-1</sup>. North to South cross sections indicated stronger static stability and analyzed winds of 5-7 m s<sup>-1</sup>.

DTIC

*Synoptic Meteorology; Wind (Meteorology)*

**20070027367** Naval Postgraduate School, Monterey, CA USA

**Meteorological Factors That Lead to Separation of the California Coastal Jet from the Central Coast**

Mason, Jonathan D; Mar 2007; 89 pp.; In English

Report No.(s): AD-A467287; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study investigates the impact of off-shore cross-coast winds on the coastal-jet along the Central California Coast specifically Vandenberg AFB. Events that resulted in synoptic-scale offshore flow over most of the Central Californian coast were identified and considered for this study throughout the late spring through early fall 2006 season. A total of 18 events were found along the central coast during this time frame. Two case were selected from the 18 events for detailed analyses by examining the cross-coast offshore winds, length of duration, the degree of marine boundary layer compression, and westward migration of coastal jet. Results indicate changes in the California Coastal Jet are dominantly influenced by two major processes: subsidence due to increase of low to mid-level thickness above the boundary layer and downsloping winds directly above the marine boundary layer from flow over Coastal Mountain Ranges. Both processes lead to compression of

the marine boundary layer near coast, increasing the east-west thermal gradient in the inversion above the marine boundary layer causing the coastal jet to tightest temperature and pressure gradient.

DTIC

*Air Water Interactions; Atmospheric Boundary Layer; Boundary Layers; Coasts; Marine Meteorology; Meteorological Parameters*

**20070027370** Naval Postgraduate School, Monterey, CA USA

**Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System**

McMillen, John D; Mar 2007; 145 pp.; In English

Report No.(s): AD-A467299; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force Combat Climatology Center produces an analysis of meteorological conditions in a column over any point on the globe. Currently this analysis does not include aerosol impact on radiative transfer. Instead, the meteorological parameters are used to choose an aerosol representation native to MODTRAN radiative transfer software. This research investigates the impact of dust aerosol on radiative transfer in the 1-5  $\mu$ m wavelength band. Theoretical radiative transfer properties are calculated for various dust aerosols. The aerosols vary in size distribution and index of refraction. The aerosols also vary in phase functions, extinction coefficients, absorption coefficients, and asymmetry parameters. MODTRAN is used to simulate radiative transfer in the 1-5  $\mu$ m wavelength band incorporating the various dust aerosols in the bottom 1-2 km of the atmosphere. Radiance values from MODTRAN are converted into brightness temperatures, allowing interpretation of the impact dust aerosol has on remote sensing in this wavelength band. Dust aerosol does impact radiative transfer in the 1-5  $\mu$ m wavelength band. Brightness temperatures vary by as much as 50 K between no aerosol simulations and certain dust simulations below 3 m, and can vary by 1 K above 3 m.

DTIC

*Aerosols; Climatology; Combat; Dust; Intelligence; Meteorological Parameters; Radiative Transfer*

**20070027374** Naval Postgraduate School, Monterey, CA USA

**Long-Range Operational Military Forecasts for Afghanistan**

Moss, Sarah M; Mar 2007; 99 pp.; In English

Report No.(s): AD-A467305; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have investigated statistically significant signals in Afghanistan associated with two global scale climate variations, El Niño-La Niña (ENLN) and the North Atlantic Oscillation (NAO). The results of primary interest were in seasonal 850hPa temperatures and precipitation rates (PR), as these variables affect many military operations. Our primary data sets were National Centers for Environmental Prediction (NCEP) reanalysis fields and indices of ENLN and NAO activity. Our methods involved a two-step process. We first performed composite analyses of past events in an effort to identify statistically significant (SS) relationships between climate variations and 850hPa temperatures and PRs for Afghanistan. If SS was identified, we then used a forecast of ENLN or NAO conditions to produce a probabilistic forecast of potential occurrence of the particular variable, with a two-week lead time. We identified statistically significant results in all four seasons for both ENLN and NAO. The NAO has a larger impact on 850hPa temperatures while ENLN has a larger impact on PRs. The ENLN impacts on PRs are associated with anomalous advection of moisture out of the Arabian Sea or out of central Asia. The NAO impacts on 850hPa temperatures are associated with variations in storm tracks over southwest Asia. We generated initial probabilistic forecasts of PRs and 850hPa temperatures for Afghanistan for all four seasons. These serve as first steps in providing in-depth climatological planning products to military commanders and bridging the gap between civilian and military climatological products.

DTIC

*Afghanistan; Anomalies; Climate; Forecasting; Military Operations; Planning*

**20070027394** Naval Postgraduate School, Monterey, CA USA

**Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared**

Luckyk, Paul W; Mar 2007; 89 pp.; In English

Report No.(s): AD-A467392; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this thesis is to investigate the vertical distribution of dust and its impact on the top of the atmosphere radiance and associated remotely sensed thermal variability in the midwave infrared wavelengths. Due to the inconsistent

availability and coincidence of in-situ data with dust events, model data was used to identify the vertical dust regions. The Navy Aerosol Analysis and Prediction System global aerosol model was used to determine mass concentration and vertical extent of dust. Mass concentration was converted to extinction and individual dust events were analyzed to characterize the vertical distribution, extinction, and optical depth. The average height was defined for specific dust regions of Iraq and Korea. This value was used to determine the impact of the dust layer on the top of the atmosphere radiance and brightness temperature in the wavelengths of interest. Radiative transfer software was used to determine the top of the atmosphere radiance of the modeled dust atmosphere. Resultant brightness temperature was calculated to obtain the thermal characteristics of the dust layer and associated atmosphere. The vertical distribution of the dust layer was varied with fixed atmospheric components to gain insight into the resultant variation of radiance and subsequent brightness temperature to provide a set of possible values for a regionally specific dust event.

DTIC

*Atmospheric Temperature; Brightness Temperature; Dust; Infrared Radiation; Radiance; Radiative Transfer; Thermodynamic Properties*

**20070027675** Scripps Institution of Oceanography, La Jolla, CA USA

**Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers**

Shields, Janet E; Karr, Monette E; Burden, Art R; Johnson, Richard W; Hodgkiss, William S; May 2007; 50 pp.; In English  
Contract(s)/Grant(s): N00014-01-D-0043-0004

Report No.(s): AD-A468076; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the work done for the Starfire Optical Range, Kirtland Air Force Base under Contract N00014-01-D-043 DO #4, between 25 May 01 and 31 September 06. This work relates to the Air Force's need to characterize the cloud distribution during day and night, for a variety of applications, including support of satellite tracking, and support of research into impact of clouds on laser communication. This contract followed Contract N00014-97-D-0350 DO #6, which will be discussed in Section 2, and is documented in Shields et al 2004b, Technical Note 265. The primary goals of Delivery Order #4 discussed in this current report included further development of day and night cloud algorithms and support of the fielded Whole Sky Imager instruments. Much of the work done under DO #4 was completed by the end of 2004. Some additional work was done in 2005 and 2006 under the DO #4 funding, but most of the SOR work during this interval was done under a follow-on contract, ONR N00014-01-D-0043 DO #11, funded September 04. The work under DO #11 will be reported under a separate report.

DTIC

*Augmentation; Optical Equipment; Real Time Operation*

**20070027744** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Skin Temperature Feedback Optimizes Microclimate Cooling**

Stephenson, L A; Vernieuw, C R; Leammukda, W; Kolka, M A; Jan 2007; 7 pp.; In English

Report No.(s): AD-A468452; M06-22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A novel pulsed cooling paradigm (PC<sub>skin</sub>) integrating mean skin temperature (T<sub>sk</sub>) feedback was compared with constant cooling (CC) or time-activated pulsed cooling (PC). Methods: Eight males exercised while wearing personal protective equipment (PPE) in a warm, dry environment (dry bulb temperature: 30°C; dew-point temperature: 11°C in each of the tests. Treadmill exercise was performed (~225 w 1 m<sup>-2</sup>) for 80 min. A liquid cooling garment (LCG) covered 72% of the body surface area. Core temperature (T<sub>c</sub>), local skin temperatures, heart rate, inlet and outlet LCG perfusate temperatures, flow, and electrical power to the LCG and metabolic rate were measured during exercise. At 75 min of exercise T<sub>sk</sub> was higher (33.9 ± 0.5 °C) or CC(32.0 ± 0.6 °C) and PC > CC. The changes in T<sub>c</sub> and heart rate during the tests were not different. T<sub>c</sub> at 75 min was not different among the cooling paradigms (37.6 ± 0.3°C in PC<sub>skin</sub>, 37.6 ± 0.2 °C in PC and 37.6 ± 0.2 °C in CC). Heart rate averaged 124 ± 10 bpm in PC<sub>skin</sub>, 120 ± 9 bpm in PC and 117 ± 9 bpm in CC. Total body insulation (C · W<sup>-1</sup> · m<sup>-2</sup>) was significantly reduced in PC<sub>skin</sub> (0.020 ± 0.003) and PC (0.024 ± 0.004) from CC (0.029 ± 0.004). Electrical power in PC<sub>skin</sub> was reduced by 46 % from CC and by 28% from PC. Real-time T<sub>sk</sub> feedback to control cooling optimized LCG efficacy and reduced electrical power for cooling without significantly changing cardiovascular strain in exercising men wearing PPE.

DTIC

*Cardiovascular System; Cooling; Feedback; Heart Rate; Metabolism; Microclimatology; Moisture Content; Protectors*

**20070028538** Army Research Lab., White Sands Missile Range, NM USA

**Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield**

Sauter, David; Torres, Mario; McGee, Steve; Okrasinski, Richard; Oct 2000; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467962; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Computer and communication technology has been advancing within military command and control (C2) systems since the advent of the modern computer. These C2 systems have progressed noticeably from the first systems that were primarily stove pipe workstations that did not share information among the various battlefield functional areas (BFAs), much less among the services. Realizing this shortcoming and leveraging the advances in computer and communication technology, the 1990s saw a proliferation of networked C2 systems that automate the sharing of battlefield information. The ABCS connects numerous workstations (via a local area network) that cover the BFAs of maneuver, intelligence, field artillery, logistics, and air and missile defense. The Integrated Meteorological System (IMETS) is the Army's tactical system for weather and resides as a subordinate system of the intelligence BFA. IMETS provides weather data and weather effects to the various other BFAs as well as to the IMETS operator. The Army Research Laboratory (ARL) has developed an Integrated Weather Effects Decision Aid (IWEDA) that is being transitioned to the fielded Army via integration with all BFAs. IWEDA processes high-resolution mesoscale model output into weather effects information for graphic and text display and allows the user to display as much or as little information about impacts as required. Figure 1 shows a weather effects matrix (WEM) over a 72-hour forecast period for several of the available weapon systems or operations. Emerging technology will allow for even more advances, including autonomous intelligent agents, more fully integrated software modules, cross service common applications, and the development of common displays and databases both within and across the services. This paper examines in more detail the current status of this environmental effects software, and discusses new applications that will leverage ongoing advances in computer and communication technology.

DTIC

*Command and Control; Decision Support Systems; Environment Effects; Environmental Surveys; Forecasting; Local Area Networks; Systems Integration*

**20070028665** Geological Survey, Reston, VA USA

**Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05**

DeMeo, G. A.; Flint, A. L.; Lacznia, R. J.; Nylund, W. E.; January 2006; 20 pp.; In English

Report No.(s): DE2007-896768; USGS/OFR-2006-1312; No Copyright; Avail.: Department of Energy Information Bridge

Micrometeorological and soil-moisture data were collected at two instrumented sites on Rainier Mesa at the Nevada Test Site, January 1, 2002 August 23, 2005. Data collected at each site include net radiation, air temperature, and relative humidity at two heights; wind speed and direction; subsurface soil heat flux; subsurface soil temperature; volumetric soil water; and matric water potential. These data were used to estimate 20-minute average and daily average evapotranspiration values. The data presented in this report are collected and calculated evapotranspiration rates.

NTIS

*Evapotranspiration; Mesas; Micrometeorology; Nevada; Soil Moisture; Soils*

**20070028679** Forest Service, Portland, OR USA

**Bringing Climate Change Into Natural Resource Management. Proceedings of a Workshop**

Mar. 2007; 155 pp.; In English

Report No.(s): PB2007-109942; FSGTR-PNW-706; No Copyright; Avail.: National Technical Information Service (NTIS)

These are the proceedings of the 2005 workshop titled implications of bringing climate into natural resource management in the Western USA. This workshop was an attempt to further the dialogue among scientists, land managers, landowners, interested stakeholders and the public about how individuals are addressing climate change in natural resource management. Discussions illustrated the complexity of global climate change and the need for managers to consider how the impacts of climate change will unfold across regional and local landscapes. The workshop offered examples of how managers are already responding to those aspects of the global climate change that they can see or perceive. While no comprehensive solutions emerged, there was an appreciation that policy complexity may exceed the science complexity but that eventually the accumulation of local actions will shape the future.

NTIS

*Climate Change; Conferences; Resources Management*



**20070028747** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Optimizing the Prioritization of Natural Disaster Recovery Projects**

Aftanas, Jason M; Mar 2007; 269 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467368; AFIT/GEM/ENS/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prioritizing reconstruction projects to recover a base from a natural disaster is a complicated and arduous process that involves all levels of leadership. The project prioritization phase of base recovery has a direct affect on the allocation of funding, the utilization of human resources, the obligation of projects, and the overall speed and efficiency of the recovery process. The focus of this research is the development of an objective and repeatable process for optimizing the project prioritization phase of the recovery effort. This work will focus on promoting objectivity in the project prioritizing process, improving the communication of the overall base recovery requirement, increasing efficiency in utilizing human and monetary resources, and the creation of a usable and repeatable decision-making tool based on Value-Focused Thinking and integer programming methods.

DTIC

*Disasters; Optimization; Priorities; Computer Programming*

**20070028770** Miami Univ., FL USA

**Microphysics of Air-Sea Exchanges**

Brown, O B; Evans, R H; Donelan, M A; Minnett, P J; Ward, B; McGillis, W R; Jun 30, 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0384

Report No.(s): AD-A466972; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objectives are to achieve a better understanding of the physics of the surface temperature structure and near-surface temperature gradients; specifically how they respond to different flux and wind regimes. An extensive set of measurements were taken in the Air-Sea Interaction Saltwater Tank (ASIST) at RSMAS under controlled conditions of wind speed and air-sea temperature difference to examine the behavior of the thermal skin layer. Air-water fluxes were controlled by changing the water temperature in the tank. Throughout the course of the experiment, air-water temperature differences were varied from 15 K to + 15 K in increments of 5 K, and the wind speed was varied from 0 to 10 ms-i in increments of 1 ms-i. Analysis has been undertaken in terms of the surface geometry, the subsurface temperature vertical microstructure, and the two-dimensional temperature variability at the water surface.

DTIC

*Air Water Interactions; Atmospheric Temperature*

**20070028888** Pacific Northwest National Lab., Richland, WA, USA

**Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities**

Shaw, W. J.; Wang, W.; Rutz, F. C.; Rishel, J. P.; Xie, Y.; Feb. 2007; 51 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2007-901186; PNNL-16422; No Copyright; Avail.: National Technical Information Service (NTIS)

The U.S. Department of Homeland Security (DHS) is responsible for developing systems to detect the release of aerosolized bioagents in urban environments. The system that accomplishes this, known as BioWatch, is a robust first-generation monitoring system. In conjunction with the BioWatch detection network, DHS has also developed a software tool for cities to use to assist in their response when a bioagent is detected. This tool, the Biological Warning and Incident Characterization (BWIC) System, will eventually be deployed to all BioWatch cities to aid in the interpretation of the public health significance of indicators from the BioWatch networks. BWIC consists of a set of integrated modules, including meteorological models, that estimate the effect of a biological agent on a city's population once it has been detected. For the meteorological models in BWIC to successfully calculate the distribution of biological material, they must have as input accurate meteorological data, and wind fields in particular. The purpose of this document is to provide guidance for cities to use in identifying sources of good-quality local meteorological data that BWIC needs to function properly. This process of finding sources of local meteorological data, evaluating the data quality and gaps in coverage, and getting the data into BWIC, referred to as meteorological integration, is described. The good news for many cities is that meteorological measurement networks are becoming increasingly common. Most of these networks allow their data to be distributed in real time via the internet. Thus, cities will often only need to evaluate the quality of available measurements and perhaps add a modest number of stations where coverage is poor.

NTIS

*Aerosols; Air Pollution; Biological Weapons; Characterization; Detection; Meteorological Parameters; Pollution Monitoring*

**20070029293** Lawrence Livermore National Lab., Livermore, CA USA

**Implementation of the Immersed Boundary Method in the Weather Research and Forecasting Model**

Lundquist, K. A.; Dec. 08, 2006; 61 pp.; In English

Report No.(s): DE2007-900883; UCRL-TH-226657; No Copyright; Avail.: National Technical Information Service (NTIS)

Accurate simulations of atmospheric boundary layer flow are vital for predicting dispersion of contaminant releases, particularly in densely populated urban regions where first responders must react within minutes and the consequences of forecast errors are potentially disastrous. Current mesoscale models do not account for urban effects, and conversely urban scale models do not account for mesoscale weather features or atmospheric physics. The ultimate goal of this research is to develop and implement an immersed boundary method (IBM) along with a surface roughness parameterization into the mesoscale Weather Research and Forecasting (WRF) model. IBM will be used in WRF to represent the complex boundary conditions imposed by urban landscapes, while still including forcing from regional weather patterns and atmospheric physics. This document details preliminary results of this research, including the details of three distinct implementations of the immersed boundary method. Results for the three methods are presented for the case of a rotation influenced neutral atmospheric boundary layer over flat terrain.

NTIS

*Atmospheric Boundary Layer; Atmospheric Models; Atmospheric Stratification; Boundary Layer Flow; Weather Forecasting*

**20070029335** Lawrence Livermore National Lab., Livermore, CA USA

**Stratospheric Relaxation in IMPACTs Radiation Code**

Edis, T.; Grant, K.; Smith, P. C.; Nov. 15, 2006; 20 pp.; In English

Report No.(s): DE2007-900173; UCRL-TR-226128; No Copyright; Avail.: National Technical Information Service (NTIS)

While Impact incorporates diagnostic radiation routines from our work in previous years, it has not previously included the stratospheric relaxation required for forcing calculations. We have now implemented the necessary changes for stratospheric relaxation, tested its stability, and compared the results with stratosphere temperatures obtained from CAM3 met data. The relaxation results in stable temperature profiles in the stratosphere, which is encouraging for use in forcing calculations. It does, however, produce a cooling bias when compared to CAM3, which appears to be due to differences in radiation calculations rather than the interactive treatment of ozone. The cause of this bias is unclear as yet, but seems to be systematic and hence cancels out when differences are taken relative to a control simulation.

NTIS

*Computer Programs; Stratosphere; Stratosphere Radiation; Atmospheric Models*

**20070029366** Lawrence Livermore National Lab., Livermore, CA USA

**1958-2006 Precipitation Climatology for Lawrence Livermore National Laboratory, Livermore Site and Site 300**

Brown, B. M.; January 2006; 37 pp.; In English

Report No.(s): DE2007-902306; UCRL-TR-228582; No Copyright; Avail.: National Technical Information Service (NTIS)

This report was written and is intended for a wide audience of readers, from scientists, engineers, and technologists who can use the data directly, to individuals who want to know rainfall patterns at Lawrence Livermore National Laboratory's (LLNL) Livermore site and Site 300. For this reason, and because the English units of inches continue to be the standard in National Oceanic and Atmospheric Administration (NOAA) reporting and publications as well as many engineering documents, the familiar unit of inches is used primarily in this report. The metric unit of centimeters (cm) is also displayed on second ordinates of most graphs. In keeping with meteorological convention, the mention of wind direction refers to the direction from which the wind blows. This report complements a previously published LLNL climatology report (Gouveia and Chapman, 1989) that contains primarily wind and turbulence coefficients, temperature, and humidity analyses. A climatology report is planned for 2011 that will include analyses of updated 30-year temperature and rainfall normals, wind, temperature, and humidity measurements at the Livermore site and Site 300. This comprehensive report will include data from the 170-foot (52-m) towers recently installed at the Livermore site (2005) and Site 300 (2006) and include additional measurements such as vertical turbulence coefficients, evaporation, soil temperature, moisture and heat flux, solar and infrared radiation, and atmospheric pressure.

NTIS

*Climatology; Laboratories; Precipitation (Meteorology); Sites*

**20070029407** Geological Survey, Austin, TX, USA

**Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194**

Asquith, W. H.; Rouseel, M. C.; Thompson, D. B.; Cleveland, T. G.; Fang, X.; Jan. 2005; 78 pp.; In English  
Report No.(s): PB2007-110184; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Hyetographs and storm depth distributions are important elements of hydraulic design by Texas Department of Transportation engineers. Design hyetographs are used in conjunction with unit hydrographs to obtain peak discharge and hydrograph shape for hydraulic design. Storm-depth distributions can be used to assess the probability of a total rainfall depth for a storm. A research project from 20002004 has been conducted to (1) determine if existing Natural Resources Conservation Service (NRCS) dimensionless hyetographs are representative of storms in Texas, (2) provide new procedures for dimensionless hyetograph estimation if the NRCS hyetographs are not representative, and (3) provide a procedure to estimate the distribution of storm depth for Texas. This report summarizes the research activities and results of the research project. The report documents several functional models of dimensionless hyetographs and provides curves and tabulated ordinates of empirical (nonfunctional) dimensionless hyetographs for a database of runoff-producing storms in Texas. The dimensionless hyetographs are compared to the NRCS dimensionless hyetographs. The distribution of storm depth is documented for seven values of minimum interevent time through dimensionless frequency curves and tables of mean storm depth for each county in Texas. Conclusions regarding application of the research results are included in the report.

NTIS

*Depth; Dimensionless Numbers; Rain; Storms; Transportation*

**20070029425** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**CLMT2 User's Guide: A Coupled Model for Simulation of Hydraulic Processes from Canopy to Aquifer**

Pan, L.; Jul. 26, 2006; 24 pp.; In English

Report No.(s): DE2007-900656; LBNL-60857; No Copyright; Avail.: National Technical Information Service (NTIS)

CLMT2 is designed to simulate the land-surface and subsurface hydrologic response to meteorological forcing. This model combines a state-of-the-art land-surface model, the NCAR Community Land Model version 3 (CLM3), with a variably saturated groundwater model, the TOUGH2, through an internal interface that includes flux and state variables shared by the two submodels. Specifically, TOUGH2, in its simulation, uses infiltration, evaporation, and root-uptake rates, calculated by CLM3, as source/sink terms; CLM3, in its simulation, uses saturation and capillary pressure profiles, calculated by TOUGH2, as state variables. This new model, CLMT2, preserves the best aspects of both submodels: the state-of-the-art modeling capability of surface energy and hydrologic processes from CLM3 (including snow, runoff, freezing/melting, evapotranspiration, radiation, and biophysiological processes) and the more realistic physical-process-based modeling capability of subsurface hydrologic processes from TOUGH2 (including heterogeneity, three-dimensional flow, seamless combining of unsaturated and saturated zone, and water table). The preliminary simulation results show that the coupled model greatly improved the predictions of the water table, evapotranspiration, and surface temperature at a real watershed, as evaluated using 18 years of observed data.

NTIS

*Aquifers; Earth Surface; Hydrology; Simulation*

**20070029444** Massachusetts Inst. of Tech., Cambridge, MA, USA

**Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR)**

Weber, M. E.; Cho, J. Y.; Robinson, M.; Evans, J. E.; Feb. 26, 2007; 68 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-002

Report No.(s): PB2007-106512; ATC-332; No Copyright; Avail.: National Technical Information Service (NTIS)

Possible alternatives to the Terminal Doppler Weather Radar (TDWR) are assessed. We consider both the low altitude wind shear detection service provided by TDWR and its role in reducing weather-related airport delays through its input to the Integrated Terminal Weather System (ITWS). Airborne predictive wind shear (PWS) radars do not provide an acceptable alternative because many commercial aircraft and practically all general aviation and business aircraft are not equipped. Further, the PWS radars have limited range and scan-angle capability and cannot provide the broad area situational awareness needed to proactively reroute aircraft away from the affected runways. We considered in detail the alternatives of using the ASR-9 Weather Systems Processor (WSP) and NEXRAD in lieu of TDWR. An objective metric for wind shear detection capability was calculated for each of these radars at all TDWR equipped airports. TDWR was uniformly superior by this metric, and at a number of the airports, the AS-9/NEXRAD alternative scored so low as to raise questions whether it would be operationally acceptable. To assess airport weather delay reduction impact, we compared the accuracy of the high-benefit

ITWS 'Terminal Winds' product with and without TDWR input. Removal of the TDWR data would have increased the mean estimate error by a factor of 3 near the surface.

NTIS

*Air Traffic Control; Alternatives; Doppler Radar; Meteorological Radar*

**20070029445** Environmental Protection Agency, Athens, GA, USA

**USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling**

Burns, L. A.; Suarez, L. A.; Prieto, L. M.; May 2007; 397 pp.; In English

Report No.(s): PB2007-110161; EPA/600/R-07/053; No Copyright; Avail.: CASI: [A17](#), Hardcopy

ORD numerical models for pesticide exposure include a model of spray drift (AgDisp), a cropland pesticide persistence model (PRZM), a surfacewater exposure model (EXAMS), and a model of fish bioaccumulation (BASS). A unified climatological database for these models has been assembled from several National Weather Service (NWS) datasets, including Solar and Meteorological Surface Observation Network (SAMSON) data for 1961-1990 (versions 1.0 and 1.1), combined with NWS precipitation and evaporation data. Together these NWS products provide coordinated access to solar radiation, sky cover, temperature, relative humidity, station atmospheric pressure, wind direction and speed, and precipitation. The resulting hourly and daily weather parameters provide a unified dataset for use in coordinated exposure modeling. The data files, which include some derived data of use to exposure modeling (e.g., short-grass crop standard evapotranspiration ET(sub 0)) are publicly available (gratis) on EPA's Center for Exposure Assessment Modeling (CEAM) web site at <http://www.epa.gov/ceampubl/tools/metdata/index.htm>. By using observational data for models, trace-matching Monte Carlo simulation studies can transmit the effects of environmental variability directly to exposure metrics, by-passing issues of correlation (covariance) among external driving forces. This report covers a period from May 2, 2001 to December 27, 2004 and work was completed as of December 27, 2004.

NTIS

*Exposure; Meteorological Parameters; Pesticides; Prediction Analysis Techniques; United States*

**20070029447** California Univ., Berkeley, CA USA; California Dept. of Forestry and Fire Protection, Sacramento, CA, USA

**Climate Change Impact on Forest Resources. White Paper**

Battles, J. J.; Robards, T.; Das Allen, A.; Waring, K.; Gillies, J. K.; Mar. 2006; 45 pp.; In English

Report No.(s): PB2007-110359; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This study evaluated the climate change impacts on the productivity, health, and value of a forest for a specific region in California the Sierran mixed conifer timberbelt. The research team adapted an industry standard planning tool to forecast 30-year tree growth and timber yields for forest stands in El Dorado County under a changing climate. The model projections were constrained by structural and demographic data from the Blodgett Forest Research Station in El Dorado County in order to represent a realistic range of legal management regimes employed on private and governmental forests in the region.

NTIS

*Climate Change; Forests*

**20070029452** Maryland Univ., College Park, MD, USA; University of Southwestern Louisiana, Lafayette, LA, USA; National Center for Atmospheric Research, Boulder, CO USA; Louisiana State Univ., Baton Rouge, LA USA

**Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources**

Kennedy, V. S.; Twilley, R. R.; Kleypas, J. A.; Cowan, J. H.; Hare, S. R.; Aug. 2002; 64 pp.; In English

Report No.(s): PB2007-110353; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Coastal and Marine Ecosystems and Global Climate Change is the eighth in a series of Pew Center reports examining the potential impacts of climate change on the U.S. environment. It details the likely impacts of climate change over the next century on U.S. coastal and marine ecosystems, including estuaries, coral reefs, and the open ocean.

NTIS

*Climate Change; Climatology; Coasts; Ecosystems; Marine Environments*

**20070029458** Cambridge Univ., UK

**Agriculture: The Potential Consequences of Climate Variability and Change for the USA**

January 2007; 150 pp.; In English

Report No.(s): PB2007-110374; No Copyright; Avail.: National Technical Information Service (NTIS)

This report is part of the US National Assessment process, the Potential Consequences of Climate Variability and Climate

Change, published by Cambridge University Press (National Assessment Synthesis Team, 2000, 2001). In addition to summarizing scientific understanding about the potential consequences for the Agriculture sector, the report provided input for the two-part national level report entitled, Climate Change Impacts on the USA which has been aimed at evaluating the impacts of climate change and climate variability on the USA, across its various regions and including sectors beyond agriculture.

NTIS

*Agriculture; Climate Change; United States*

**20070029462** Environmental Protection Agency, Washington, DC, USA

### **Achievements in Stratospheric Ozone Protection**

Apr. 2007; 40 pp.; In English

Report No.(s): PB2007-110370; EPA/430/R-07/001; No Copyright; Avail.: National Technical Information Service (NTIS)

Countries around the world are phasing out the production and use of chemicals that destroy ozone in the Earth's upper atmosphere. The USA has already phased out production of those substances having the greatest potential to deplete the ozone layer. At the same time, we have ensured that businesses and consumers have alternatives that are safer for the ozone layer than the chemicals they replace. These vital measures are helping to protect human health and the global environment. With our many partners, the U.S. Environmental Protection Agency (EPA) is proud to have been part of a broad coalition that developed and implemented flexible, innovative, and effective approaches to ensure stratospheric ozone layer protection. These partnerships have fundamentally changed the way we do business, spurring the development of new technologies that not only protect the ozone layer but, in many cases, also save energy and reduce emissions of greenhouse gases. Together, we continue to look for alternatives and technologies that are as ozone- and climate-friendly as possible. This report covers the important and substantial achievements of the people, programs, and organizations that are working to protect the Earth's ozone layer. As impressive as these accomplishments are, our work is not done. Even though we have reduced or eliminated the use of many ozone-depleting substances, some still remain. Additionally, since ozone-depleting substances persist in the air for long periods of time, the past use of these substances continues to affect the ozone layer today. We must also continue to ensure that the alternatives being brought to the market support the country's long-term environmental goals in a cost-effective manner.

NTIS

*Atmospheric Composition; Ozone; Ozonosphere; Protection; Stratosphere*

**20070029464** Maryland Univ., Solomons, MD, USA

### **Ecosystems and Climate Change: Research Priorities for the U.S. Climate Change Science Program. Recommendations from the Scientific Community**

Lucier, A.; Palmer, M.; Mooney, H.; Nadelhoffer, K.; Ojima, D.; January 2006; 56 pp.; In English

Report No.(s): PB2007-110368; UMCES-CBL-06-038; No Copyright; Avail.: National Technical Information Service (NTIS)

In 2003, the Ecosystems Interagency Working Group (EIWG) of the U.S. Climate Change Science Program (CCSP) convened a small group of scientists to plan a workshop and encourage participation by leading ecologists and resource managers in the public and private sectors. The goal of the workshop was to identify critical research needs that address the complex linkages and feedbacks between climate and ecological systems. The Ecosystems and Climate Change workshop was held in 2004 in Silver Spring, MD, and was attended by over 100 participants. Here we summarize and interpret the workshop discussions and outcomes with a focus on the key research needs that were identified within each of three areas: 1. Feedbacks between ecological systems and global change 2. Consequences of global change for ecological systems 3. Sustaining and improving ecological systems in the face of global change. By self-selection, workshop participants divided into three groups for each of the three research areas. Each group was asked to: (a) identify priority research questions related to its area; and (b) describe approaches to addressing the research questions. For each of the three groups, volunteers moderated the discussions and captured the essential points that came from the group discussions. They also contributed to the development of this document. Every attempt was made to represent the consensus views of the participants.

NTIS

*Climate Change; Ecosystems*

**20070029469** California Energy Commission, Sacramento, CA, USA

**Climate Change Impacts and Adaptation in California. Staff Paper**

Franco, G.; Jun. 2005; 43 pp.; In English

Report No.(s): PB2007-110363; CEC-500-2005-103-SD; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper presents a short review of the existing literature on climate change impacts and adaptation options for California. At the global scale, there is a scientific consensus that climate is changing and that the increased concentration of greenhouse gases in the atmosphere are responsible for these changes. California will get warmer in the future, but the level of warming is not known. With respect to precipitation, there is no consensus on how California would be affected, but it is clear that the warming would result in increased runoff in the winter season and decreased runoff in the spring and summer. Human adaptation to climate change in the state may be costly. Ecosystems, one of the most precious state resources, could be severely affected not only by climate change, but also by other stressors such as increased urbanization. Because of the thermal inertia of the Earth, our climate will continue to warm and, for this reason, the identification of adaptation options should be a state priority. Finally, this paper suggests that scientific research should be an integral part of the state overall strategy for how to deal with climate change.

NTIS

*Climate Change; California; Adaptation*

**20070029809** CNA Corp., Alexandria, VA USA

**National Security and the Threat of Climate Change**

Jan 2007; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469156; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469156>

The purpose of this study is to examine the national security consequences of climate change. A dozen of the nation's most respected retired admirals and generals have served as a Military Advisory Board to study how climate change could affect our nation's security over the next 30 to 40 years the time fram for developing new military capabilities. The specific questions addressed in this report are: 1. What conditions are climate changes likely to produce around the world that would represent security risks to the USA. 2. What are the ways in which these conditions may affect America's national security interests? 3. What actions should the nation take to address the national security consequences of the climate change? The Military Advisory Board hopes these findings will contribute to the call President Bush made in his 2007 State of the Union address to 'help us to confront the serious challenge of global climate change' by contributing a new voice and perspective to the issue.

DTIC

*Climate; Climate Change; Security*

**20070029976** Commerce Dept., Washington, DC, USA

**Survey of Hurricane Katrina and Hurricane Rita Contracts and Grants. Public Release**

Jul. 2006; 7 pp.; In English

Report No.(s): PB2007-110760; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Hurricanes; Surveys*

**48**

**OCEANOGRAPHY**

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

**20070028812** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity**

Antoine, David; Chami, Malik; Claustre, Herve; d'Ortenzio, Fabrizio; Morel, Andre; Becu, Guislain; Gentili, Bernard; Louis, Francis; Ras, Josephine; Roussier, Emmanuel; Scott, Alec J.; Tailliez, Dominique; Hooker, Stanford B.; Guevel, Pierre; Deste, Jean-Francois; Dempsey, Cyril; Adams, Darrell; December 2006; 68 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): ESTEC-14393/00NL/DC; ESRI-17286/03/I-OL

Report No.(s): NASA/TM-2006-214147; Rept-2007-00282-0; Copyright; Avail.: CASI: [A04](#), Hardcopy

This report presents the Bouee pour l'acquisition de Series Optiques a Long Terme (BOUSSOLE) project, the primary

objectives of which are to provide a long-term time series of optical properties in support of a) calibration and validation activities associated with satellite ocean color missions, and b) bio-optical research in oceanic waters. The following are included in the report: 1) an introduction to the rationale for establishing the project; 2) a definition of vicarious calibration and the specific requirements attached to it; 3) the organization of the project and the characteristics of the measurement site--in the northwestern Mediterranean Sea; 4) a qualitative overview of the collected data; 5) details about the buoy that was specifically designed and built for this project; 6) data collection protocols and data processing techniques; 7) a quantitative summary of the collected data, and a discussion of some sample results, including match-up analyses for the currently operational ocean color sensors, namely MERIS, SeaWiFS, and MODIS; and 8) preliminary results of the vicarious radiometric calibration of MERIS, including a tentative uncertainty budget. The results of this match-up analysis allow performance comparisons of various ocean color sensors to be performed, demonstrating the ability of the BOUSSOLE activity, i.e., combining a dedicated platform and commercial-off-the-shelf instrumentation, to provide data qualified to monitor the quality of ocean color products on the long term.

Author

*Calibrating; Water Color; Oceans; Remote Sensing; Optical Properties; Mediterranean Sea*

## 51

### LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

**20070026380** Oregon Health Sciences Univ., Portland, OR USA

#### **The Role of CRELD1 Isoform 9B in the Pathogenesis of Breast Cancer**

Maslen, Cheryl L; Corless, Christopher; Oct 2005; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0634

Report No.(s): AD-A466056; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466056>

The goal is to develop a mouse model that expresses isoform 9b in mammary tissues, and to determine if CRELD1-9b causes or predisposes the mice to develop breast tumors, or participates in cancer progression. Scope: This study will determine if expression of CRELD1-9b contributes to the cause and/or progression of breast cancer. Information from this study will be used to better understand the relationship of CRELD1-9b to breast cancer tumor biology, and to develop it as a new marker for early detection of breast cancer or breast cancer progression. Since utilization of exon 9b appears to be unique to cancer cells it is thought to participate in the malignant process and hence would be a potentially viable target for therapeutic intervention. Major findings: We have tested two different mammalian expression vectors for expression of the CRELD1-9b under the control of the mouse mammary tumor virus (MMTV) promoter. The promoter is inducible, giving us control over mammary tissue-specific expression. One of the vectors exhibited superior performance in expressing CRELD1-9b, with verified protein expression.

DTIC

*Breast; Cancer; Diseases; Mammary Glands; Pathogenesis*

**20070026381** Rochester Univ., NY USA

#### **Knockout AR in Prostate**

Chang, Chawnsang; Oct 2005; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0199

Report No.(s): AD-A466057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466057>

Prostate cancer progresses from androgen-dependent to androgen-independent state. The androgen receptor (AR) is expressed throughout progression. We would like to understand the AR role in this progression. Using lox-Cre methodology, we have generated mice in which AR function is abolished in the entire animal (ARKO) or tissue specific manner. We will generate mice with ARKO in prostate only or in different stages to be used to study prostate cancer progresses. Our Aims follow. 1: Generate mice lacking functional AR in prostate epithelium. 2: Generate inducible ARKO mouse line to be used to determine potential effect of androgen in absence of AR on prostate growth/maintenance. 3: Determine AR role in prostate cancer development/progression by crossing ARKO mice with TRAMP mice to examine AR role in TRAMP induced

prostatecancer and permit determination of points in prostate cancer requiring AR function. 4: Determine AR role in tumorigenicity of androgen-dependent and androgen-independent ARKO prostate cancer cell lines. The effect of AR loss in these cells will be examined for ability to generate/promote tumors in mice. This year we generated mice with ARKO in the prostate epithelium and will be able to continue the other aims in the proposal in the coming years.

DTIC

*Cancer; Hormones; Males; Prostate Gland*

**20070026382** Pennsylvania Univ., Philadelphia, PA USA

**The Role of TSC Proteins in Regulating Cell Adhesion and Motility**

Krymskaya, Vera P; Sep 2006; 49 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0819

Report No.(s): AD-A466058; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466058>

The goal of this project was to define the molecular signaling mechanisms by which TSC1 and TSC2 proteins regulate cell adhesion and motility as it relates to the genetic disorder tuberous sclerosis complex (TSC). The pathogenesis of TSC that develops due to the loss-of-function of tumor suppressors TSC1 and TSC2 proteins represents an extremely complex and not fully understood interplay of deregulated cell functions. The neurological manifestations of TSC are related to brain lesions named tubers that have been defined as a neuronal migration disorder and occur due to aberrant neuronal motility during brain development. As a result of aberrant neuronal motility affected individuals may suffer from seizures mental retardation and autism. Thus TSC represents a major cause of developmental disorders and epilepsy in the pediatric population. The central hypothesis of this proposal was: TSC proteins regulate cell adhesion and motility and loss of either TSC1 or TSC2 function alters cell adhesion and induces aberrant motility promoting the pathological conditions associated with TSC PI3K and small GTPases RhoA and Rac1 respectively serve as the upstream modulator and downstream effectors of TSC1 and TSC2 proteins. The significance of this work relates to better understanding of the molecular and cellular mechanisms of the pathobiology of TSC such that new therapeutic targets can be identified to treat this devastating disease.

DTIC

*Adhesion; Brain; Locomotion; Proteins*

**20070026395** Alabama Univ., Birmingham, AL USA

**Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor**

Hui, Xu; Feb 2005; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0185

Report No.(s): AD-A466091; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466091>

Slit2 is a soluble protein that has been demonstrated to regulate cell migration and inhibit inflammatory reactions. Recent studies suggest that Slit2 may play a role in tumor development. However conflict results have been reported about the expression level of Slit2 in normal and tumor tissues and the effect of Slit2 on development. The current studies in this report have for the first time demonstrated that forced expression of Slit2 in tumors suppresses the growth of human prostate tumor Du145 fibrosarcoma HT1080 and epidermoid tumor A431 cells in an anchorage independent way. Further experiments indicate that Slit2 inhibits tumor growth and reduces metastasis of HT1080 tumors in lungs of nude mice. Additionally in situ detection of transcriptional level indicates that Slit2 is down regulated in human tumor samples compared to normal tissues that mostly express Slit2 mRNA. Since all three tumor cell lines in the current studies express Robo4 a receptor for Slit2, the suppressive effect of Slit2 on tumors is likely mediated by the interaction of Slit2 with the receptor. These data imply that Slit2 is a tumor suppressor which is down regulated during tumor development. The effect of Slit2 on tumorigenesis is largely unexplored and further studies are required to define the mechanism for Slit2 mediated suppression of tumors.

DTIC

*Augmentation; Cancer; Migration; Prostate Gland; Proteins; Solubility; Tumors*

**20070026407** Dana Farber Cancer Inst., Boston, MA USA

**Expression and Genomic Profiling of Minute Breast Cancer Samples**

Makrigiorgos, G M; Jul 2006; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0240

Report No.(s): AD-A466110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466110>

To be able to apply the newest genetic analysis technologies in breast cancer research, enough DNA material must be



available to perform this analysis. Often this is impossible with the minute amounts of tissue obtained via fine needle aspiration or laser capture microdissection currently the best methods available for removal of small amounts of tissue. Therefore whole genome-based DNA amplification techniques (e.g. PCR) are essential. The aim of this proposal was to evaluate a newly developed method, balanced PCR, which overcomes the difficulty of non-linear PCR-amplification of complex genomes and faithfully retains the difference among corresponding genes or gene fragments. In the three years of work we demonstrated the application of balanced PCR in performing genomic profiling of breast CA cell lines and samples (part of Tasks 2 and 3). In the second year we demonstrated the application of the method for gene expression profiling of breast CA cell lines (Task 1). This report describes the work conducted over the three years.

DTIC

*Breast; Cancer; Genetics; Genome; Mammary Glands*

**20070026429** Medical Univ. of South Carolina, Charleston, SC USA

**Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemo- Resistance - Potential Mechanism of PIM Action**

Kraft, Andrew S; Dec 2006; 39 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0126

Report No.(s): AD-A466143; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466143>

Pim is a protein kinase that has been implicated to play a role in prostate cancer. Kaplan-Meier analysis demonstrated that those patients with high Pim-1 expression are at a significantly greater risk for developing metastatic cancer. In transgenic animal models, the levels of Pim-1 protein kinase are elevated in prostate tumors caused by over expression of the c-myc oncogene, a gene overexpressed in human prostate cancer. In this proposal, we will examine whether Pim mimics Akt and TOR or modulates additional biochemical pathways and use knockout mice to dissect how myc and Pim collaborate to induce transformation and growth of prostate cancers. Pim inhibitors alone or in combination with TOR inhibitors will make a powerful chemotherapeutic strategy.

DTIC

*Cancer; Chemotherapy; Enzymes; Phosphorus; Prostate Gland; Proteins; Tumors*

**20070026432** Armed Forces Research Inst. of Medical Sciences, Bangkok, Thailand

**Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army**

Nobithai, Anont; Nitayaphan, Sorachai; Jan 2007; 98 pp.; In English

Contract(s)/Grant(s): W81XWH-06-2-0012; DAMD17-01-2-0005

Report No.(s): AD-A466146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466146>

Cooperative agreement # DAMD17-01-2-0005 was implemented January 1, 2006 to provide funding support for Royal Thai Army at Armed Forces Research Institute of medical Sciences (AFRIMS) engaged in research activities in collaboration with US Army. Administrative, logistical and scientific personnel required to support the ongoing US Army AFRIMS research efforts, and utilities and maintenance required to support the US Army AFRIMS research effort.

DTIC

*Infectious Diseases; Medical Services; Military Operations; Military Technology; Research and Development; United States*

**20070026433** Northwestern Univ., Evanston, IL USA

**Identifying Molecular Factors in Androgen Receptor Nuclear Export**

Weng, Yujuan; Jan 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0193

Report No.(s): AD-A466147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466147>

Androgen receptor (AR) plays a central role in prostate cancer and the regulation of its nuclear/cytoplasmic transport represents another level control of its activity. However how AR is transported into and out of the nucleus remains largely a mystery. Yeast (*S. cerevisiae*) provides a powerful system to study fundamental cellular mechanisms. Thus we use yeast as a model system to identify factors that are involved in the AR nuclear export. A mutagenesis screen was performed and thus far 6000 individual clones (about 1 yeast genome) have been examined. Seven mutants that displayed a defect in nuclear export

were isolated. Preliminary results suggest that one mutant yeast clone 27.7D is a recessive gene that may play a role in the nuclear localization of AR. In addition the mutant clone 27.7D also exhibit retarded growth. The export and growth defects observed in clone 27.7D appear to be caused by the same mutation or two separate but very closely linked mutations. Complementation experiments show that 27.7D is distinct from two other mutants clones I .3E and 72.5E which are actively being characterized. Initial results also suggest that the combination of the mutation in 27.7D and the mutation of another mutant clone I 02.5D results in lethality. This suggests the possibility that these two genes may belong to two parallel pathways.

DTIC

*Cancer; Hormones; Identifying; International Trade; Males; Prostate Gland*

**20070026434** Washington Univ., Saint Louis, MO USA

**The Opposing Roles of Nucleophosmin and the ARF Tumor Suppressor in Breast Cancer**

Apicelli, Anthony J; Apr 2006; 87 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0394

Report No.(s): AD-A466148; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466148>

The ARF tumor suppressor protein plays an important role in the tumor surveillance of human cancer. In the search for novel ARF binding proteins, we uncovered NPM. Despite the important role ARF plays in the regulation of tumorigenesis, alterations selectively affecting its ability to negate NPM function have not been studied. In our proposed study, we aimed to determine the impact of ARF-NPM interactions in the pathogenesis of breast cancer. To this end, we have found that overexpression of NPM in the absence of ARF is a powerful transforming event. NPM promotes tumorigenesis without affecting genomic stability, implying that the subsequent tumors should remain diploid, a hallmark of ARF-null breast cancers. Indeed, when we analyzed sixty breast carcinomas, NPM was highly overexpressed in 50% of cases. We have begun further analyses of how NPM promotes tumor formation and have discovered that it does so through ribosome dysregulation, opening up the door to new therapeutic targets in breast cancer: protein synthesis.

DTIC

*Breast; Cancer; Mammary Glands; Neoplasms; Suppressors; Tumors*

**20070026435** Geisinger Medical Center, Danville, PA USA

**Radio-sensitizing Effects of Novel Histone De-Acetylase Inhibitors in Prostate Cancer**

Gupta, Seema; Ahmed, Mansoor M; Mar 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0816

Report No.(s): AD-A466149; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466149>

In the proposal, we hypothesized that HDAC inhibitors will sensitize the effects of ionizing radiation (IR) through inhibition of pro-survival events with simultaneous up-regulation of pro-apoptotic events. The following three specific aims were proposed: Aim 1. To determine the combined effects of HDAC inhibitors and ionizing radiation on prostate cancer cell lines (PC-3, LN-3, LnCAP, DU-145 and 22Rv1). Aim 2. To understand the signaling pathways induced by combined exposures to HDAC inhibitors and ionizing radiation in both androgen dependent and independent prostate cancer cell lines. Aim 3. To determine the combined effects of HDAC inhibitors plus ionizing radiation on the regression of (i) prostate cancer xenografts (PC-3) in nude mice and (ii) insitu prostate tumor in TRAMP mice. The following tasks were achieved: Aim 1: The radiosensitizing effects of VAD-18 and VAD-20 were studied in PC-3 cells. Further, due to change in the inhibitors for the remaining part of the grant, effects of SAHA and (S)-HDAC-42 were investigated in PC-3, LN-3 and DU-145 cells. (S)-HDAC-42 and SAHA could sensitize PC-3 and DU-145 cells to radiation. Aim 2: Effects of VAD-18 and VAD-20 were mediated through cell cycle arrest, down-regulation of anti-apoptotic proteins, upregulation of pro-apoptotic proteins and abrogation of radiation-induced nuclear translocation of p65, thereby, enhancing cell death. Further, a novel transcription factor, USF-1 was identified which may be responsible for the radiosensitizing effects of these inhibitors. Aim 3: The breeding of TRAMP mice is in progress. We are currently increasing the population of true TRAMP mice for further experiments. Ultrasound Imaging protocol will be used for assessing in situ regression of tumors.

DTIC

*Apoptosis; Cancer; Inhibitors; Prostate Gland; Sensitizing*

**20070026438** Queensland Univ., Brisbane, Australia

**Development of a Novel, Non-Invasive Diagnostic Test for Prostate Cancer**

Gardiner, Robert; Jan 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0092

Report No.(s): AD-A466152; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466152>

Hypothesis: The overall objective is to provide for routine clinical use a simple and reliable method for identifying patients with prostate cancer so that transrectal ultrasound guided biopsies can be restricted to men harboring PCa. Our broad strategy will involve the use of selected markers for sensitive detection of cancer cells in ejaculate. Objectives: (1) To recruit patients for a prospective clinical trial in a screening assay of patient ejaculate and urine samples from which PCa cells will be isolated by (2) immunocapture using antibodies to specific cell-surface markers and (3) detected by real-time PCR with a combination of genes upregulated in PCa. These methods will be refined for application for routine laboratory use. Logistic regression analysis will be used with the above combination of PS MA DD3 and Hepsin to determine each patient's probability of harboring PCa. This data will be correlated with clinical data obtained by conventional diagnostic methods. Relevance: It is our strong expectation that this research will lead to provision of a simple and reliable approach for diagnosing PCa in the longer term reducing the need for the invasive imprecise and unpleasant procedure of TRUS-guided prostatic biopsies. In addition we expect that the earlier detection will be associated with and even greater proportion of cancer localised to the prostate at time of diagnosis.

DTIC

*Cancer; Prostate Gland*

**20070026439** SRI International Corp., Menlo Park, CA USA

**Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations**

Lim, Peter; Oct 2006; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-03-C-0111

Report No.(s): AD-A466154; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466154>

During the annual contract period, September 22, 2005 to September 21, 2006, the project personnel continued to perform chemical/physical analyses on bulk pharmaceutical substances and formulated drug products, and to develop and (with borrowed labor) manufacture dosage formulations of interest to the USAMRMC Drug Development Program for parasitic and infectious diseases, chemical and biological defense, etc. Specific objectives were to design, develop, validate, and apply methods to determine chemical and physical characteristics of the bulk drugs, drug products, and to determine their stability under defined conditions.

DTIC

*Chemical Warfare; Drugs; Parasites; Warfare*

**20070026440** Brookhaven National Lab., Upton, NY USA

**Structural Studies on Toxins and Virulence Factors of Yersinia Pestis**

Swaminathan, S; Jul 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0491

Report No.(s): AD-A466156; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466156>

In this annual report we present our continuing efforts on two or three fronts. We are working on the expression purification and crystallization of complexes of YopB and YopD with other proteins like their chaperones. We have made progress in purifying YopB:YopD:SycD complex. If successful this will help in understanding the translocation mechanism of effector proteins. Our crystallization efforts on YopH and SycD are continuing.

DTIC

*Toxins and Antitoxins; Virulence*

**20070026441** Northern California Cancer Center, Union City, CA USA

**Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study**

Glaser, Sally L; John, Esther M; Clarke, Christina A; Erlich, Henry A; May 2006; 86 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0430

Report No.(s): AD-A466157; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466157>

As both breast cancer incidence and the highly polymorphic genes for the human leukocyte antigen (HLA) component of the immune system differ across racial/ethnic groups, HLA may be a biologically based risk factor for breast cancer and explain some of its racial/ethnic variation. In a population-based series of 915 post-menopausal white, black and Hispanic breast cancer cases and controls, we determined HLA class I (A, B) and class II (DR, DO) genotypes through DNA methodology and calculated age- and risk factor-adjusted odds ratios to estimate allele-specific risks. We found moderate associations of HLA alleles with breast cancer overall but varying with race/ethnicity. Overall, breast cancer risk was suggestively increased for allele A-33, suggestively decreased for alleles B-13 and B-39, and doubled for the DR-DO haplotype 0803. In whites, A-23 increased risk. In blacks, A-32, A-33 and DOB-5 increased risk, while DRB-9 reduced risk. In Hispanics, B-40 increased risk, while A-01, B-07, and B-45 decreased risk. Some associations were modified by disease stage at diagnosis, ER status of tumors, and breast cancer family history. Associations noted for A-01, A-23, A-32, B-07, DRB1-01, DOB1-02 and DOB1-05 were consistent with observed racial/ethnic incidence differentials, but other associations were in contradictory directions. Our findings, limited by sample size and multiple comparisons, support a possible but complex role of HLA or linked loci in breast cancer occurrence and perhaps the racial/ethnic variation in its incidence.

DTIC

*Antigens; Breast; Cancer; Epidemiology; Ethnic Factors; Genes; Leukocytes; Mammary Glands; Populations*

**20070026442** New York Hospital-Cornell Medical Center, New York, NY USA

**Anti-Angiogenic Action of Neutral Endopeptidase**

Nanus, David; Nov 2006; 15 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0051

Report No.(s): AD-A466158; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466158>

Angiogenesis, or the formation of new blood vessels from existing vasculature is an important event in tumor progression. It results from a complex, multistep biochemical cascade that is initiated by the activation of endothelial cells in response to angiogenic factors. In prostate cancers, angiogenic factors are produced by epithelial and stromal cells, and are believed critical to prostate cancer growth and progression. One of the most important of these factors is basic fibroblast growth factor (bFGF), which plays an important role in angiogenesis through the stimulation of endothelial cell proliferation, migration, and protease production in vitro phenomenon. A number of studies both in vitro and in patient specimens suggest that enhanced expression of bFGF contributes to more aggressive prostate cancer. Clearly, a better understanding of the pathways regulating angiogenesis in the prostate and how these pathways change during malignant transformation and prostate cancer progression will assist in developing more effective therapies for patients with prostate cancer. Cell-surface peptidases are the guardians of the cell against small stimulatory peptides, functioning to control growth and differentiation in normal cells by regulating peptide access to their cell-surface receptors. They are integral membrane proteins with their enzymatic site exposed to the external cell surface, Neutral endopeptidase (NEP) is a cell-surface peptidase normally expressed by prostatic epithelial cells, whose expression is lost in over half of prostate cancers. NEP substrates include small peptides that have been implicated in prostate cancer progression, including endothelin-1, bombesin and neurotensin. We have now reported that bFGF is also a substrate for NEP. The goals of this application focus on deciphering the interaction between NEP and bFGF.

DTIC

*Angiogenesis; Blood Vessels; Cancer; Endothelium; Prostate Gland*

**20070026443** SIGA Technologies, Inc., Corvallis, OR USA

**Smallpox Antiviral Drug**

Hruby, Dennis E; Jan 2007; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-C-0040

Report No.(s): AD-A466159; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466159>

Using a homology-based bioinformatics approach a new structural model of the vaccinia virus (VV) I7L proteinase active

site has been generated. This model was used to perform Virtual Ligand Screening of a comprehensive library of approximately 3.5 million available compounds including about 208,000 available ketones and aldehydes. Compounds with a docking score of <-32 were ordered and screened using our newly developed fluorescence quench biochemical assay for those compounds able to inhibit the activity of the I7L enzyme. Compounds have been identified that inhibit I7L more than 50% at 200 pM which validate the 3D ligand binding model and provide initial leads for further rational optimization of poxvirus I7L proteinase inhibitors.

DTIC

*Drugs; Smallpox; Viruses*

**20070026444** Johns Hopkins Univ., Baltimore, MD USA

**Development of Antigen Presenting Cells for Adoptive Immunotherapy in Prostate Cancer**

Oelke, Mathias; Dec 2006; 13 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0133

Report No.(s): AD-A466160; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466160>

While adoptive immunotherapy holds promise as a treatment for cancer and infectious diseases, development has been impeded by the lack of reproducible methods for generating therapeutic numbers of antigen-specific CD8+ CTL. As a result, there are only limited reports of expansion of antigen-specific CTL to levels required for clinical therapy. Therefore, our groups has previously developed artificial Antigen-Presenting Cells (aAPC), made by coupling soluble HLA-Ig and anti-CD28 to beads. These aAPC have successfully been used to induce and expand CTL specific for CMV or melanoma. For the current study we have proposed to used and further developed those aAPC for the generation of prostate cancer specific CTL. Our preliminary data demonstrate that aAPC loaded with the prostate cancer specific antigen EpHA2 have been used to generate functional active prostate cancer-specific CTL from peripheral blood healthy donors.

DTIC

*Antigens; Cancer; Clinical Medicine; Infectious Diseases; Prostate Gland*

**20070026445** Baylor Coll. of Medicine, Houston, TX USA

**Role of Caveolin-1 in Prostate Cancer Angiogenesis**

Thompson, Timothy C; Dec 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0116

Report No.(s): AD-A466161; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466161>

Overall we have made exceptional progress in the first year funding period of this project. Tasks 1-3 are on schedule and although as is often the case we have made some unanticipated and necessary adjustments (replacement of 178-2BMAK cells with RM-9 cells for Task 3) we are moving toward our stated goals. Importantly our data thus far are yielding important mechanistic insight into the angiogenic activities of prostate cancer cell derived secreted cav-1. In our view after we further define these mechanisms we will be able to take the next important step exploiting this new knowledge for prostate cancer diagnosis and therapy.

DTIC

*Cancer; Prostate Gland*

**20070026446** Stanford Univ., Stanford, CA USA

**Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy**

Li, Tianfang; Jan 2007; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0235

Report No.(s): AD-A466162; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466162>

Modern radiotherapy equipment is capable of delivering high precision conformal dose distributions to the target. However, the target localization especially for soft-tissue target such as prostate is an issue, because of its possible non-rigid internal motion relative to bony structures or external landmarks. Recently, a new technology of kilo-voltage cone-beam CT (CBCT) has been integrated with the linear accelerator treatment machine. Superior to the common approach based on the two orthogonal images provided by the mega-voltage EPID, CBCT can provide high-resolution three-dimensional (3D) information of the patient in the treatment position. Thus the target localization could be potentially done more accurately

without using any implanted fiducials. In practice, however, there is currently still a general lack of efficient method to utilize the 3D CBCT images. In this work, we have developed a clinically practical technique for automatic patient positioning based on the newly emerged CBCT, accounting for the non-rigid motions of the prostate and surrounding structures. A novel deformable registration method has also been developed to improve the positioning accuracy. Furthermore, a low-dose CBCT acquisition protocol is being developed so that a daily use of CBCT becomes possible for prostate patients.

DTIC

*Algorithms; Cancer; Dosage; Patients; Positioning; Prostate Gland; Radiation Therapy*

**20070026448** Stanford Univ., Stanford, CA USA

**Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing**

Hoffman, Andrew R; Beck, Belinda; Matheson, Gordon; Bergman, Gabrielle; Dec 2006; 41 pp.; In English

Contract(s)/Grant(s): DAMD17-98-1-8519

Report No.(s): AD-A466165; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466165>

To determine the effect of capacitively coupled electric field stimulation on tibial stress fracture healing in men and women. Methods: A convenience sample of 20 men and 24 women with posteromedial tibial stress fractures was recruited. Subjects were randomly assigned an active or placebo OrthoPak(Registered) Bone Growth Stimulator (sinusoidal wave, 3-6 V, 60 kHz, 5-10 mA), to be used for 15 hours per day until healed. Subjects were given supplemental calcium and instructed to rest from training. Healing was confirmed when hopping 10 cm off the ground for 30 seconds was pain free. Data was analyzed using 2-way ANOVA for effects of treatment and sex on healing time. Compliance and other between-group differences and relationships were examined via ANOVA, t-tests and correlation analyses. The influence of anthropometric and behavioral characteristics on time to healing was evaluated by multiple regression analysis. No difference in time to healing was detected between treatment and placebo groups. Treatment compliance was positively associated with reduced time to healing ( $p = 0.003$ ). Rest non-compliance was associated with increased time to healing ( $p = 0.05$ ). Female subjects healed more slowly than men ( $p = 0.05$ ). Capacitively coupled electric fields did not accelerate tibial stress fracture healing in comparison with placebo treatment (modified rest), but women took longer to recover than men. Daily device use and weight bearing loading during treatment appeared to positively and negatively (respectively) influence the efficacy of the active device.

DTIC

*Bones; Electric Fields; Fractures (Materials); Fracturing; Healing; Stimulation; Tibia*

**20070026449** Virginia Commonwealth Univ., Richmond, VA USA

**Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity**

Poynter, Kennon R; Holt, Shawn; Mar 1, 2007; 21 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0421

Report No.(s): AD-A466166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466166>

Telomerase, a ribonucleoprotein enzyme composed of an RNA template (hTR) and a catalytically active protein subunit (hTERT), synthesizes telomeres after cell divisions and is obligatory for continuous tumor cell proliferation as well as malignant progression of breast cancer cells. Telomerase is an attractive anti-cancer therapeutic agent because telomerase activity is present in over 90% of human breast cancers but is undetectable in most normal somatic cells. Traditional therapies (surgery, chemotherapy, radiotherapy, etc.) lack the ability to effectively control and cure breast cancer, primarily because residual cells are or become resistant to DNA damaging modalities including standard chemo- and radio-therapies. Since telomerase requires its associated hTR for repeat synthesis, we have chosen to use RNA interference as a method to inactivate hTR and hence telomerase. RNA interference (RNAi) has become a powerful tool for the analysis of gene function in that RNAi allows sequence specific inhibition of gene expression. Another protein we targeted is p21, which has long been established as a requirement for senescence. We wanted to further examine its relationship to senescence and apoptosis, in an attempt to sensitize breast tumor cells more effectively.

DTIC

*Apoptosis; Breast; Cancer; Cell Division; Cells (Biology); Mammary Glands; Ribonucleic Acids; Sensitivity; Tumors*

**20070026450** Oregon Health Sciences Univ., Portland, OR USA

**A Novel Mechanism of Androgen Receptor Action**

Roberts, Jr, Charles T; Jan 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0152

Report No.(s): AD-A466168; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466168>

This revised project has as its goal the characterization of a novel alternative product of the Her-2/neu/erbB2 proto-oncogene derived from intron retention. The product of this splicing mechanism, termed herstatin, is a secreted protein comprised of the N terminus of the Her-2 receptor tyrosine kinase and a unique, intron-encoded C terminus that allows binding to the other members of the EGFR/erbB family. This binding down-regulates erbB expression and inhibits EGF family signaling and cell proliferation. We have found that herstatin also binds to and down-regulates the IGF-I receptor (IGF-IR) and modulates IGF signal transduction. Herstatin is, therefore, a novel bifunctional inhibitor of erbB and IGF-IR signaling. Herstatin is expressed in prostate tissue and may represent a promising therapeutic target and biomarker in CaP. The work proposed in this project will assess the effect of herstatin on CaP cell phenotype, the expression of herstatin in CaP samples, and potential mechanisms of regulation of herstatin expression.

DTIC

*Hormones; Males*

**20070026451** Pennsylvania Univ., Philadelphia, PA USA

**Hot Flashes and Quality of Life Among Breast Cancer Patients**

Jacobs, Linda A; Aug 2006; 19 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0264

Report No.(s): AD-A466169; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466169>

This prospective study examined hot flashes and quality of life (QOL) in BC patients undergoing initial treatment. The medical and complementary and alternative medicine (CAM) interventions used by patients were also examined. One hundred and ninety-six women were recruited to the study and data for several time-points continues to be collected on women who were recruited to the study 12 months ago in order to complete their 15 and 18 month questionnaires. A limited analysis of data gathered to date is available. Women were assessed for hot flash intensity/frequency, use of medical and CAM interventions, emotional distress, physical and social functioning, and QOL at diagnosis and 6, 9, 12, 15, and 18 months. Data were analyzed for each timepoint and results will be discussed in this report in relation to each specific aim. The sample is primarily middle-aged (M = 52 years; R = 27-83 years), European American (72.6%), has at least some college education (76.5%), and is married (64.2%). Approximately one-half (51.5%) of the sample reported that they were post-menopausal at diagnosis with 48.5% pre-menopausal. Of the women who were pre-menopausal prior to diagnosis, approximately (10%) reported that they were experiencing hot flashes at the 12 month time-point and these younger women reported higher levels of distress related to hot flashes than those women who were postmenopausal and already experiencing hot flashes. Of women currently experiencing hot flashes, 40.7% report at baseline, having used HRT and 26.8% used exercise to control hot flashes. The 12-month data indicates that 26.5% of the entire sample who are experiencing hot flashes, tried or are using some form of HRT to control hot flashes with exercise still the most frequently used approach to manage hot flashes with 44.2% of sample currently exercising.

DTIC

*Breast; Cancer; Mammary Glands; Patients*

**20070026453** Creighton Univ., Omaha, NE USA

**Efficacy of Calcium and Vitamin D Supplementation for the Prevention of Stress Fractures in Female Naval Recruits**

Lappe, Joan M; Oct 2006; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0807

Report No.(s): AD-A466171; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466171>

The goal is to determine if calcium and vitamin D supplementation can reduce the incidence of stress fracture by at least 50% in female Naval recruits during basic training. The secondary goal is to examine the potential mechanisms for increasing bone adaptation to intense mechanical loading. The Command Officers at the Great Lakes Naval Station stopped the study on xxx because we had recruited our originally targeted sample size. We recruited 5201 females who were randomly assigned to calcium 2000 mg and vitamin D 800 I.U. per day or a control placebo group. The intervention and stress fracture monitoring

continued through 8 weeks of basic training. We were not able to recruit the targeted number of subjects for the sub-study designed to determine changes in moment of inertia using peripheral quantitative computed tomography (pOCT). We enrolled 148 (out of a target 560) in the 3703 participants who completed the main study we found that calcium D supplementation decreased the incidence of stress fracture by 27% ( $p=0.02$ ). Furthermore supplementation suggests that supplementation can compensate for a history of low physical activity.

DTIC

*Bones; Calciferol; Calcium; Females; Fractures (Materials); Prevention*

**20070026454** Virginia Univ. Health Science Center, Charlottesville, VA USA

**The Impact of Tyrosine Kinase Signaling on Breast Cancer Development**

Marozkina, N V; Aug 2005; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0253

Report No.(s): AD-A466172; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466172>

The epidermal growth factor receptor (EGFR) plays an important role in receptor transactivation events initiated by G protein-coupled receptors (GPCRs), integrins and cytokine receptors. In these signaling pathway, the EGFR frequently is responsible for activating Ras and MAP kinase/extracellular signal-regulated kinase (ERK). EGFR transactivation may be ligand-dependent, in which case EGF or TGF $\alpha$  bind to the receptor, cause its dimerization and activation, or ligand-independent, due to the activity of intracellular kinases, such as c-Src, which induce tyrosine phosphorylation of the EGFR. EGFR and c-Src are coexpressed in a wide range of human tumors including the brain, lung, breast and prostate. Much evidence suggests that overexpression of TGF $\alpha$  and its cognate receptor EGFR is involved in the later stages of human breast cancer and may play a role in growth and metastatic processes. Results from recent studies using cultured fibroblasts and human breast cancer cell lines have indicated that c-Src and EGFR synergistically interact to promote tumor formation in nude mice xenografts. To check whether this synergism occurs in the more physiological setting of the mammary gland, I am testing the interaction of these tyrosine kinases in transgenic mouse models, where MMTV EGFR, c-Src and TGF $\alpha$  transgenic mice generated. MMTV EGFR transgenic mice will be cross-bred with MMTV-c-Src and/or TGF $\alpha$  transgenic mice to form bigenic or trigenic mice, then examined for tumor formation in the mammary gland tissue. If the synergism hypothesis is correct, bigenic mice should develop large tumors more rapidly than single transgenic mice, and trigenic more rapidly than bigenic mice thus validating the synergism between c-Src, EGFR and TGF $\alpha$  as targets for future therapies.

DTIC

*Breast; Cancer; Mammary Glands; Tyrosine*

**20070026455** Henry Ford Health System, Detroit, MI USA

**Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer**

Worsham, Maria J; Raju, Usha; Lu, Mei; Jul 2006; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0406

Report No.(s): AD-A466173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466173>

Cancer is a highly heterogeneous disease, both morphologically and genetically. A current shortcoming in cancer prognosis and treatment is a lack of methods that adequately address the complexity and diversity of the disease. Genome wide studies can provide molecular characterization or fingerprints of cancer phenotypes linked to clinical information. The aim of this research is to 1a: identify an informative set of specific genetic alterations that underlie the pathogenesis of disease progression to serve as targets for management of disease at the earliest stages and 1b: refine stage-specific disease phenotypes by integration of molecular profiles with known risk factors of breast cancer such as reproductive characteristics, medical history, and histologic parameters of breast carcinomas. We will examine 100 cases in each disease stage category of 0, 1, 2, 3, 4 and unknown to evaluate 120 breast cancer associated gene markers distributed throughout the human genome. Molecular fingerprints identified from genome wide studies should delineate patterns of genomic imbalances at the level of stage-specific gene loci, providing a novel index to estimate the extent of genomic abnormality with disease progression. This knowledge should allow the integration of stage-specific therapeutic targets as treatment intervention strategies in the management of breast cancer.

DTIC

*Breast; Cancer; Clinical Medicine; Diseases; Mammary Glands; Medical Services; Risk; Targets; Therapy*



**20070026456** Pennsylvania Univ., Philadelphia, PA USA

**Structure-Based Design of Cdk4/6-Specific Inhibitors**

Marmorstein, Ronen; Oct 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0725

Report No.(s): AD-A466179; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466179>

The CDK4/6 kinase has elevated activity in spontaneous breast cancer, making it an excellent candidate for targeted inhibition for the treatment of breast cancer. We proposed to prepare a CDK4/6-specific kinase inhibitor that is based on the naturally occurring CDK4/6 specific inhibitory proteins of the INK4 family. Since the INK4 proteins are notoriously unstable, we have been working towards the preparation and structural characterization of INK4 proteins with improved thermostability that could be used as a scaffold to prepare peptide sub-fragments that may serve as a scaffold to prepare small molecule CDK4/6- specific inhibitors. During the funding period, we successfully prepared p18INK4c proteins with increased thermostability and have characterized the structure of a subset of the more thermostable p18INK4c proteins. This structure-function analysis revealed the chemical basis for the increased stability properties of the more thermostable p18INK4c proteins. Significantly, a thermostable F71N mutant protein also showed enhanced CDK6 interaction and cell cycle inhibitory activity in vivo, as measured using co-immunoprecipitation and transient transfection assays, respectively. Together, our studies show that a structure-based approach to increase the thermodynamic stability of INK4 proteins can be exploited to prepare more biologically active molecules with potential applications for the development of molecules to treat INK4-mediated cancers.

DTIC

*Breast; Cancer; Inhibitors; Mammary Glands; Thermodynamics*

**20070026457** Nevada Univ., Reno, NV USA

**Chemokine Blockade in Combination with Cytoablative Conditioning in Metastatic Breast Cancer**

Murphy, William J; Aug 2006; 12 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0525

Report No.(s): AD-A466180; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466180>

Chemokines have been shown to provide angiogenic effects. Blocking chemokines can reduce metastatic breast cancer cell growth. We proposed that cytoablative conditioning will force the tumor to rely on angiogenesis as a survival mechanism and thus make the tumor more susceptible to chemokine blockade. We demonstrate that tumor cells increase production of IL-8 and MCP-1 transcripts in vivo in response to IL-8 neutralization and/or gamma irradiation and cytoxan administration. We have also demonstrated that IL-8 but not MCP-1 can function as autocrine growth or survival factor for MDA-231 cells in vitro but neutralization requires high concentrations of antibody. This observation is consistent with the more significant anti-tumor effect observed with anti-IL-8 as a single agent and suggest that IL-8 promotes tumor cell growth through multiple mechanisms. We also showed that administration of anti-IL-8 and anti-MCP-1 can inhibit the formation of human breast cancer lung metastasis in a xenograft model.

DTIC

*Angiogenesis; Breast; Cancer; Mammary Glands; Metastasis*

**20070026460** Colorado Univ., Aurora, CO USA

**HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate**

Nordeen, Steven K; Dec 2005; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0918

Report No.(s): AD-A466187; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466187>

Our preliminary data had suggested that HOXC5 gene expression was increased in prostate tumor and in tumor-associated normal epithelium compared to epithelium from normal prostate, raising hopes that HOXC5 could be a biomarker that could guide whether a patient with a negative biopsy should undergo a rebiopsy. We compared methods for preparation of RNA from formalin-fixed, paraffin embedded tissue and used the best method to prepare RNA from normal prostate tissue and from dissected tumor and tumor-associated normal tissue. While there was a trend toward increased frequency of HOXC5 expression in tumor and tumor-associated normal tissue compared to normal prostate, the trend fell slightly short of statistical significance. Moreover, there was only a small difference between the frequency of detection of HOXC5 expression in normal

and tumor-associated normal. These results do not support the efficacy of HOXC5 as a biomarker for the presence of tumor elsewhere in the gland.

DTIC

*Biomarkers; Diseases; Genes; Neoplasms; Prostate Gland; Ribonucleic Acids; Tumors*

**20070026473** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

**Environmental Survival, Military Relevance, and Persistence of Burkholderia Pseudomallei**

Inglis, Timothy J; Sagripanti, Jose-Luis; Apr 2007; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466217; ECBC-TR-507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466217>

*Burkholderia pseudomallei* causes melioidosis, a fatal septicemic infection following either soil or water exposure. The organism is endemic in Asia, where it is able to survive in either desiccated environments or distilled water for several years. The goal of this work was to evaluate available data and to assess the biological hazard posed by *B. pseudomallei* in environmental water, soil, or on inanimate surfaces. We reviewed the historical impact of melioidosis on the military, clinical aspects of the disease, its laboratory diagnosis, and the molecular and phenotypic characteristics of *B. pseudomallei*. We then evaluated the effect of geographic environments and habitats (water, soil, climate), as well as physical (ultraviolet radiation, temperature) and chemical (pH, chlorine) factors on the survival of *B. pseudomallei*. In addition, we analyzed a variety of biological properties that enhance the survival of *B. pseudomallei*, including metabolic adaptation, biofilm formation, and intracellular survival in protozoa, fungi, and specific parts of legume roots. We identified critical data needed for accurate risk prediction and effective threat reduction of the risk posed by *B. pseudomallei*. The lack of a vaccine, together with its unusual resistance in the environment, makes *B. pseudomallei* a concern for public health and bio-defense.

DTIC

*Survival*

**20070026474** Society for In Vitro Biology, Columbia, MD USA

**2006 In Vitro Biology Meeting. Volume 42**

Harbell, John W; Apr 25, 2006; 98 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-C-0140

Report No.(s): AD-A466219; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466219>

*In Vitro Cellular and Developmental Biology- Plant* publishes peer-reviewed original research and reviews concerned with the latest developments and state-of-the-art research in plant cell and tissue culture and biotechnology from around the globe. Four issues cover cellular, molecular and developmental biology research using in vitro grown or maintained organs, tissues or cells derived from plants. Two special IAFTC&B issues deal with plant tissue culture, and molecular and cellular aspects of plant biotechnology. The IAFTC&B and SIVB maintain completely separate and independent International boards for their issues. Topics covered by the Journal include: 1) biotechnology/genetic transformation; 2) metabolic engineering; 3) developmental biology/morphogenesis; 4) plant physiology; 5) micropropagation; 6) cell biology; 7) functional genomics; 8) somatic cell genetics; 9) molecular farming; 10) secondary metabolism.

DTIC

*Biotechnology; Genetics; In Vitro Methods and Tests; Medical Science*

**20070026523** Australian National Univ., Canberra, Australia

**New Materials, Techniques and Device Concepts for Organic NLO Chromophore-based Electrooptic Devices. Part 1**

Samoc, Marek; Samoc, Anna; Miniewicz, Andrzej; Aug 23, 2006; 48 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0131

Report No.(s): AD-A466371; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466371>

DNA (deoxyribonucleic acid) has been characterized for photonic applications. The optical properties of DNA in various forms: both the native, sodium ion-based DNA, and a surfactant treated modification: DNA-CTMA were studied. The work covers study on interaction of DNA with dyes.

DTIC

*Chromophores; Electro-Optics; Nonlinear Optics; Optoelectronic Devices*

**20070026587** Stanford Univ., Stanford, CA USA

**Multiple Aperture Radiation Therapy (MART) for Breast Cancer**

Li, Tianfang; Nov 2006; 73 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0657

Report No.(s): AD-A466522; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466522>

Conventional breast radiotherapy utilizes two opposed tangential fields (OTF) can result in high radiation dose to lung and heart and inhomogeneous dose distribution in the target for large-size breast. Modern advances in radiation therapy such as the intensity-modulated radiotherapy (IMRT) may be used to achieve dose distribution with superior tumor conformality and normal tissue spare. However, the increased complexity of the treatment planning and delivery procedures is a problem in a busy clinical environment. In this USAMRMC-supported project, we have developed a multiple-aperture radiation therapy (MART) procedure dedicated to breast irradiation, which combines the planning simplicity of the conventional OTF with the superior dose distribution of IMRT methods. The MART has been implemented in a clinic environment and systematically assessed. The improvement of dose distribution over traditional OTF has been clearly demonstrated. Furthermore, techniques related to breathing motion control have also been extensively investigated and included in this report.

DTIC

*Apertures; Breast; Cancer; Clinical Medicine; Mammary Glands; Radiation Dosage; Radiation Therapy*

**20070026601** Ogata Research Lab., Hokkaido, Japan

**Self Assembled Nano-Photonic Devices Derived from Marine DNA for Opto-Electronic Applications**

Ogata, Naoya; Mar 30, 2006; 39 pp.; In English

Report No.(s): AD-A466546; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466546>

Optical and photochromic properties of spiropyran-intercalated DNA-surfactant complex films were studied for optical switching. The switching speed was observed as 200-300 ms. They depended on the type of spiropyran as well as the type of surfactant. Spiropyrans containing the oxazine ring and intercalated into DNA showed a very rapid photochromic response. It also showed that photochromic response times became much faster when intensity of the excitation light increased. Various DNA-cationic lipid complexes and their bulk films were also prepared and their physical properties were measured.

DTIC

*Deoxyribonucleic Acid; Optical Switching; Photochromism*

**20070026605** Buck Inst. for Age Research, Novato, CA USA

**Cellular Senescence and Breast Cancer**

Campisi, Judith; Aug 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0546

Report No.(s): AD-A466555; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466555>

Aging is the single largest risk factor for developing breast cancer and is thought to be due the convergence of the accumulation of mutations together with the accumulation of senescent cells. Our working hypothesis is that senescent epithelial cells can cause preneoplastic or neoplastic changes in its neighbors, and that these changes will be manifest when cells are cultured in three dimensions, which more closely mimics the natural tissue environment than conventional two dimensional cultures. To test this hypothesis, we have successfully established two and three dimensional culture models of normal human mammary epithelial cells (HMECs) with and without a functional 16-tumor suppressor pathway. We have also created preneoplastic HMECs by introducing defined genes with oncogenic potential, particularly genes that selectively inactivate the p53 or pRB tumor suppressor pathways. We have used these, and frankly neoplastic human mammary epithelial cells, in the two and three dimensional co-culture assays in which presenescent HMECs are mixed with senescent HMECs and stromal breast fibroblasts. We have devised ways to analyze factors secreted by senescent cells and compared human mammary epithelial cells with their stromal counterparts.

DTIC

*Breast; Cancer; Mammary Glands*

**20070026607** Jackson (Henry M.) Foundation, Rockville, MD USA

**Children's Hospice**

Naulty, Cheryl M; Jan 2006; 170 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-C-0064

Report No.(s): AD-A466557; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466557>

The goal of this program is to develop and recommend a model of care that enhances the of life for DOD children with life-threatening conditions and their families. Our strategy is to maximize current benefits and coordinate medical care with existing community resources and services, tailored to support the family's specified needs and requirements. The first year of work focused on a feasibility study to gather data on the intent, interpretation and implementation of the benefit; status of service delivery; available resources through the Military Health System, contract providers, community and other government agencies; and to conduct an assessment of needs of families. A distinct research protocol was designed to use individual interviews and focus groups to determine family and provider needs. The benefits likely to be used by military families and their children were analyzed. A data assessment collection tool has been designed to capture descriptors regarding community resources. The plan is to web enable the database in order to provide maximum availability and accessibility to the various potential users. An existing education curriculum for providers, Initiative for Pediatric Palliative Care, developed by the CHI PACC model.

DTIC

*Children; Medical Services*

**20070026608** Duke Univ., Durham, NC USA

**Regulation of Apoptosis by AFG3L2, a Potential Oncogene**

Schafer, Zachary; Aug 1, 2005; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0234

Report No.(s): AD-A466558; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466558>

Apoptosis, or programmed cell death, is frequently triggered through the release of cytochrome c from mitochondria. Cytosolic cytochrome c then binds to a cytosolic protein known as Apaf-1, which binds to and activates the cell death protease, caspase 9. Many cancers are resistant to apoptosis induced by chemotherapies. During the course of this work we demonstrated that breast cancer cells, while resistant to release of mitochondrial cytochrome c are actually hypersensitive to cytochrome c, once it is released. Our work provides a unique point of sensitivity that might be exploited for the successful treatment of breast cancers.

DTIC

*Apoptosis; Breast; Cancer; Chemotherapy; Mammary Glands; Oncogenes; Tumors*

**20070026609** Wisconsin Univ., Madison, WI USA

**Biological Impact of Senescence Induction in Prostate Cancer Therapy**

Jarrard, David F; Jan 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0207

Report No.(s): AD-A466559; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466559>

Recently, it has been recognized that a distinct mechanism of terminal proliferation arrest after chemotherapy involves the reactivation of senescence. However, whether this phenotype occurs in vivo is unclear, as is the biological impact of senescence induction. We have previously identified pathways and genes involved in human senescence that may serve as senescence markers, and have demonstrated that senescence occurs in prostate cancer cell lines after chemotherapy. In this proposal, we will: a) determine whether senescent tumor cells alter the proliferation and invasion of surrounding prostate cancer cells in vitro and in vivo, b) assess for and augment senescence in prostate cancer xenograft models and human tumors, and c) identify novel small molecules that induce senescence in prostate cancer cells. Both in vitro and in vivo approaches using human prostate cancer cells will be utilized to identify and determine the mechanisms underlying senescence. With this data, our understanding of cellular senescence will undergo a quantum leap and permit the translation of this entity both as a marker of response and for directing therapy.

DTIC

*Aging (Biology); Cancer; Chemotherapy; Prostate Gland; Therapy*

**20070026611** Massachusetts General Hospital, Boston, MA USA

**Long-Term Outcomes of Alternative Brachytherapy Techniques for Early Prostate Cancer**

Talcott, James A; Jan 2007; 18 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0093

Report No.(s): AD-A466561; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466561>

All active, potentially curative treatments for clinically localized prostate cancer damage quality of life. Brachytherapy, or radioactive seed implants, theoretically may increase the target radiation dose and thus improve control of cancer. has been rapidly adopted in the U.S. despite limited long-term published outcomes, in part because of its convenience apparently attractive toxicity profile. However, our recent survey of brachytherapy patients after longer follow-up surprisingly frequent urinary incontinence and erectile dysfunction. Retrospective evidence suggests that reducing the radiation dose to the urethra may prevent later urinary incontinence. A recent refinement of conventional brachytherapy technique targets only the peripheral zone of the prostate, sharply reducing the dose to the urethra, and attempts to reduce radiation cold spots by using intraoperative feedback from real-time magnetic resonance imaging(MRI). Using our validated cancer-specific scales, our pilot data suggested that the altered brachytherapy technique had the intended benefit but also unexpected outcomes. We have extended our cohort study of 276 brachytherapy patients and now compare 3- and 24-month outcomes of this technique to standard ultrasounded-guided brachytherapy.

DTIC

*Cancer; Prostate Gland; Radiation Dosage; Signs and Symptoms; Toxicity*

**20070026612** Mount Sinai School of Medicine, New York, NY USA

**Effect of COX-2 (PGE2) and IL-6 on Prostate Cancer Bone Mets**

Levine, Alice C; Feb 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0166

Report No.(s): AD-A466562; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466562>

We hypothesize that (1) prostate cancer cells that express cyclooxygenase-2 (COX-2), prostaglandin E2(PGE2) and interleukin-6 (IL-6) display enhanced bone targeting and (2) the level of expression of COX-2, PGE2 and IL-6 in established bone metastases determines the overall bone response, with lower vs. higher cytokine levels inducing osteoblastic vs. osteolytic responses, respectively. We utilize two human prostate cancer cell lines (MDA-PCa-2B that expresses low levels of COX-2 and PGE2 and produces osteoblastic lesions vs. PC-3 that expresses high levels COX-2/PGE2 and induces osteolytic mets). Over the past year, we demonstrated that (1) low levels of PGE2 stimulate preosteoblast cell growth, differentiation and Wnt signaling (2) Forced overexpression of COX-2 in MDA-PCa-2b cells induces the Wnt antagonist DKK-1 (3) PGE2 addition to PC-3 cells stimulates Dkk-1 (4) Forced overexpression of COX-2 in MDA-PCa-2B cells inhibits preosteoblastic cell growth in co-culture. Over the next and final year of the grant proposal we will determine the effects of COX-2/PGE2 expression in the two PCa cell lines on in vivo bone targeting and bone reaction

DTIC

*Bones; Cancer; In Vivo Methods and Tests; Metastasis; Prostate Gland*

**20070026613** Health Research, Inc., Rensselaer, NY USA

**PCBs Alter Dopamine Mediated Function in Aging Workers**

Seegal, Richard F; Jan 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0173

Report No.(s): AD-A466563; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466563>

The major hypotheses to be tested in this project are that high-level occupational exposure of former capacitor workers to polychlorinated biphenyls (PCBs) will result in reductions in: (i) performance on neuropsychological and neurological tests that reflect the historic PCB body burden of the individual and (ii) the number of dopamine (DA) terminals in the basal ganglia. Aging former capacitor workers, previously employed at capacitor manufacturing facilities located approximately fifty miles north of Albany, NY, have undergone neuropsychological and neurological exams, completed a comprehensive occupational, residential and dietary questionnaire, had blood drawn to measure serum thyroid hormone and PCB concentrations, and undergone a non-invasive test to determine bone lead concentrations in Albany, NY. This latter measure will reduce the likelihood of confounding the neurological effects of prior PCB exposure with the neurological effects of prior lead exposure. Finally, approximately 40% of the subjects have participated in a second portion of the study that uses brain

-CIT SPECT imaging to determine whether prior occupational exposure to PCBs reduces the number of basal ganglia DA terminals. Imaging took place at the Institute for Neurodegenerative Disorders in New Haven, CT under the supervision of Dr. Kenneth Marek. In order to test the above hypotheses we have gathered a team of internationally recognized experts in the epidemiology of environmental and occupational exposure to PCBs, the neurology of movement disorders and Parkinson's Disease, the assessment of toxicant-induced deficits in neuropsychological function, measurement of serum PCB concentrations, non-invasive determination of bone lead concentrations, and brain imaging of central DA neurons and their relationship to movement disorders, including Parkinson's Disease.

DTIC

*Dopamine; Neurology; Personnel; Polychlorinated Biphenyls*

**20070026614** Wisconsin Univ., Madison, WI USA

**Identification of Sonic Hedgehog-Induced Stromal Factors That Stimulate Prostate Tumor Growth**

Shaw, Aubie; Bushman, Wade; Nov 2006; 69 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0060

Report No.(s): AD-A466565; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466565>

We will determine the mechanism by which Shh signaling accelerates prostate tumor growth, identify Shh targets in prostate tumor stroma, and test the effect of individual target genes on tumor growth. The purpose of the report is to evaluate the first year of research. Sonic hedgehog induces tumor growth by a paracrine mechanism using tumor stroma. Shh signaling independent of Shh ligand in tumor stroma accelerates tumor growth. We have identified potential stromal Shh target genes in xenograft tumors and have begun to evaluate the genes in human prostate cancer. Noggin was identified as a Shh-induced paracrine factors that may drive tumor growth by interfering with BMP signaling. Noggin was overexpressed in tumor stroma. Stromal-derived Noggin does not accelerate tumor growth in the presence or absence of Shh. Future research will continue to identify and evaluate Shh-induced paracrine factors that accelerate prostate tumor growth.

DTIC

*Cancer; Prostate Gland; Tumors*

**20070026617** Buck Inst. for Age Research, Novato, CA USA

**Cellular Senescence and Breast Cancer**

Campisi, Judith; Aug 1, 2005; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0546

Report No.(s): AD-A466569; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466569>

Aging is the single largest risk factor for developing breast cancer and is thought to be due the convergence of the accumulation of mutations together with the accumulation of senescent cells. Our working hypothesis is that senescent epithelial cells can cause preneoplastic or neoplastic changes in its neighbors, and that these changes will be manifest when cells are cultured in three dimensions, which more closely mimics the natural tissue environment than conventional two dimensional cultures. To test this hypothesis, we have successfully established two and three dimensional culture models of normal human mammary epithelial cells (HMECs) with and without a functional 16-tumor suppressor pathway. We have also created preneoplastic HMECs by introducing defined genes with oncogenic potential, particularly genes that selectively inactivate the p53 or pRB tumor suppressor pathways. We have used these, and frankly neoplastic human mammary epithelial cells, in the two and three dimensional co-culture assays in which presenescent HMECs are mixed with senescent HMECs and stromal breast fibroblasts.

DTIC

*Breast; Cancer; Mammary Glands*

**20070026619** Texas Univ., Dallas, TX USA

**Leg Muscle Usage Effects on Tibial Elasticity during Running**

Antich, Peter P; Jan 2007; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0219

Report No.(s): AD-A466571; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466571>

Tibial stress fractures (TSFs) are a substantial problem in military training, but a means of predicting their occurrence

remains elusive. Bone strength is key to the resistance of TSF, but bone density, a determinant of strength, is known not to predict TSF. Elasticity is nearly as important as density in determining bone strength but has not been tested in TSF, or even studied in runners. However, clinical studies of osteoporotic patients given bisphosphonates have shown significant correlations between low elasticity and fracture incidence. These basic validation studies will determine if modulators of tibial stress, such as strike mechanics and surface incline, also modulate bone elasticity during running. Because these modulators may operate on the tibia via muscles, we have combined ultrasound characterization of tibial elasticity with MRI monitoring of muscle recruitment during a running protocol in healthy volunteers.

DTIC

*Bones; Elastic Properties; Fractures (Materials); Fracturing; Muscles; Tibia*

**20070026623** Michigan Univ., Ann Arbor, MI USA

**Structure-Based Approach for Discovery of Small Molecule Inhibitors Targeted at AKT**

Weng, Shaomeng; Apr 1, 2006; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0259

Report No.(s): AD-A466577; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466577>

AKT/PKB represents potentially a promising molecular target for the design of new anticancer therapies for the treatment of human breast cancer and other types of cancer. In this DOD Idea Award grant, using computational approach, we have discovered a class of potent small-molecule inhibitor of AKT/PKB (API-59). API-59 selectively inhibits AKT activity and has little effect on other upstream protein kinases or MAP kinases. API-59 is highly potent and effective in inhibition of cell growth and induces apoptosis in human breast cancer cell lines with high levels of AKT and has selectivity over cancer cells with low levels of AKT. Importantly, API-59 has little toxicity to normal cells. Our present study provides a solid proof-of-the-concept that targeting AKT or AKT pathway in human breast cancer is a promising strategy for the design and development of a class of anticancer therapy, and API-59 represents a promising lead compound for further evaluation and optimization.

DTIC

*Breast; Cancer; Inhibitors; Mammary Glands; Molecular Dynamics*

**20070026625** Howard Univ., Washington, DC USA

**A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques**

Chouikha, Mohamed F; May 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0267

Report No.(s): AD-A466579; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466579>

In this partnership training program, experts from Georgetown and Howard Universities participated in training through seminars, specialized tutorials and workshops. Further, we developed a large digitized mammography database of African-American patients. The database was made accessible through the web to support breast cancer research. We have accomplished the objectives of this 4-year project and have reached our goal. As a result, a large number of Howard faculty investigators and students, both undergraduate and graduate, have been trained for breast cancer research. Under this program, one Ph.D. student and three Masters students have successfully completed their theses and obtained their degrees from Howard University; four graduate students have entered the Ph.D. degree program of the ECE Department; and half a dozen of undergraduate students have successfully completed their degree work. More than a dozen academic papers have been published in both international journals and at international conferences based on the research activities of this partnership program. We have also developed a large-scale mammography database featuring Africa-American patients and a mammography research website, among other major achievements listed in this final report.

DTIC

*Africa; Breast; Cancer; Data Bases; Digital Techniques; Education; Imaging Techniques; Libraries; Mammary Glands*

**20070026626** Wisconsin Univ., Milwaukee, WI USA

**Association between Microtubule Associated Protein -2 and the EGRF Signaling in Breast Cancer**

Adhami, Vaqar M; Sep 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0741

Report No.(s): AD-A466580; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466580>

Microtubule associated proteins (MAP)-2 a component of the MAP family is a marker for neurons and its

immuno-reactivity has been demonstrated in several neoplasms. We hypothesized that MAP-2 expression is deregulated in EGFR over-expressing breast cancers thus rendering them resistant to conventional therapy. Here we show that loss of MAP-2 expression in breast cancer cells during sustained activation of the EGFR results in resistance to chemotherapeutic drugs. We observed higher expression of MAP-2 in EGFR over-expressing cells than in non-EGFR over-expressing cells both at protein and mRNA levels. MCF-7 and MCF-10A cells were challenged with increasing doses of EGF (25-150 ng/ml) and examined for the expression of phosphorylated EGFR. We observed that expression of MAP-2 in cell lines challenged with EGF increased with increasing doses of EGF however its expression was almost completely lost at concentrations >100 ng/ml of EGF treatment. This observation suggested a possible mechanism of resistance in breast cancer patients with EGFR over-expression. We also found increasing resistance to growth inhibition by docetaxel in cells that were challenged with higher concentrations of EGFR (>50 ng/ml). This suggested that over expression of EGFR signaling in breast cancers could in fact be responsible for resistance to therapeutic agents. The loss of MAP-2 expression could have implications in treatment of breast cancers over-expressing the EGFR and exhibiting resistance to conventional therapy.

DTIC

*Breast; Cancer; Mammary Glands; Proteins*

**20070026629** Titan Corp., San Diego, CA USA

**Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults**

Stuhmiller, James H; Bykanova, Lucy; Chan, Philemon; Dang, Xinglai; Fournier, Adam; Long, Diane W; Lu, Zi; Masiello, Paul; Ng, Laurel; Niu, Eugene; Dec 2006; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-C-0051

Report No.(s): AD-A466592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466592>

This report summarizes the first year of a 5-year program to develop physiologically and biomechanically based mathematical models that will allow the estimation of physical and cognitive performance decrements from blunt trauma and inhalation insult. The main objectives of this research effort are as follows: (1) to develop advanced lung models that include multi-scale mechanical, anatomical, functional, and patho-physiological components to predict the acute trauma and performance decrement due to blunt impacts and blasts; (2) validate the models against animal test data; (3) integrate and release models into an application software that can be used for all blunt pulmonary hazards evaluation purposes; and (4) couple the blunt models with the toxic gas models to provide injury and performance decrement assessment from all pulmonary hazards. Progress is captured in this report as brief summaries of individual projects that have lead to a variety of knowledge, software, and hardware products. The work from Year 1 has produced 14 products in a wide range of applications. These products are the result of the on-going, collaborative research between the Military Operational Medicine Research Program (MOMRP) and other military (e.g., U.S. Army Center for Health Promotion and Preventive Medicine, U.S. Army Research Laboratory, U.S. Army Natick Soldier Center) and civilian research agencies (e.g., U.S. Environmental Protection Agency, Department of Justice, National Highway Traffic Safety Administration). The projects include Human FEM Validation Against Blast Data (No Armor), Sheep FEM Development, Blast Health Hazard Assessment for Joint Strike Fighter, Blast Protection Concepts Using Human FEM Coupled with Armor, Behind Armor Blunt Trauma Assessment Program, TGAS 2.0P, Generalized Skull Fracture Criterion, Biofidelity of Motorcycle Helmet Criteria, Effect of Blast Overpressure on the Human Head, THOR GUI, and Thorax FEM Validation Against Seat Belt Test.

DTIC

*Biodynamics; Cognition; Dynamic Models; Gases; Injuries; Mathematical Models; Mental Performance; Performance Prediction; Physiological Effects; Physiology; Poisons; Respiration*

**20070026640** Mayo Clinic, Rochester, MN USA

**A Phase II Immunotherapeutic Trial: Combination Androgen Ablative Therapy and CTLA-4 Blockade as a Treatment for Advanced Prostate Cancer**

Kwon, Eugene D; Dec 2006; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0245

Report No.(s): AD-A466628; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466628>

The objectives of this study are to generally test whether the addition of CTLA-4 blockade can enhance clinical treatment responses in advanced prostate cancer patients compared with treatment with AA therapy alone. Patients will be randomized to 3 months of concurrent AA therapy + MDX-01 0 or 3 months of initial AA therapy alone. Of 25 enrolled patients approximately 10 have received sufficient follow-up to assess whether any treatment effects may be occurring: 10 patients



have received AA therapy alone; 11 patients have received AA therapy + MDX-01 0. Those 11 patients who have received AA therapy alone. Specifically the 11 test subjects have experienced faster declines in PSA suggesting that MDX-01 causes hormone therapy to work more effectively than using hormone therapy alone. We have observed that some of the test subjects experienced a more prolonged response (diminished PSA) relative to those that received hormone therapy alone. Based on these preliminary observations our strong hunch is that patients who received AA therapy + MDX-01 0 treatment may be deriving a benefit from the experimental form of therapy beyond that which occurs using standard treatment (which is hormone therapy alone).

DTIC

*Ablation; Cancer; Prostate Gland; Therapy*

**20070026647** Kimmel (Sidney) Cancer Center, San Diego, CA USA

**Adjuvant Immunotherapy for Patients at High Risk of Recurrence Following Radiation Therapy for Prostate Cancer**

Deisseroth, Albert B; Aug 2005; 107 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0771

Report No.(s): AD-A466640; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466640>

Pre-clinical testing has shown that subcutaneous injection of an Ad-sig-TAA/ecdCD40L adenoviral vaccine strategy overcomes anergy to tumor associated antigens (TAA) in mice which are genetically engineered to be tolerant of these antigens. Two injections of the vector confer up to a year's immunity and induce regressions of TAA positive tumor even in old (18mo. Old) mice which are known to be poorly responsive to vaccination. This is important since diminished response to vaccine has been seen clinically in human subjects in the age range of peak prevalence of prostate cancer. We have chosen to use hMUC-1, an antigen which is a marker of poor prognosis in prostate cancer, for the clinical development of this vaccine. We have completed the development of a phase I clinical protocol of the ad-sig-hMUC-1/ecdCD40L adenoviral vector vaccine for individuals diagnosed with localized prostate cancer who have evidence of recurrence of their prostate cancer (rising PSA) following radiation therapy for clinically localized disease. We are in the midst of completing the pharmacology, toxicology, and biodistribution assays, GMP production of the Ad-sig-hMUC-1/ecdCD40L and the quality control testing of the GMP production, all of which are needed for FDA approval of the phase I trial is arranged.

DTIC

*Cancer; Patients; Prostate Gland; Radiation Therapy; Risk*

**20070026648** Loma Linda Veterans Association for Research and Education, Loma Linda, CA USA

**Molecular Mechanisms of Soft Tissue Regeneration and Bone Formation in Mice: Implications in Fracture Repair and Wound Healing in Humans**

Mohan, Subburaman; Apr 2007; 119 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9571

Report No.(s): AD-A466642; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466642>

The primary goal of the proposed work is to identify genes which play an anabolic role in bone and soft tissue function and to clarify the function of these genes. Three hypotheses have been proposed: 1) The high bone density gene in chromosome 1 in our CAST/B6 congenic mice can be cloned; 2) Genes that regulate soft- and hard-tissue regeneration can be identified by using appropriate mouse strains that exhibit differences in regeneration; and 3) ENU mutagenesis, applied to our mouse model, will lead to the identity of genes that regulate soft and hard tissue function. During the last funding period, we have proposed several specific objectives for each of the above-mentioned hypotheses. As disclosed in the progress report, we have successfully accomplished all of the specific objectives. Our work during the first year of the funding period has resulted in two manuscripts in press, two published manuscripts, and three abstracts. We believe that the successful accomplishment of the proposed studies will provide a better understanding of the molecular mechanisms involved in hard- and soft-tissue regeneration and will provide a framework for future development of therapies for hard and soft tissue injuries.

DTIC

*Bones; Fracturing; Genes; Wound Healing*

**20070026649** New York Univ., New York, NY USA

**Origin and Properties of Prostatic Stem Cells**

Wilson, E L; Gupta, Rashmi; Feb 2007; 32 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0255

Report No.(s): AD-A466643; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466643>

The aims of this proposal were to isolate and characterize prostatic epithelial stem cells and also to determine if bone marrow (BM) cells can differentiate into prostatic tissue. We show that the murine prostate contains a small population of cells (<1%) capable of effluxing the Hoechst dye by an active process (the side population, SP), indicating the presence of cells with features of stem cells. As SP cells expressed Sca-1, a protein expressed by stem cells of other origins, we isolated Sca-1 expressing cells and determined their proliferative ability in an in vivo prostate reconstitution assay. We show that prostate stem cells reside in the proximal region of ducts within the population that expresses high levels of Sca-1. We also show that BM stem cells can differentiate into prostatic epithelial and stromal cells. Low numbers of basal epithelial cells (-1%) are of BM origin but significant numbers of stromal cells (-15%) are derived from BM. These findings may have considerable implications for prostatic diseases such as cancer as gastric cancer has been shown to originate in BM-derived cells.

DTIC

*Antigens; Bone Marrow; Prostate Gland; Rodents; Stem Cells*

**20070026653** Boston VA Research Inst., Inc., MA USA

**Autologous Marrow-Derived Stem Cell-Seeded Gene-Supplemented Collagen Scaffolds for Spinal Cord Regeneration as a Treatment for Paralysis**

Spector, Myron; Jan 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0129

Report No.(s): AD-A466655; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466655>

The long-term objective of this research is to develop a device for treating spinal cord injury. The specific aims of the proposed study are to test new types of collagen tubes and porous collagen scaffolds. Moreover we will be investigating the effects of incorporating genes from nerve growth factors into the collagen scaffolds and seeding the scaffolds with marrow-derived mesenchymal stem cells. The standardized defect site is a 5-mm gap in the rat thoracic spinal cord. Our principal method of evaluation is histomorphometry. During the past project year the following were accomplished toward achieving the objectives determining the effects of selected design variables on the reparative processes in spinal cord defects: 1) produce oriented pore in the porous collagen scaffold 2) non-virally transfect undifferentiated marrow-derived mesenchymal stem cells (MSCs) in monolayer with plasmid DNA encoding a neurotrophic factor 3) supplement the collagen scaffold with plasmid DNA and 4) transfect MSCs grown in the gene-supplemented collagen scaffold with plasmid DNA for a neurotrophic factor.

DTIC

*Bone Marrow; Collagens; Paralysis; Spinal Cord; Stem Cells*

**20070026657** Lexicon Genetics, Inc., Woodlands, TX USA

**Discovery of Therapeutics for Ricin Toxicosis**

Sanda, Arthur T; Jan 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0048

Report No.(s): AD-A466665; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466665>

Ricin a type II ribosome inactivating protein (a heterodimeric glycoprotein containing two subunits joined together by a disulfide bond) is a biological toxin with a history of use as a weapon of war and bioterrorism. Biological toxins act in concert with various (mostly unknown) host proteins; specific host proteins are essential for toxin action. In an effort to identify possible targets for pharmaceutical intervention that may lead to an effective treatment for ricin toxicosis this study investigates the effects of inactivating specific host proteins and cellular response when exposed to ricin. Specifically 278 genes were selected for challenge based on the criteria developed by Lexicon Genetics to identify genes that might encode pharmaceutically tractable proteins. A full phenotypic analysis of all knockout mouse lines (278) was performed and fibroblast cell cultures were established for all 278 KO lines. A kill curve was established for the mouse fibroblast cells and the fibroblast cell cultures were challenged in triplicate (3 separate homozygous knockout mice for each KO line) with ricin at different points in the curve. Through a cooperative research and development agreement (CRDA) with investigators at USAMRIID

specific whole animal gene knockout models will also be made available for testing of modified responses to ricin toxin; this task awaits approval from the USAMRMC Animal Care and Use Review Office (ACURO). A 12-month extension of the performance period (to December 14 2006) was granted in December 2005 to allow time for breeding and shipping mouse lines to USAMRIID.

DTIC

*Chemotherapy; Drugs; Toxins and Antitoxins*

**20070026660** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**An Analysis of Robust Workforce Scheduling Models for a Nurse Rostering Problem**

Tower, Paul K; Mar 2007; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466671; AFIT/GLM/ENS/07-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466671>

Disruptions impacting workforce schedules can be costly. A 1999 study of the UK's National Health Service estimated that as much as 4% of the total resources spent on staffing were lost to schedule disruptions like absenteeism. Although disruptions can not be eliminated, workforce schedules can be improved to be more responsive to disruptions. One key area of study that has expanded over the past few years is the application of traditional scheduling techniques to re-rostering problems. These efforts have provided methods for responding to schedule disruptions, but typically require deviations to the disrupted schedule. This thesis examines five workforce scheduling models designed for a nurse rostering problem. Each model is designed to produce a robust workforce schedule that remains valid in the midst of disruptions and requires no schedule deviations. Each model is evaluated based on the number of disruptions it can receive before becoming invalid. Nonparametric statistical analysis is used to analyze the disruption data for each model and determine which workforce scheduling model produces the most robust schedule. The results of this research indicate that additional manpower must be applied to the correct skill sets in order to produce robust workforce schedules. Furthermore, workforce managers can consider leaving a portion of the workforce unscheduled (or in reserve) to accommodate schedule disruptions.

DTIC

*Medical Personnel; Nonparametric Statistics; Scheduling*

**20070026661** Connecticut Univ., Farmington, CT USA

**The Distribution, Levels, and Relevance of the Interleukin-1 Family of Cytokines and Receptors in Human Breast Carcinoma-Induced Osteolysis**

Pantschenko, Alexander G; Oct 2005; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0608

Report No.(s): AD-A466672; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466672>

Bone metastasis in human breast carcinoma (HBC) occurs in 83% of patients with advanced disease HBC bone metastasis causes degeneration of the bone matrix (osteolysis) hypercalcemia pathologic fracture and nerve-compression syndrome The pathophysiology of human breast carcinoma-induced osteolysis (HBC-IO) involves an increase in the number and activity of osteoclasts within the HBC metastatic lesion We examined the expression of the IL-1 family of cytokines and receptors and IL-8 in HBC-IO using archival human samples (mean age 52 yrs; age range 34-83 yrs; no prior radiation to site) and immunohistochemistry We observed IL-1 and IL-8 expression by HBC cells and IL-1 Receptor I expression on osteoclasts. These data suggest that HBC-derived IL-1 is an important mediator of human breast cancer-induced osteolysis and supports our hypothesis: 1) IL-1 can activate osteoclastogenesis promote osteoclast (OC) activation and osteolysis via paracrine induction of IL-1 Receptors on osteoclasts. 2) IL-1 can promote tumor progression by autocrine induction and subsequent activation of IL-8. 3) IL-8 expressed by HBC cells can support tumor growth and progression by stimulating angiogenesis through IL-8 Receptors expressed on vascular endothelial cells. This study suggests that IL-1 may be an important mediator of HBC pathophysiology and therefore a potential target for therapeutic intervention.

DTIC

*Breast; Cancer; Immune Systems; Interleukins; Mammary Glands; Metastasis*

**20070026662** Scripps Research Inst., La Jolla, CA USA

**Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer**

Reisfeld, Ralph A; Feb 2007; 17 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0310

Report No.(s): AD-A466673; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466673>

We demonstrated that a DNA-based vaccine encoding fibroblast activation protein (FAP), overexpressed on tumor-associated fibroblasts (TAFs), induces a CD8+ T cell response killing TAFs. This effectively suppressed or eradicated primary tumors or their pulmonary metastases in a murine breast carcinoma model. Moreover, eradication of TAFs decreased the interstitial fluid pressure of the tumor since it markedly diminished collagen type I produced by TAFs. This resulted in increased tumor uptake (70%) of doxorubicin which made the combination of the pFAP vaccine with chemotherapy highly effective as it completely eradicated primary breast tumor growth in a mouse tumor model.

DTIC

*Breast; Cancer; Chemotherapy; Fibroblasts; Mammary Glands; Metastasis; Tumors; Vaccines*

**20070026664** Cincinnati Univ., OH USA

**The Role of RB in the Therapeutic Response of Breast Cancer**

Bosco, Emily E; Mar 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0329

Report No.(s): AD-A466676; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466676>

The retinoblastoma tumor suppressor protein (RB) is functionally inactivated in the majority of human cancers, and lost in one third of all breast cancers. RB regulates G1/S phase cell cycle progression and is a critical mediator of anti-proliferative signaling. Here the specific impact of RB loss on E2F-regulated gene expression, tumorigenic proliferation, and the response to distinct lines of therapy was interrogated in breast cancer cells. RB loss resulted in RB/E2F target gene deregulation and accelerated tumorigenic proliferation, thereby demonstrating that even in the context of a complex tumor cell genome, RB status exerts significant control over proliferation. Furthermore, the loss of RB compromised the short-term cell cycle inhibition following DNA damage and anti-estrogen therapies. In the context of DNA damaging agents this bypass resulted in increased sensitivity to these agents in cell culture and xenograft models. In contrast, the bypass of anti-estrogen signaling resulted in continued proliferation and xenograft tumor growth in the presence of tamoxifen. These effects of RB loss were recapitulated by ectopic E2F expression, indicating that control of downstream target genes was an important determinant of the observed responses. Specific analyses of the RB/E2F gene expression signature in 60 human patients indicated that deregulation of this pathway was associated with early recurrence following tamoxifen monotherapy. Thus, because the RB-pathway is a critical determinant of tumorigenic proliferation and differential therapeutic response, it may represent a critical basis for directing therapy in the treatment of breast cancer.

DTIC

*Breast; Cancer; Deoxyribonucleic Acid; Mammary Glands; Proteins; Suppressors; Therapy*

**20070026665** California Univ., Los Angeles, CA USA

**Identification of a Protein for Prostate-Specific Infection**

Pang, Shen; Dec 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0084

Report No.(s): AD-A466677; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466677>

In this proposal, we will identify and clone a protein that can be used to generate infection-specific gene therapy vector. We expect that using this protein to modify various gene therapy vectors, we can specifically deliver cytotoxic genes into prostate cancer cells using systemic treatment, and eventually eradicate metastatic prostate cancer cells in patients. During the third year, we inserted the sequences that encode these two peptides to modify lentiviral vector envelope gene and used one of the modified membrane proteins to target prostate cells. The viral vector that have peptide YDSVLALSAALQATR (P2) modified gp41 envelope protein was used to infect LNCaP cells in 24-well plates. The control vector that does not have gp41-P2 envelope protein on viral surface was also used to infect LNCaP cells as the control. Our results demonstrated that with the gp41-P2 envelope protein on the surface of the viral vector, lentiviral vectors increase infectivity by 30% to 70%.

DTIC

*Cancer; Infectious Diseases; Prostate Gland; Proteins*

**20070026666** Wayne State Univ., Detroit, MI USA

**Cord Blood Stem Cell Procurement in Minority Donors**

Ratanatharathorn, Voravit; Mar 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0266

Report No.(s): AD-A466680; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466680>

This progress report summarizes the clinical activity of cord blood procurement and the preliminary analysis of the yield of cord blood cells for the purpose of clinical transplantation. The purpose of collection and procurement of cord blood is for public use and will be accessible to all stem cell transplantation centers worldwide. Cord blood is a readily available source of hematopoietic stem cells. It is more accessible than other sources such as live donors since the cryopreserved cord blood units (CBU) have already been extensively characterized in terms of tissue typing and screening for infectious disease markers. The CBU from minority donors especially African/American is particularly valuable because of the difficulty with finding a matched donor. The CBU allows for less stringent matching; thus CBU is a rapid solution to patients who are in urgent need of stem cell transplantation and have no living donor available. We will now summarize the findings of our efforts to expand the cord blood collection program in an outreach setting with a comprehensive educational program to recruit African/American donors. We are able to demonstrate a significant increase of the CBUs collected with time indicating improvement of access to the African/American donor. This activity may compensate for the poor individual yield of the total nucleated cells in the African/American donor CBU and therefore prove to be a more effective method to build the CBU inventory.

DTIC

*Blood Cells; Cordage; Minorities; Procurement; Stem Cells*

**20070026673** Michigan Univ., Ann Arbor, MI USA

**Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer**

Wang, Shaomeng; Dec 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0128

Report No.(s): AD-A466688; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466688>

Targeting the anti-apoptotic Bcl-2 members using non-peptide small-molecule inhibitors is a new and exciting therapeutic strategy. Our work has led to the discovery of potent non-peptide small-molecule inhibitor apogossypolone that not only binds to Bcl-2 and Bcl-xL proteins but also Mcl-1. Consistent with its strong binding affinity to Bcl-2 members apogossypolone potently and effectively inhibits cancer cell growth in androgen-independent human prostate cancer PC-3 and DU-145 cell lines. Apogossypolone is well-tolerated in animals and has an excellent oral bioavailability. Extensive in vivo studies are being carried out to determine its antitumor activity in animal models of human prostate cancer. Apogossypolone may have a great therapeutic potential to be developed as an effective and non-toxic new therapy for the treatment of advanced androgen-independent human prostate cancer.

DTIC

*Cancer; Hormones; Inhibitors; Prostate Gland; Refractories; Therapy*

**20070026677** California Univ., Livermore, CA USA

**PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans**

Bogen, Kenneth T; Jan 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0153

Report No.(s): AD-A466696; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466696>

Prostate cancer (PC) is the second leading cause of male U.S. cancer deaths, with African-Americans having the highest rate of PC mortality worldwide. A 5- year prospective NIH-funded clinic-based study investigated whether prostate-specific antigen (PSA) and digital rectal exam (DRE) screening indicators of PC risk in 500 African-American men 50 to 70 years of age who underwent PC screening in Oakland, CA (East Bay San Francisco area), were associated with estimated dietary exposures to 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP), which forms when meat is overcooked. The DOD-funded study expands that NIH-funded work by adding a new %-free-PSA test for 312 (108 from the NIH-funded study, plus 200 additional) men, results of which will be compared with PSA/ DRE results and PhIP exposures estimated by dietary

interviews. For 392 men studied under the NIH protocol, an odds ratio (95% CL) of 32 (3.2, 720) for highly elevated PSA ( $\geq 20$  ng/mL) was observed in the highest 15% vs. the lower 50% of estimated daily PhIP intakes. As of 31-12-06, a total of 220 additional men completed participation using the expanded protocol, for a combined total of 612 men. For 562 of these men studied to date, the corresponding OR was found to be 24 (2.20, 533). This study will help define the potential value of improved screening and dietary/behavioral intervention to reduce PC risk.

DTIC

*Africa; Amines; Cancer; Diets; Exposure; Heterocyclic Compounds; Prostate Gland; Risk*

**20070026678** Texas Univ., Houston, TX USA

**Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells**

McConkey, David J; Nov 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0059

Report No.(s): AD-A466697; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466697>

The proteasome inhibitor bortezomib (PS-341 Velcade) synergizes with tumor necrosis factor-related apoptosis-inducing ligand (TRAIL) acts via a p21-dependent mechanism to induce high levels of apoptosis in prostate cancer cells. Our further investigation into the molecular mechanisms underlying the effects of bortezomib implicated endoplasmic reticular (ER) stress in its anti-tumoral effects. These effects also provide us with a molecular mechanism to explain the observed anti-angiogenic effects of bortezomib in prostate cancer cells. We have generated luciferase-transduced variants of our human prostate cancer cell lines in order to use them to generate orthotopic tumors in nude mice that can be imaged non-invasively. We plan to use these models in the coming 6-12 months to test the toxicity and anti-tumoral efficacy of combination therapy with bortezomib plus TRAIL in vivo. Preliminary toxicity studies confirmed that mice tolerate daily therapy with recombinant TRAIL plus biweekly therapy with bortezomib (at its MTD) very well.

DTIC

*Apoptosis; Cancer; Inhibitors; Ligands; Prostate Gland; Sensitivity; Tumors*

**20070026679** Stanford Univ., Stanford, CA USA

**Selective Androgen Receptor Downregulators (SARDs): A New Prostate Cancer Therapy**

Bhattacharyya, Rumi S; Oct 2006; 27 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0582

Report No.(s): AD-A466698; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466698>

The androgen receptor (AR) plays a key role in the development and progression of prostate cancer. Targeting the AR for down-regulation would be a useful strategy for treating prostate cancer especially hormone-refractory or androgen independent prostate cancer (AIPO). In the present study we showed that the antiestrogen Fulvestrant (ICI 182,780, ICI) effectively suppressed AR expression in several human prostate cancer cells including androgen-independent cells. In LNCaP cells 101(10 microM) treatment decreased AR mRNA expression by 43% after 24 hours and AR protein expression by approximately 50% after 48 hours. We further examined the mechanism of AR down-regulation by ICI in LNCaP cells. ICI did not bind to the T877A mutant AR present in the LNCaP cells nor did it promote proteasomal degradation of the AR. ICI did not affect AR mRNA or protein half-life. However ICI decreased the activity of an AR promoter-luciferase reporter plasmid transfected into LNCaP cells suggesting a direct repression of AR gene transcription. As a result of AR down-regulation by ICI androgen induction of PSA mRNA and protein expression were substantially attenuated. Importantly LNCaP cell proliferation was significantly inhibited by ICI treatment. Following 6 days of 101 treatment a 70% growth inhibition was seen in androgen stimulated LNCaP cells. These data demonstrate that the antiestrogen ICI is a potent AR down-regulator that causes significant inhibition of prostate cancer cell growth. Our study suggests that AR down-regulation by ICI would be an effective strategy for the treatment of all prostate cancer especially AR-dependent AIPC.

DTIC

*Cancer; Hormones; Males; Prostate Gland; Proteins; Therapy*

**20070026680** Brookhaven National Lab., Upton, NY USA

**Structural Studies on Intact Clostridium Botulinum Neurotoxins Complexed with Inhibitors Leading to Drug Design**

Swaminathan, Subramanyam; Feb 2006; 54 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-2-0011

Report No.(s): AD-A466700; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466700>

In this fourth annual report we present our progress on several fronts. We have identified a number of inactive mutants of BoNT/E-LC which may be potentially used as vaccine candidates. Crystal structures of several catalytic domains of clostridial neurotoxins have been determined and it has been shown that there is a commonality of the architecture of the active site. Accordingly it must be possible to design a common drug for all of them. We have determined the structure of the C fragment of botulinum neurotoxin type B and found that the N-terminal helix reorients. Virtual screening with small molecule library has been successfully carried out with BoNT/E-LC. The C fragment of BoNT/A has been successfully cloned and expressed.

DTIC

*Bacteria; Clostridium Botulinum; Drugs; Ganglia; Inhibitors; Toxins and Antitoxins*

**20070026685** Chicago Univ., Chicago, IL USA

**Structural Determination of Certain Novel ER Complexes**

Wu, Ya-Ling; Greene, Geoffrey L; Sep 1, 2006; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0674

Report No.(s): AD-A466712; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466712>

Tamoxifen is effective for the prevention and treatment of estrogen-dependent breast cancers, but is associated with an increased incidence of endometrial tumors. We completed the first aim of this proposal to solve the crystal structure of the estrogen receptor alpha ligand-binding domain (ERalphaLBD) bound to the structurally similar compound GW5638, which has therapeutic potential and does not stimulate the uterus.

DTIC

*Breast; Cancer; Mammary Glands*

**20070026690** Rand Arroyo Center, Santa Monica, CA USA

**Medical Risk in the Future Force Unit of Employment. Results of the Army Medical Department Transformation Workshop V**

Johnson, David E; Cecchine, Gary; Jan 2006; 101 pp.; In English

Contract(s)/Grant(s): DASW01-01-C-0003

Report No.(s): AD-A466724; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466724>

This report documents the Army Medical Department's continuing process of identifying medical issues in the Army's transformation to the Future Force. It contains an assessment of the AMEDD Transformation Workshop (ATW) V; describes the workshop's organization, objectives, scenario, and analysis methodology; and provides observations and conclusions. The purpose of this workshop was to continue the assessment, begun in ATWs I-IV, of the medical risks associated with emerging Army operational concepts and the capacity of the AMEDD to mitigate these risks. ATWs I-III focused on medical risk in a Unit of Action (UA) within a theater that had a defined echelons-above-UA Health Service Support (HSS) system (a 44-bed Combat Support Hospital [CSH]). Based in part on these initial workshops, the AMEDD determined that a 44-bed CSH would likely be insufficient, and it set out to determine what HSS system would be required at echelons above UA. ATW IV assessed the medical risk and demand on an echelons-above-UA HSS system that 76 casualties from a single UA would create during a simulated 12-hour battle. The principal focus of ATW V was to continue the process of establishing the casualty demand data that must be addressed by the echelons-above-UA HSS system. It involved four UAs (and supporting units of employment [UE]) with 429 casualties over a 100-hour simulated battle. Thus, the principal purpose of ATW V was to provide analytical support to the AMEDD to assist it in designing the HSS system above the UA level.

DTIC

*Employment; Medical Services; Military Operations; Organizations; Risk*

**20070026716** Institute for Systems Biology, Seattle, WA USA

**Decipher the Transcriptional Program in Prostate Cancer Cells**

Yan, Xiaowei; Oct 2005; 17 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0058

Report No.(s): AD-A466803; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466803>

A systematic computational approach is proposed to characterize the transcriptional factor binding sites and related molecular pathways involved in prostate cancer, based on the available expression data generated from systems approaches on prostate cancer cells as well as comparative genomics data from the human and mouse genome sequencing projects. Androgen Response pathways in LNCaP and CL-1 cells are analyzed and re-constructed from MPSS and ICAT experiment datasets, the TRANSFAC data base, the Mogul scanner, and the KEGG (Kyoto Encyclopedia of Genes and Genomes) pathway data base.

DTIC

*Cancer; Prostate Gland*

**20070026753** Weston (Roy F.), Inc., West Chester, PA USA

**Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development**

Williams, Richard T; Ziegenfuss, P S; Marks, Peter J; Jan 1989; 92 pp.; In English

Contract(s)/Grant(s): DAAK11-85-D-007

Report No.(s): AD-A467061; CETHA-TE-CR-89006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467061>

The role of biodegradation in the environmental fate of DIMP, dieldrin, isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal soils was evaluated. Surface soil borings were collected from contaminated and uncontaminated regions at RMA. The extent of heterotrophic microbial activity in the soil samples was determined by monitoring <sup>14</sup>C-CO<sub>2</sub> production from soils spiked with a mixture of <sup>14</sup>C-glucose, <sup>14</sup>C-acetate, and <sup>14</sup>C-amino acids. Soil extracts were plated on nutrient agar to enumerate total heterotrophs. Two of six soil samples exhibited little or no heterotrophic activity. The lack of metabolic activity in these two samples was attributed to microbially inhibitive soil contaminants. Inactive soils were not utilized in subsequent mineralization studies. The mineralization of radiolabeled DIMP, dieldrin, isodrin, DBCP, and PCPMSO in contaminated and uncontaminated RMA soils was determined. Soil samples were spiked with test compound and incubated at 22 deg C. Headspace in the test flasks was periodically sampled and analyzed for <sup>14</sup>C-organics and <sup>14</sup>C-CO<sub>2</sub>. Mineralization studies were conducted for a period of 26 weeks. All five test compounds were poorly degraded under aerobic conditions. Low, but statistically significant (compared to sterile controls) levels of <sup>14</sup>C-CO<sub>2</sub> were produced from <sup>14</sup>C-isodrin and <sup>14</sup>C-dieldrin. Previous research by other investigators indicated that the five test compounds are resistant to aerobic degradation. Data from the present study support these findings. The mineralization of <sup>14</sup>C-isodrin was also evaluated in a laboratory-scale composting system maintained at 55 deg C. Less than 0.1 percent of <sup>14</sup>C-isodrin was evolved as <sup>14</sup>C-CO<sub>2</sub> during a 39 day test period.

DTIC

*Biodegradation; Dieldrin; Installing; Mountains; Restoration; Rocky Mountains (North America); Soils*

**20070026759** National Marrow Donor Program, Minneapolis, MN USA

**Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents**

Coppo, Patricia A; Davis, Judy W; Spellman, Steve M; Mar 31, 2007; 44 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0310; N00014-05-1-0859

Report No.(s): AD-A467161; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467161>

N00014-05-1-0310: Task 1: Evaluate optimal short term storage parameters for stimulated and unstimulated leukapheresis (donor lymphocytes) and bone marrow products, including the type of storage media and the cell concentration, in addition to temperature and duration of storage before processing or infusion. Task 2: The NMDP has developed an algorithm that 'predicts' high resolution HLA typing results on donor samples that exist in the Registry with only low or intermediate results reported. N00014-05-1-0859 and N00014-06-1-0704: Task 1: Contingency preparedness. Task 2: Rapid identification of matched donors. Task 3: Immunogenetic studies. Task 4: Clinical research in transplantation.

DTIC

*Biotechnology; Bone Marrow; Contingency; Medical Equipment; Medical Science; Toxicity; Transplantation*



**20070026772** Sky Ltd., Napa, CA USA

**Screening Doses for Induction of Cancers Calculated With the Interactive Radio Epidemiological Program (IREP)**

Kocher, David C; Apostoaei, A I; Apr 2007; 86 pp.; In English

Contract(s)/Grant(s): DTRA01-03-C-0064; Proj-CS

Report No.(s): AD-A467351; DTRA-TR-07-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467351>

This report presents tabulations of equivalent doses of ionizing radiation, referred to as screening doses, that correspond to an estimated probability of causation (PC) of specific cancers of approximately 50% at the upper 99% credibility limit. Screening doses for 32 cancer types were calculated with the Interactive RadioEpidemiological Program (IREP), which is used by the Department of Veterans Affairs (VA) in adjudicating claims for compensation for cancer by veterans of military services.

DTIC

*Cancer; Dosage; Epidemiology; Nuclear Explosions; Radiology*

**20070026776** Science Applications International Corp., Abingdon, MD USA

**Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete**

Brevett, Carol A; Nickol, Robert G; Sumpter, Kenneth B; Wagner, George W; Apr 2007; 31 pp.; In English

Contract(s)/Grant(s): DAAD13-03-D-0017; Proj-206023.84BPO

Report No.(s): AD-A467404; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467404>

The degradation of the Chemical Warfare Agent sulfur mustard, bis(2-chloroethyl) sulfide, and the half-mustard simulant, 2-chloroethyl phenyl sulfide was studied on ambient and moist concrete using <sup>13</sup>C solid-state magic-angle-spinning nuclear magnetic resonance (SSMAS NMR). Two samples of concrete made by the same formulation, but differing in age and surface alkalinity, were used. The 2-chloroethyl phenyl sulfide hydrolyzed to form the 2-hydroxyethyl phenyl sulfide, which then formed the ether on all of the concrete samples. The sulfur mustard formed minor amounts of vinyl species on the newer, more alkaline concrete samples. The sulfur mustard eventually degraded to thiodiglycol and 1,4-oxathiane via the intermediate sulfonium ions H-2TG and O(CH<sub>2</sub>CH<sub>2</sub>)<sub>2</sub>S(+)<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH on all of the concrete samples.

DTIC

*Concretes; Degradation; Nuclear Magnetic Resonance; Phenyls; Solid State; Sulfides*

**20070026788** Madigan Army Medical Center, Takoma, WA USA

**Automating Behavioral Health Screening - Addressing Risk Communication Electronically**

Crow, Bruce E; Gahm, Gregory; Sep 2004; 23 pp.; In English

Contract(s)/Grant(s): MIPR-4ETBWM4063

Report No.(s): AD-A467449; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467449>

The Army has identified the need for early and robust screening of Soldiers for a variety of health risk behaviors. Behavioral health factors are a key component of this. This report presents mental health screening data for 2,882 Soldiers seeking services at a military facility outpatient behavioral health clinic and 3,451 Soldiers screened 90 days following return from OIF deployment. The screening was completed via scanning software and has more recently been updated to a completed automated kiosk system. PTSD and depression were the most commonly identified disorders, followed by alcohol abuse. Screening positive for multiple symptom domains was common, with over 60% of the clinical sample screening positive for more than one clinical symptom domain. Clinical implications include the development of treatment approaches that address multiple diagnoses. Future research efforts in outpatient screening will assist in the design of clinical interventions. Comprehensive screening that leverages technology in a military setting is useful in case identification and in guiding clinician assessment and treatment efforts. Such a standardized approach enhances efficiency and ensures that all critical domains are addressed. Technology could potentially be leveraged even further in the form of online screening, psychoeducational tools, CBT modules, and virtual reality tools for assessment and treatment of combat-related symptoms.

DTIC

*Clinical Medicine; Health; Mental Health; Military Technology; Risk; Telecommunication*

**20070026792** Walter Reed Army Medical Center, Washington, DC USA

**Voice Recognition Interface in the Rehabilitation of Combat Amputees**

Lenhart, Martha; Yancosek, Kathleen E; Sep 2004; 9 pp.; In English

Contract(s)/Grant(s): MIPR-4EWCDM4057

Report No.(s): AD-A467456; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467456>

The goal of this pilot study is to assess the impact of training on voice recognition software as part of the rehabilitation process that Military patients with amputation, or peripheral nerve loss to at least on upper extremity, undergo at Walter Reed Army Medical Center, WRAMC. the integration of voice recognition software into a comprehensive rehabilitation program may create new employment opportunities for the upper extremity injured or amputee patients recovering at, WRAMC. The technology of voice recognition software offers a viable alternative for standard computer keyboard operation that the loss of function with one or both hands disrupts.

DTIC

*Combat; Computer Programs; Injuries; Medical Services; Military Personnel; Speech Recognition*

**20070026825** Texas Univ., Smithville, TX USA

**Apoptosis-Dependent and Apoptosis-Independent Functions of Bim in Prostate Cancer Cells**

Tang, Dean; Liu, Junwei; Mar 2005; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0146

Report No.(s): AD-A467615; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467615>

Attenuated apoptotic response and extended cell survival have been implicated in prostate cancer (PCa) development and progression. We recently found that Bim, a BH3-only pro-apoptotic protein, is upregulated in PCa cells in vitro and in vivo. The main objective of this postdoctoral fellowship is to elucidate why PCa cells upregulate Bim and what is the role of the upregulated Bim proteins in modulating PCa cell behavior (death, survival, proliferation/division, etc.). Our hypothesis is that, under normal, unstimulated conditions, with its apoptotic function blocked, the upregulated Bim in PCa cells plays an apoptosis-independent function(s). Under apoptosis-stimulated conditions, however, Bim can still participate in triggering a robust apoptotic response, thus guaranteeing that weaker or more susceptible PCa cells be eliminated from the population. Two Specific Aims were proposed to determine: 1) apoptosis-independent functions of the upregulated Bim in PCa cells under unstimulated conditions, and 2) apoptosis-dependent functions of the upregulated Bim in PCa cells under stimulated conditions. The PI of the grant, Dr. Junwei Liu, had to leave the lab Oct. of 2004. Before he left, he had completed all experiments in Specific Aim 2 with one manuscript published (Append. I). After he left, with the small amounts of funds left over from the Fellowship, we have just accomplished all of the experiments proposed in Specific Aim 1 and are in the process of preparing a manuscript, which will be supplied to DOD when it is ready.

DTIC

*Apoptosis; Cancer; Prostate Gland*

**20070026836** Loyola Coll., Baltimore, MD USA

**Tissue Engineering Research**

McIntire, Larry V; Greisler, Howard P; Griffith, Linda; Johnson, Peter C; Mooney, David J; Mrksich, Milan; Parenteau, Nancy L; Smith, David; Jan 2002; 232 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): ENG-9707092; ENG-0104476

Report No.(s): AD-A467673; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467673>

This report is a comparative review of tissue engineering research and development activities in the USA, Japan, and Western Europe conducted by a panel of leading U.S. experts in the field. It covers biomaterials, cells, biomolecules, non-medical applications, engineering design, informatics, and legal and regulatory issues associated with tissue engineering research and applications. The panel's conclusions are based on a literature review, a U.S. review workshop held at NIH in June of 2000, and a series of site visits to leading tissue engineering research centers in Japan and Western Europe. A summary of the June 2000 workshop is included as an appendix, as are site reports from each of the panel's overseas visits. An executive summary is included conveying the panel's overall conclusions.

DTIC

*Tissue Engineering*

**20070026838** Lawson (Harding) Associates, Denver, CO USA

**Final Site Safety and Health Plan for Phase II RCRA Facility Investigation Fort Benjamin Harrison Marion County, Indiana**

May 1996; 349 pp.; In English

Contract(s)/Grant(s): DAAA15-91-D-0013; Proj-28343-01.14.00

Report No.(s): AD-A467688; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467688>

The U.S. Environmental Protection Agency (EPA) requires that all environmental monitoring and measurement efforts mandated or supported by EPA participate in a centrally managed Quality Assurance (QA) program. Any party generating data under the centrally managed QA program described in this plan has the responsibility to implement minimum procedures to ensure that the precision, accuracy, representativeness, completeness, and comparability of its data are known and documented. To ensure that responsibility is met uniformly, each party must prepare a written QA Project Plan (QAPjP) covering each project the party is to perform. This QAPjP presents the organization, objectives, functional activities, and specific QA activities and quality control (QC) performance criteria associated with the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for Fort Benjamin Harrison (FBH), Marion County, Indiana. This QAPjP also describes the specific protocols that will be followed for sampling, sample handling and storage, chain of custody, and field and laboratory analysis. QA/QC procedures presented in this QAPjP are in accordance with applicable professional technical standards, EPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPjP is prepared by HLA to fulfill the requirements of the USAEC under the Total Environmental Program Support (TEPS) Contract DAA15-91-D-0013 in accordance with EPA QAPjP guidance documents, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005/80) (EPA, 1986), and the Region V Model QAPjP (EPA, 1991c).

DTIC

*Health; Indiana; Quality Control; Safety*

**20070026844** Nebraska Univ., Lincoln, NE USA

**Process Research and Development of Antibodies as Countermeasures for C. Botulinum**

Meagher, Michael; Mar 2005; 69 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0659

Report No.(s): AD-A467874; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467874>

This report describes the project to fill out shell space on the third floor of Othmer Hall, the new home for the University of Nebraska-Lincoln Biological Process Development Facility. Construction is 95% completed and all research laboratories of the BPDF are functional. The 5% includes a Master Cell Banking. The third floor is home to all process research capabilities, i.e. molecular biology, fermentation, cell culture, analytical methods, quality control, purification development, media prep, and two academic laboratories in the department of chemical engineering performing bioengineering research. The contract for detailed design of the cGMP basement was awarded June 2004 and is expected to be completed by Fall 2005. This report also describes research on the expression of an antibody against serotype A botulinum neurotoxin in Chinese Hamster Ovary (CHO). Research on new expression plasmids, development of a serum-free media, and optimization of a fed-batch process to produce the antibody against.

DTIC

*Antibodies; Bacteria; Clostridium Botulinum; Countermeasures; Toxins and Antitoxins*

**20070026849** Georgetown Univ., Washington, DC USA

**Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification**

Ressom, H W; Varghese, R S; Orvisky, E; Drake, S K; Hortin, G L; Abdel-Hamid, M; Loffredo, C A; Goldman, R; Jan 2005; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0057; CRTG-02-245-01-CCE

Report No.(s): AD-A468164; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468164>

Mass spectrometric profiles of peptides and proteins obtained by current technologies are characterized by complex spectra, high dimensionality, and substantial noise. These characteristics generate challenges in discovery of proteins and protein-profiles that distinguish disease states, e.g. cancer patients from healthy individuals. A challenging aspect of biomarker discovery in serum is the interference of abundant proteins with identification of disease-related proteins and peptides. We present data processing methods and computational intelligence that combines support vector machines (SVM) with particle

swarm optimization (PSO) for biomarker selection from MALDI-TOF spectra of enriched serum. SVM classifiers were built for various combinations of m/z windows guided by the PSO algorithm. The method identified mass points that achieved high classification accuracy in distinguishing cancer patients from non-cancer controls. Based on their frequency of occurrence in multiple runs, six m/z windows were selected as candidate biomarkers. These biomarkers yielded 100% sensitivity and 91% specificity in distinguishing liver cancer patients from healthy individuals in an independent dataset.

DTIC

*Biomarkers; Blood; Cancer; Classifications; Diseases; Intelligence; Liver; Mass Spectroscopy; Serums; Vector Analysis*

**20070026851** Texas Univ., Houston, TX USA

**Studies of Prostate Tumor Development Via CRE/LOXP Technology**

Conti, Claudio J; May 2005; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0068

Report No.(s): AD-A468174; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468174>

Although considerable progress in the understanding of prostate cancer has been made in the last few years, the basic knowledge of the biology of this disease remains elusive. The development of this cancer is related to the male sexual hormone (testosterone) but the actual mechanisms by which testosterone affects the development of this cancer is not known. The prostate gland has at least three different types of cells that contribute to the physiology of the gland: basal, luminal and neuroendocrine cells. It is not totally clear what the relationship is between these different cell types, how testosterone affects them and which one is the target cell in prostate cancer development. We will use new transgenic technology that allows tagging of a particular cell population and following its behavior over the life of the animal. These experiments will be performed in mice because this technology is well developed in these animals and there is a basic knowledge of the rodent prostate. The studies proposed here will clarify some of the basic aspects of the biology of the prostate gland and the process of carcinogenesis in this organ.

DTIC

*Cancer; Endocrine Glands; Hormones; Prostate Gland; Sex; Tumors*

**20070026872** Maryland Univ., Baltimore, MD USA

**Advanced Technologies in Safe and Efficient Operating Rooms**

Park, Adrian E; Feb 2006; 273 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468244; DAMD17-03-2-0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468244>

Work on this award continues to focus on three primary areas: Operating Room Informatics, Simulation, and Smart Image. In the area of Informatics, a meta-analysis of commercially available positioning technologies has been completed. A sampling of these technologies was installed in a lab environment and extensive testing was completed. The Simulation effort continues to build The Virtual Human, having developed a working model of normal esophageal function. The Smart Image research has demonstrated the ability to fuse multi-source images, creating a real-time 3-dimensional view for the laparoscopic surgeon. Work continues on refining these images.

DTIC

*Computer Aided Tomography; Computerized Simulation; Image Processing; Pattern Registration; Rooms; Surgery; Virtual Reality*

**20070027242** Department of the Navy, Washington, DC USA

**A Device for the In-Situ Measurement of Acoustically Stimulated Bioluminescence**

Savoie, Matthew J, Inventor; Aug 22, 2005; 11 pp.; In English

Report No.(s): AD-D020285; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020285>

A device and method of use for measurement of in-situ bioluminescence generally comprising an acoustical pulse generator, a detector chamber, a lens assembly and a photomultiplier tube. The generator comprises transducers which can generate acoustical energy in the object field of the device. The acoustical energy provides a stimulus of aquatic organisms within the object field (typically an aqueous volume) to produce the bioluminescence. The generator is positioned outside of the detector chamber and the photomultiplier tube and lens assembly are mounted within the chamber. The lens assembly restricts light to the photomultiplier tube of that bioluminescence light originating only from the volume. The photomultiplier

tube detects the bioluminescence generated by any aquatic organisms in a captured volume or if a changing measurement occurs by water flow in the volume. The output of the photomultiplier tube is provided to a controller to be analyzed.

DTIC

*Acoustic Emission; Bioluminescence; Detection; In Situ Measurement*

**20070027244** Washington Univ., Saint Louis, MO USA

**Modeling Phenotypes of Tuberous Sclerosis in the Mouse**

Shipley, James M; Feb 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0205

Report No.(s): AD-A466831; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall goal of this project is to generate a mouse model of the smooth muscle-related facets of tuberous sclerosis, specifically in an attempt to model the lung phenotype seen in a subset of TS patients and patients with LAM. We have conditionally targeted the TSC1 gene in smooth muscle, which results in mortality at approximately 10 weeks of age. This mouse now provides a useful model in which to investigate the function of individual MMPs or other proteins in this pathological progression, and to evaluate relevant therapeutic interventions such as rapamycin.

DTIC

*Diseases; Genetics; Mice; Muscles*

**20070027255** Office of the Under Secretary of Defense (Acquisitions and Technology), Washington, DC USA

**Transformational Medical Technologies Initiative (TMTI)**

Jan 2007; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466878; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report responds to the tasks identified by the SAC-D Report No. 109-292. First, it highlights the reporting requirement. Second, it provides background information on the TMTI program. Third, it includes our reporting requirement response to the three specified Senate Appropriations Committee-Defense questions. Finally, it provides a summary.

DTIC

*Biochemistry; Biotechnology; Security*

**20070027257** Maryland Univ., Queenstown, MD USA

**Evaluation of Daphnia Magna Neonate Viability under Low Temperature Exposure Conditions**

Burton, Dennis T; Turley, Steven D; Jan 25, 2007; 46 pp.; In English

Report No.(s): AD-A466881; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army Center for Environmental Health Research (USACEHR) expressed interest in the possibility of maintaining Daphnia magna neonates under prolonged cold conditions (4-6 degrees C). As a result, Science Applications International Corporation (SAIC) issued a Statement of Work (SOW) on July 19, 2006, which described the tasks that USACEHR wanted covered to address the maintenance of Daphnia magna under cold conditions (SAIC, 2006). The University of Maryland (UMD) submitted a proposal to SAIC on July 21, 2006, to conduct the tasks described in SAIC's SOW. This report describes the result of the tasks.

DTIC

*Anesthetics; Arthropods; Exposure; Low Temperature; Toxicity; Viability; Water Quality*

**20070027285** North Carolina State Univ., Raleigh, NC USA

**Integration of Soluble and Adhesive Gradient Signals in Directed Cell Migration**

Haugh, Jason M; Nov 2006; 5 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0594

Report No.(s): AD-A467054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our research has led to a comprehensive model of fibroblasts' responsiveness to PDGF gradient stimulation at the level of PI 3-kinase signaling, and we have analyzed the implications of this mechanism for dermal wound invasion. In this research, we have utilized and in some cases developed advanced tools for live-cell microscopy and quantitative analysis including mathematical modeling. Thus, our research has contributed to the fundamental understanding of directed fibroblast migration, a critical process in wound healing.

DTIC

*Adhesives; Gradients; Migration; Platelets*

**20070027314** Naval Postgraduate School, Monterey, CA USA

**Effects of the Global War on Terror on Medical Service Corps Retention Rates**

Dietrich, Erich J; Mar 2007; 77 pp.; In English

Report No.(s): AD-A467118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis analyzes the retention behavior of first term Medical Service Corps officers and examines the effect of the Global War on Terror (GWOT) on all communities within the Navy Medical Service Corps including Healthcare Administration (HCA), Healthcare Science (HCS) and Clinical Care Provider (CCS). Data were collected from the Defense Manpower Data Center for MSC officers in entering cohort years 1998, 1999 and 2001. Four logistic regression models were estimated to capture the effects of different types of deployments on the retention of first term MSC officers. The models included both demographic and military experience explanatory variables. A difference-indifference estimator was incorporated into each model to measure the effects of the deployment variables across the pre and post- GWOT periods. The post-GWOT period is defined as following the initiation of major combat operations in Iraq (March 2003). Factors having positive effects on retention included age, having greater than two dependents, entering through the In-Service Procurement Program, and deployments including at least one hostile deployment during the first term. Negative influences on retention included serving in HCS or CCS when compared to HCA, entering through the Health Services Collegiate Program and commissioning in the 2001 cohort year. While serving a first term in the post-GWOT period has a negative effect on retention, the post-GWOT deployment indicators were inconclusive in this study.

DTIC

*Manpower; Medical Personnel; Medical Services; Military Operations; Warfare*

**20070027324** Naval Postgraduate School, Monterey, CA USA

**Integrating Local Public Health Agencies into the Homeland Security Community**

Reed, Patricia D; Mar 2007; 60 pp.; In English

Report No.(s): AD-A467136; No Copyright; Avail.: Defense Technical Information Center (DTIC)

After more than seven years of funding through The Centers for Disease Control and Prevention, local public health agencies have made inconsistent progress in fulfilling their Homeland Security objectives. Most progress has been made in those areas in which Public Health has previous experience. However, in those activities requiring integration with other responder agencies Public Health has lagged in developing effective capabilities in prevention, preparedness, response, mitigation and recovery. This thesis argues that several factors contribute to this lack of success, including funding structures and guidelines, the reluctance on the part of other responder agencies to include Public Health in emergency planning and response activities, and the organizational isolation in which Public Health has existed. In order for local public health agencies to meet their Homeland Security objectives, funding structures and guidelines must support local Public Health and public health agencies must be better integrated with their Homeland Security partners. Public health agencies at all levels and their leadership have the opportunity to effect organizational changes designed to accelerate the transformational process, enhancing their Homeland Security partnerships. Public Health agencies can be more effectively integrate into the larger Homeland Security community by demonstrating commitment to making these changes.

DTIC

*Emergencies; Management Methods; Public Health; Security*

**20070027351** Naval Postgraduate School, Monterey, CA USA

**Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers**

Gilliard, Jr, Richard; Mar 2007; 69 pp.; In English

Report No.(s): AD-A467230; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis took steps towards determining the right number of dentists the Navy should recruit to meet projected targets. Dental Corps data were provided from the Dental Corps Manpower office covering fiscal years 1984 through 2005. The accession sources for Dental Corps officers were a concern at the onset of this study. One goal of the research was to determine whether or not certain behaviors were associated with particular accession programs. The results showed that no particular accession source dominated any of the five specialties that were selected. To develop the loss rates, data from two Excel files, DC Total Inventory and DC Losses were merged. After merging the files, only one record per dentist remained from fiscal years 1988 through 2005. This evolution produced 3,643 records that portray each dentist's career. The loss rate results suggest that once Dental Corps officers reach their tenth year they are less likely to leave the military than in earlier years. This would

suggest that retention incentives should be focused during the fourth through sixth years of the Dental officer's career. Oral Surgeons, however, are more likely than the other specialties to leave the military after their tenth year.

DTIC

*Dentistry; Manpower; Medical Services; Military Operations; Military Personnel; Navy; Targets*

**20070027385** Naval Postgraduate School, Monterey, CA USA

**Medical Reserve Corps Volunteers' Ability and Willingness to Report to Work for the Department of Health During Catastrophic Disasters**

Schechter, Shelly; Mar 1, 2007; 97 pp.; In English

Report No.(s): AD-A467359; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Local public health systems must have the capacity to meet the surge requirements of a health emergency that requires an extraordinary increase in activity including the rapid prophylaxis of an effected community. According to recent studies of paid healthcare professionals, approximately forty percent may be unable or unwilling to report to work during catastrophic disasters, but these questions have not yet been asked in the volunteer community. The Medical Reserve Corps (MRC) is a group of medical volunteers with a primary mission of support to the public health system during periods of surge. This thesis surveyed the members of a county health department MRC to determine their ability and willingness to volunteer in a public health emergency. The survey also elicited information on barriers and enablers to response and perceptions of community preparedness. Both significant differences in the responses of paid versus volunteer health professionals regarding their ability and willingness and striking similarities in their responses regarding barriers and enablers to report to work were identified. Volunteer motivation, cognitive dissonance and the nature of self selected volunteers are examined as they relate to these findings and strategies to strengthen the ability and willingness of MRC units to respond with the public health system are suggested.

DTIC

*Disasters; Health; Medical Personnel; Medical Services; Reserves*

**20070027391** Naval Postgraduate School, Monterey, CA USA

**Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers**

Morrissey, James F; Mar 2007; 92 pp.; In English

Report No.(s): AD-A467383; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Terrorism-related intelligence gathering, analysis and information dissemination would be improved and enhanced by including a medical and health element in law enforcement intelligence fusion centers. The lack of medical representation and participation in intelligence analysis and information dissemination has been an obstacle to effective terrorism prevention, preparedness and response. Terrorist acts, including weapons of mass destruction, would have a significant and profound impact on the medical and health community. The medical and health community should work more closely with the intelligence community and be privy to terrorism-related information and alerts. The three areas of implementation to be examined include the FBI's Joint Terrorism Task Force, state level fusion centers and local (city, county, regional) terrorism early-warning groups. The Terrorism Liaison Officer Program will be examined as an option for medical personnel to become involved in anti-terrorism efforts. Literature on the subject shows overwhelming support for the involvement of non-law enforcement public safety representation, including the medical and health communities, in intelligence fusion centers.

DTIC

*Health; Information Transfer; Intelligence; Law (Jurisprudence); Medical Services; Public Health; Terrorism*

**20070027430** Medicine and Dentistry Univ. of New Jersey, Newark, NJ USA

**Activation and Protection of Dendritic Cells in the Prostate Cancer Environment**

Guruli, Georgi; Jordan, Mark L; Feb 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0181

Report No.(s): AD-A467561; No Copyright; Avail.: Defense Technical Information Center (DTIC)

First annual report for this award. Experiments were conducted as was scheduled in the Statement of Work. So far studies have demonstrated for the first time the presence of endothelin receptors on murine DC and the fact of endothelin-I production by murine DC upon stimulation with TNF(dot). Phenotyping of dendritic cells stimulated with TNF(dot) and treated with endothelin receptor inhibitors demonstrated decreased expression of pro-inflammatory co-stimulatory molecules (CD40 VD80 CD86 CD205 MHC class II) with the blockade of ETA receptors and no change or mild increase in the expression of

co-stimulatory molecules with the blockade of ETB receptors. In vivo administration of endothelin A receptor inhibitor abolished the effect of infectious stimulus to mobilize dendritic cells to draining lymph nodes. Functional studies are under way to further characterize the role of endothelin receptors in the biology of dendritic cells as well as to study the interaction of dendritic cells and prostate cancer cells and develop the means of active cell therapy for murine prostate cancer model.

DTIC

*Activation; Cancer; Prostate Gland; Protection*

**20070027432** Michigan Univ., Ann Arbor, MI USA

**Differential Mechanisms of Androgen Resistance**

O'Mahony, Orla A; Dec 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0105

Report No.(s): AD-A467564; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We proposed to study the mechanisms of androgen resistance by focusing on androgen receptor mutations and may arise due to selective pressures of antiandrogen treatment. We have utilized xenograft and a humanized mouse model of prostate cancer. To date we have identified mutations throughout the androgen receptor coding region and are in the process of carrying out functional analysis. It is proposed that these mutations may lead to greater androgen receptor activity under particular conditions and potentially highlight sites of interaction with critical coactors that might themselves serve as novel therapeutic targets to complement androgen ablation. During this study analysis of tumor progression in the h/mAR X TRAMP mice have highlighted differences in disease course between antiandrogen treated and hormone deplete (castrated) mice. We are in the process of determining mechanisms underlying these differences by characterizing AR levels and subcellular localization in these tumors

DTIC

*Cancer; Diseases; Hormones; Males; Prostate Gland*

**20070027433** Johns Hopkins Univ., Baltimore, MD USA

**Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men**

Bova, G S; Sep 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0817

Report No.(s): AD-A467565; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent advances in prostate biology suggest that stromal cells surrounding prostate epithelia may play a key role in permitting or stimulating epithelial cells to lose control and form precancerous and cancerous lesions. The goal and purpose of this Hypothesis Development project is to obtain preliminary data sufficient to begin to explore the role of prostate stromal cells in prostate carcinogenesis under conditions as rigorously controlled as current technology allows. This hypothesis development project tests the feasibility of identification, laser capture microdissection, and expression analysis of prostate-stroma specific cells in normal and cancerous prostates, and aims to develop preliminary data sufficient to identify potential differences in stromal RNA expression in normal and cancerous prostate tissue. The studies found that it is difficult but not impossible to histologically identify prostate zones with an acceptable degree of confidence in frozen tissues, thus eliminating the need to attempt expression studies in fixed tissues with their attendant biases. Laser capture microdissection of stromal tissue was completed for 5 normal prostates from men across the age range and from two racial groups (African Americans and Caucasians), and for prostates from men of similar ages with adenocarcinoma identified distant from the area of dissection. High Quality RNA was isolated, and duplicate Affymetrix Plus 2.0 chip analysis was recently completed. RNA expression data analysis has just begun. Selective validation testing of these analyzed data is planned and will be the final step of this painstaking hypothesis development project. The key research accomplishments during this period were as follows: identification of appropriate normal tissues for study, determination of frozen tissues as the best foundation for study, completion of tedious laser capture microdissections, and completion of Affymetrix Gene Chip hybridizations.

DTIC

*Cancer; Epithelium; Gene Expression; Genes; Histology; Human Beings; Males; Prostate Gland; Ribonucleic Acids*

**20070027435** Adelaide Univ., Australia

**Disruption of the Circadian Rhythms of Gene Expression and the Development of Breast Cancer**

Kennaway, David J; Feb 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0265

Report No.(s): AD-A467567; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project uses a mouse model to examine the effects of shiftwork on the expression of genes that are directly involved



in the genesis and progression of breast cancer. Task 1: Shift work simulation experiments in mice have been accomplished. High variability has made it advisable to increase the number of animals from n=5 per group to n=10. Results show that shift work produces a shift in the rhythm of core clock genes and the attenuation of expression of genes involved in cell cycle. A manuscript with these results is currently in preparation. Task 2: Two preliminary experiments have been carried out to assess the grafting success of MCF-7 and MDA-MB-231 tumour cells. We expect to run the full experiment within 8 weeks. Task 4: We have successfully crossed the Clock mutation on to a BALB/c-Foxn1nu background. The pups from this cross were not viable due to the inability of the mothers to lactate their offspring. This, in itself, is a very interesting finding. We have been able to maintain this colony by cross fostering the mutant pups to a lactating heterozygote mother. As a backup we have started to cross the Clock mutation on to a Severe combined immuno-deficient (SCID) mouse background with the expectation that these will not manifest the same problems.

DTIC

*Breast; Cancer; Circadian Rhythms; Gene Expression; Genes; Mammary Glands*

**20070027438** Oregon Health Sciences Univ., Portland, OR USA

**The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model**

Schreiber, Martin A; Muller, Patrick; Kiraly, Laszlo; Englehart, Michael; Tieu, Brandon; Underwood, Samantha; Phillips, Charles; Watters, Jennifer; Jan 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0104

Report No.(s): AD-A467570; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Objectives: To determine the optimal fluid resuscitation and anesthetic regimen for swine undergoing uncontrolled hemorrhage. To develop a severe multi-system trauma model resulting in the lethal triad. Methods: 1. 20 swine underwent Grade V liver injury followed by 30 minutes of hemorrhagic shock without resuscitation. Hemodynamics were measured using PICCO 2. Systemic and local lung inflammation was measured in animals undergoing TIVA and isoflurane anesthetic. 3. Femur fracture controlled hemorrhage hypothermia and liver injury were combined to create a reproducible model replicating the lethal triad. Results: 1. Resuscitation with NS results in decreased SVR and increased CO as well as increased extravascular lung water. This suggests that NS is more likely to predispose trauma patients to ARDS. 2. A systemic pro-inflammatory response can be measured within 2 hours of injury and shock. Anesthesia with TIVA produces suppression of TNF-alpha mRNA in the lung compared to anesthesia with isoflurane. 3. A severe reproducible multi-system injury can be created in swine with good short term survivability. This injury model can be reliably reproduced at multiple distant centers.

DTIC

*Coagulation; Hemorrhages; Hypotension; Injuries; Liver; Mortality; Resuscitation; Shock (Physiology); Swine*

**20070027439** Florida Univ., Gainesville, FL USA

**Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation**

Li, Jian; Sheplak, Mark; Cattafesta, Lou; Zmuda, Henry; Jiang, Huabei; Arreola, Manuel; Mar 2007; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0389

Report No.(s): AD-A467571; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research plans to develop enhanced contrast thermal acoustic imaging (TAI) technology for the detection of breast cancer by combining amplitude-modulated (AM) electromagnetic (EM) field excitation resonant acoustic scattering and advanced signal processing techniques. While EM-induced TAI possesses great promise the thermal acoustic signals tend to be weak. However when the tumor is excited into resonance via EM stimulation the effective acoustic scattering cross-section may increase by a factor in excess of 100 based on predictions for microsphere-based ultrasound contrast agents. Such an increase would truly be revolutionary making the EM-induced TAI technology a very promising candidate for routine breast screening. The image formation methods in the existing TAI systems are data-independent and have poor resolution and high sidelobe problems. We will devise adaptive image formation algorithms to achieve high resolution and excellent interference and noise suppression capability.

DTIC

*Acoustic Imaging; Augmentation; Breast; Cancer; Electromagnetic Radiation; Mammary Glands; Stimulation; Thermal Mapping*

**20070027440** Institute for Cancer Research, Philadelphia, PA USA

**Analysis of p21-Activated Kinase Function in Neurofibromatosis Type 2**

Chernoff, Jonathan; Jan 2007; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0213

Report No.(s): AD-A467572; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this project is to determine if group A p21-activated kinases (Paks) are important elements in signaling in neurofibromatosis type II (NF2). Our hypothesis is that activation of the NF2 gene disrupts a signaling pathway emanating from the small GTPase Rac and its effector, p21-activated kinase (Pak). We propose that stimulation of the Rac/Pak signaling axis in cells lacking Merlin leads to changes in transcriptional activity and cytoskeletal dynamics, ultimately resulting in enhanced cell proliferation and motility, which are hallmarks of tumorigenesis.

DTIC

*Enzymes; Phosphorus*

**20070027441** Pittsburgh Univ., Pittsburgh, PA USA

**Protein Transduction Based Therapies for Breast Cancer**

Robbins, Paul D; Jul 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0489

Report No.(s): AD-A467574; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have demonstrated that certain transduction peptides such as 12 lysines and 12 arginines can facilitate internalization into breast tumor lines with higher efficiency than smaller polymers of cationic amino acids. In addition we have demonstrated that PTD-Sma34 worked in conjunction with Ad=TRAIL gene transfer to induce breast tumor apoptosis. We also have demonstrated that membrane bound TRAIL worked more effectively than soluble (secreted) TRAIL to induce breast cancer apoptosis. Moreover we have demonstrated that coadministration of Ad=TRAIL with PTD-Smac34 resulted in not only enhanced adenoviral transduction of the tumors but resulted in a stronger apoptotic effect. Finally we have initiated studies to identify breast cancer specific tumor lines by screening a peptide phage display library both in cell culture as well as in nude mice bearing xenografts. Initial results in prostate tumors have demonstrated the feasibility of this approach and suggests breast tumor specific internalization peptides can be identified.

DTIC

*Breast; Cancer; Genetics; Mammary Glands; Peptides; Proteins; Therapy; Transferring*

**20070027447** Johns Hopkins Univ., Baltimore, MD USA

**Neurofibromatosis and the Painful Neuroma**

Belzberg, Allan J; Jan 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0176

Report No.(s): AD-A467583; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Pain is a common and distressing symptom that impacts the quality of life of many patients with neurofibromatosis. The pain is often due to the formation of a neuroma. To understand better how neuromas cause pain and what treatments may be provided, we have attempted to develop an animal model of a painful neuroma. We have completed the first of the three specific aims in this research project. The tibial neuroma transposition (TNT) model has been confirmed as a model of neuropathic pain. The TNT model has been established as reliable and valid. In the TNT model, the neuroma test-site mechanosensitivity is dependent on neural input from the tibial neuroma. In the TNT model, hindpaw mechanical hyperalgesia is independent of input from the tibial neuroma. We will now move on with work related to developing methods to prevent painful neuroma formation.

DTIC

*Nervous System; Pain*

**20070027448** Children's Hospital Medical Center, Boston, MA USA

**DRF3 as a Cholesterol-Dependent Regulator of Src in Prostate Cancer**

Freeman, Michael R; Jan 2007; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0197

Report No.(s): AD-A467584; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project focuses on the novel finding from our group that the formin protein, Drf3, is a signaling molecule positioned downstream from the EGF receptor that intersects with the tyrosine kinase Src in prostate cancer cells. Formins bind small

GTPases and have been implicated in actin cytoskeletal remodeling. Evidence was presented in the original proposal that the EGFR Drf3 Src signaling circuit appears to traverse cholesterol-rich lipid raft membranes in prostate cancer cells. Lipid rafts are cholesterol-and sphingolipid-enriched membrane microdomains that serve as signal transduction platforms by sequestering and excluding signaling proteins and by harboring pre-formed multi-protein complexes. We have hypothesized in this project, and in our published work in this area, that cholesterol accumulation in prostate cancer cells may promote oncogenesis by altering the nature of and/or the types of signals that flow through lipid raft microdomains. Several new lines of evidence consistent with our hypothesis have been produced in year 1 of the project and are described and summarized in this progress report.

DTIC

*Cancer; Cholesterol; Prostate Gland; Proteins; Regulators; Tyrosine*

**20070027449** Antigen Express, Inc., Worcester, MA USA

**Intra-Prostate Cancer Vaccine Inducer**

Humphreys, Robert; Xu, Minzhen; von Hofe, Eric; Lu, Xueqing; Hillman, Gilda; Jul 2006; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0279

Report No.(s): AD-A467585; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Antigen Express has generated potent human Ii-RNAi constructs for use in prostate cancer therapy. We identified active Ii- RNAi sequences, selected the most active promoter (CMV) and demonstrated good suppression of Ii. The constructs also were used to enhance a gp120 DNA vaccine model, confirming that Ii suppression increases the potency of a tumor cell and DNA vaccine. We have shown that an anti-tumor immune response can be strongly induced by intratumoral induction of the MHC class I+II+II- phenotype and effectively and specifically protects mice from re-challenge by the same tumor cells. The frequency and dose of plasmid injections have been optimized as well as the dose of IL-2 to induce a potent immune response following generation of the MHC class I+II+II- phenotype. The duration of plasmid in cells in vitro and the in vivo have been evaluated and indicate that this immunotherapy should be safe. Finally, we have found that DU-145, PC-3, and LNCap prostate cell lines are heterogeneous for MHC class II and II expression and that PC-3 and LNCap cells are MHC class II-/II+. Overall, our results suggest that Ii suppression has the potential to be an elegant method for prostate cancer immunotherapy.

DTIC

*Antigens; Cancer; Deoxyribonucleic Acid; Prostate Gland; Ribonucleic Acids; Vaccines*

**20070027450** Washington Univ., Seattle, WA USA

**Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy**

Goo, Young A; Dec 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0108

Report No.(s): AD-A467588; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Functional development of the prostate is governed by stromal induction and epithelial response. Stromal/epithelial signaling can be mediated through direct cell-cell contact and diffusible factors with their cell surface receptors. One approach to gain a molecular understanding of epithelial/stromal interaction is to identify the organ-specific stromal signaling factors. We proposed to do this through a comparative analysis between prostate stromal and bladder stromal cells. For the prostate/bladder transcriptome analysis, we isolated stromal cell populations by the use of specific CD markers: CD49a for prostate and CD13 for bladder with magnetic cell sorting (MACS) and laser-capture microdissection (LCM). The Affymetrix microarray platform was used to determine the cell type-specific transcriptomes. The glycopeptide-capture method was used to profile protein expression differences because most secreted proteins are glycosylated. We have identified an increased expression in prostate stromal cells of signal transducers like AXL receptor tyrosine kinase, and protein tyrosine kinase 7, which have been implicated in tumor progression. Western blot analysis was performed to validate their expression. Our comparative stable isotope-free proteomic analysis using a modification of the N-linked glycopeptide-capture method allowed facile measurement of changes in protein expression. A number of secreted proteins which may be involved in stromal/epithelial signaling and organ-specific differentiation were identified.

DTIC

*Cancer; Epithelium; Genes; Markers; Prostate Gland; Targets; Therapy*

**20070027451** University of South Florida, Tampa, FL USA

**Brain's DNA Repair Response to Neurotoxicants**

Sanchez-Ramos, Juan; Jan 2007; 117 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0501

Report No.(s): AD-A467590; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Parkinson's Disease (PD) is associated with death of dopaminergic (DA) neurons in the substantia nigra (SN) of the brain. Military personnel abroad are at a greater risk of exposure to pesticides and toxins which may selectively damage DA neurons in the SN and increase the probability of development of Parkinson's disease (PD) later in life. The toxins of interest are mitochondrial poisons that create a bioenergetic crisis and generate toxic oxyradicals which damage macromolecules, including DNA. We hypothesized that regulation of the DNA repair response within certain neurons of the SN (the pars compacta) may be a critical determinant for their vulnerability to these neurotoxicants. We have measured regional differences in the brain's capacity to increase repair of oxidized DNA (indicated by oxyguanosine glycosylase (OGG1) activity) to three distinct chemical classes of neurotoxins (MPTP, two mycotoxins, and an organochlorine pesticide). We have found that the temporal and spatial profile of OGG1 activity across brain regions elicited by each class of neurotoxicant is distinct and unique. Even though all 3 toxicants caused various degrees of depletion of striatal dopamine, the temporal profile of DA depletion and OGG1 activity in striatum was distinct for each toxicant. DNA repair gene expression in response to OTA and dieldrin revealed differences in VTA and SN compartments that may relate to differential vulnerability to oxidative stressors.

DTIC

*Brain; Deoxyribonucleic Acid; Diseases*

**20070027455** Baylor Coll. of Medicine, Houston, TX USA

**Role of Reactive Stroma in Prostate Cancer Progression**

Rowley, David R; Feb 2007; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0189

Report No.(s): AD-A467602; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this project is to determine the role of FGF receptor 1 in reactive stroma during prostate tumorigenesis. We are using a novel approach to target transgene expression specifically to the reactive stroma of experimental prostate cancer. Using a modified approach, we are placing an inducible Cre recombinase behind the FAP gene promoter to target expression to reactive stroma. We will cross this mouse with Fgfr1flox mice (LoxP sites flanking FGF receptor 1 alleles). These mice will be crossed with TRAMP mice (prostate cancer model). Induced expression of Cre at sites of reactive stroma generated in the cancer foci will function to excise the FGF receptor 1 alleles and create a conditional knockout mouse. Progression of tumorigenesis in this line of knockout mice will be compared to heterozygous and wild type controls. Progress has been made in each Task. We have completed all cloning steps and acquired all reagents. We have rederived the Fgfr1flox and have crossed it into the appropriate backgrounds. We have completed crossing the TRAMP mice with the Fgfr1flox mice. This study will pinpoint the role of FGF receptor 1 in reactive stroma promotion of prostate.

DTIC

*Cancer; Prostate Gland; Reactivity*

**20070027456** Lankenau Inst. of Medical Research, Wynnewood, PA USA

**IDO Inhibitors for Combination Therapy of Prostate Cancer**

Prendergast, George C; Nov 2005; 12 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0010

Report No.(s): AD-A467603; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Cancer cells evade immunity during malignant progression. Thus strategies to reverse this process could offer new therapeutic options. Over expression of indoleamine 2,3-dioxygenase (IDO) in cancer cells inhibits T cell activation by tumor antigens. Notably combining an IDO inhibitor with cytotoxic drugs such as paclitaxel strongly and safely enhances antitumor efficacy in animal models of breast cancer. In this project we proposed to test whether combining an IDO inhibitor with paclitaxel could safely enhance efficacy against prostate tumors. The suggested model system was a variant of the TRAMP mouse engineered with a prostate-specific luciferase transgene. Briefly our objectives were to assign tumor-bearing mice to control and drug treatment groups and to compare tumor response after control or experimental therapies by bioluminescence imaging. Unfortunately a fatal pitfall prevented the use of the model (nonselective luciferase expression). Two alternate models explored - each based on engraftment of luciferase-expressing cells into the prostate or under the skin - also exhibited fatal pitfalls (arising tumors tended to spontaneously regress). Our findings raised serious concerns about the utility of

luciferase-expressing prostate tumor cells for bioluminescence-based studies of prostate cancer pathophysiology and therapeutic response.

DTIC

*Bioluminescence; Cancer; Inhibitors; Prostate Gland; Serums; Therapy; Tryptophan*

**20070027457** Hadassah Medical Organization, Jerusalem, Israel

**Involvement and Regulation of Heparanase in Prostate Cancer Progression**

Elkin, Michael; Feb 2007; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0235

Report No.(s): AD-A467604; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Improvement in prostate cancer patient survival requires the identification of new therapeutic targets, based on a detailed understanding of the biologic mechanisms involved in metastatic dissemination and growth in bone and other target organs. Heparanase (HPSE) is a predominant mammalian enzyme that cleaves heparan sulfate, the main polysaccharide component of the extracellular matrix (ECM). The role of HPSE in sustaining the pathology of malignant tumors is being extensively studied during the last decade. The link between HPSE and prostate carcinoma progression remains less investigated and was disputed in recent publications, favoring or opposing involvement of the enzyme. Here we report that HPSE directly contributes to the prostate tumor take and growth in bone, as well as to its ability to metastasize to distant organs. Inhibitory strategies designed in the course of the research are hoped to develop into effective anti-cancer therapeutic modalities. Knowledge gained on the regulatory machinery of heparanase promoter is of high significance, as a part of general effort to define the exact molecular mechanisms of heparanase-driven prostate tumorigenesis. In summary, our results suggest that in prostate tumorigenesis HPSE may become important molecular marker in clinical decision-making process for prostate tumor patients, as well as a target for intervention.

DTIC

*Cancer; Prostate Gland*

**20070027458** Oregon Health Sciences Univ., Portland, OR USA

**Mechanisms of Disease Persistence in Chronic Myelogenous Leukemia (CML)**

Druker, Brian J; Oct 1, 2006; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0606

Report No.(s): AD-A467605; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Disease persistence is the main issue faced by CML patients on therapy with imatinib and eradication of persistent malignant cells will be critical for the longterm success of kinase inhibitor therapy. Mechanisms underlying acquired resistance to imatinib have been extensively studied and the manner by which mutations of the Bcr-Abl kinase domain can reduce or eliminate sensitivity of CML cells to imatinib has been well characterized. Disease persistence in responding patients, in contrast, is still poorly understood. We sought to identify and extensively characterize hematopoietic stem cells responsible for disease persistence and explore their mechanisms of imatinib resistance. Using in vitro culture of primary CML progenitor cells, we identified both quiescent and cycling cells capable of surviving in the presence of imatinib. We observed inhibition of tyrosine phosphorylation by imatinib in surviving cells, suggesting a Bcr-Abl independent mechanism of survival. To apply information gained from in vitro culture to persistent cell populations in treated CML patients, we attempted to isolate Bcr-Abl positive cells from patients in cytogenetic remission. Although persistent CML cells may reside within the stem cell compartment, techniques of stem cell enrichment did not lead to enrichment of CML cells. We are therefore developing techniques for Bcr-Abl-specific detection to facilitate these studies, including creation of a Bcr-Abl junction-specific antibody, development of a Bcr-Abl mRNA junction-specific molecular beacon and analysis of potential markers of CML cells. Evaluation of the utility of these techniques in primary cells is ongoing. The detailed analysis of primary samples is technically challenging, but is essential for an understanding of disease persistence and may allow identification of novel drug targets or methods to sensitize resistant cells to imatinib or alternative Bcr-Abl kinase inhibitors.

DTIC

*Blood Cells; Diseases; Enzymes; Hematology; Leukemias; Phosphorus*

**20070027459** University of Southern Illinois, Springfield, IL USA

**Mechanism of Tumor Metastasis Suppression by the KA11 Gene**

Watabe, Kounosuke; Feb 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-01-0193

Report No.(s): AD-A467606; No Copyright; Avail.: Defense Technical Information Center (DTIC)

KA11 is a tumor metastases suppressor gene which is capable of blocking the metastatic process without affecting the

primary tumorigenesis. Based on our preliminary data, we hypothesize that the KAI1 protein on tumor cells interacts with gp-Fy on the endothelial cells, which activates a signal pathway of the KAI1 molecule, and that this activation eventually leads to cell growth arrest of tumor cells. To test this hypothesis, we will examine whether the interaction of KAI1 and gp-Fy leads to suppression of tumor metastasis in vivo (Task 1), and identify specific peptide sequences that activate KAI1 and to assess the efficacy of the peptides on tumor growth in an animal model (Task 2). We have successfully completed Task 1 and published the results during this cycle. Task 2 is currently underway and one year non-cost extension was requested. Our long-term goal is to elucidate the molecular mechanism of tumor suppression by the KAI1 gene and to develop an effective therapeutic method which restores the function of the KAI1 gene in the metastatic tumor cells.

DTIC

*Cancer; Genes; Metastasis; Prostate Gland; Tumors*

**20070027460** New York Univ., New York, NY USA

**Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast**

SKinner, Kristin A; Aug 2006; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0569

Report No.(s): AD-A467607; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In ductal carcinoma in situ(DCIS), the malignant cells are confined within the basement membrane, and so an ideal candidate for local therapies. Because DNA methylation is a potentially reversible mechanism for tumor suppressor gene inactivation, it is an intriguing target for molecular therapeutics. In this study we have documented significant methylation in eight tumor suppressor genes in DCIS. We have successfully performed ductal lavage in 24/27 patients undergoing surgery for DCIS without any complications. Unfortunately, we were able to successfully identify and lavage the malignant duct in only 25% of cases, half of which were identified because the patient presented with discharge. In the absence of nipple discharge, only 14% of the lavaged ducts were the malignant duct. While these data do not rule out the potential of targeting DNA methylation for intraductal therapy for DCIS, we need better methods for identifying the malignant ductal orifices before proceeding to clinical trials of intraductal therapy.

DTIC

*Breast; Cancer; Deoxyribonucleic Acid; Mammary Glands; Methylation; Targets; Therapy*

**20070027461** California Univ., Los Angeles, CA USA

**Humanin: A Novel Therapeutic Target in Prostate Cancer**

Cohen, Pinchas; Jan 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0211

Report No.(s): AD-A467610; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Humanin is a recently discovered potent survival peptide encoded by the 16S mitochondrial RNA. We cloned humanin as an insulin-like growth factor binding protein-3 (IGFBP-3) antagonist, and others identified it as a Bax antagonist. We hypothesize that humanin is an important prostate cancer regulator and that it may have a role as a diagnostic or prognostic marker in this disease. We proposed to characterize the role of humanin as a regulator of cell survival, growth, and signalling in prostate cancer in vitro, to define its interactions with IGF related molecules including IGFBP-3. We also proposed to identify alterations in humanin levels in sera and tissues of men with prostate cancer using a serum bank and a CaP tissue array. Our data so far indicates that humanin is present in prostate and seminal plasma, and is increased in prostate cancer specimens and its presence is a poor prognostic factor for disease free survival. As findings indicate that humanin levels are related to outcome in CaP, using humanin assays as a potential prognostic tool in patients with prostate cancer could improve treatment decisions in the future.

DTIC

*Cancer; Prostate Gland; Targets; Therapy*

**20070027462** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

**Monitoring and Counteracting Functional Deterioration in Parkinson's Disease: A Multilevel Integrative Approach in a Primate Model System**

Philippens, Ingrid H; Sep 2006; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0517

Report No.(s): AD-A467621; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is still largely unknown what the general course is in the progression of Parkinson's disease (PD). Presumably more

than one factor is responsible. There is evidence suggesting that metabolic compromise, excitotoxicity and oxidative stress are involved in the neurodegenerative process causing PD. To investigate the connection of excitotoxicity and oxidative stress with metabolic compromise in the development of the disease, anti-excitotoxic treatment with riluzole and anti-oxidant treatment with EGCG will be compared to untreated controls and to a standard treatment with L-DOPA in a MPTP induced Parkinson model. We hypothesize that critical changes indicating the nature of the gradual patho-physiological changes leading to PD will be revealed if anti-oxidants or anti-excitatory treatments are given in a situation where the brain is susceptible to develop PD. The comparison, of the results on the different levels of research, between the neuroprotective regimes and the symptom control drug L-DOPA will give insight in the relative role of the different markers for neuroprotection and behavioral output. In particular relatively new technologies such as differential proteomics and sleep research will yield novel insights. In this report period new test methods were developed, the use of brain imaging or neurophysiology was validated and the dose range finding of the test compounds was performed. The highest sign-free dose will be used in the neuroprotective experiments.

DTIC

*Antioxidants; Deterioration; Diseases; Primates*

**20070027463** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

**Feasibility of Biomonitoring of Exposure to Permethrin Through Analysis of Long-Lived (Metabolite) Adducts to Proteins**

Noort, Daan; Sep 2006; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0516

Report No.(s): AD-A467622; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Biomonitoring of exposure to the insecticide permethrin is usually performed by analysis of its urinary metabolite 3-phenoxybenzoic acid (3- PBA). However, chronic low-level exposures and cumulative exposures cannot be assessed by analyzing urinary biomarkers. We are engaged in the development of a methodology to assess the cumulative internal dose of exposure to permethrin, which is based on the assumption that (reactive) glucuronide conjugates of the major permethrin metabolites 3-PBA and cis/trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane-1-carboxylic acid (cis/trans-CI2CA) will form persistent adducts to proteins, in analogy with the glucuronide conjugates of structurally related drugs. In the first year of the project the 3-PBA and CI2CA glucuronide metabolites of permethrin have been successfully chemically synthesized. Their identities have been assessed by means of 1H- NMR spectroscopy and LC tandem mass spectrometry. The reactivity of these metabolites with various amino acids, peptides and albumin has been studied; various distinct adducts could be identified by LC tandem mass spectrometry. It is envisaged that the obtained results will form a firm basis for development of an adduct-based methodology for biomonitoring exposure to permethrin.

DTIC

*Adducts; Albumins; Exposure; Metabolites; Proteins*

**20070027468** Wisconsin Univ., Madison, WI USA

**Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer**

Mukhtar, Hasan; Afaq, Farrukh; Sarfaraz, Sami; Feb 2007; 55 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0217

Report No.(s): AD-A467641; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In recent years, cannabinoids, the active components of Cannabis sativa linnaeus (marijuana) and their derivatives are drawing renewed attention because of their diverse pharmacological activities such as cell growth inhibition and tumor regression. We have shown that the expression levels of both cannabinoid receptors CB1 and CB2 are higher in human prostate cancer cells than in normal prostate epithelial cells and treatment of LNCaP cells with WIN-55,212-2 (WIN) resulted in inhibition of cell growth and induction of apoptosis. Next study was conducted to understand the mechanistic basis of these effects. Treatment of LNCaP cells with WIN resulted in (1) an arrest of the cells in the G0/G1 phase of the cell cycle; (2) an induction of p53 & p27/KIP1; (3) down-regulation of cyclins D1, D2, E, decrease in the expression of cdk -2, -4, and -6; (4) decrease in protein expression of pRb; (5) down-regulation of E2F (1-4); and (6) decrease in the protein expression of DP1 and DP2. Similar effects were also observed when androgen-independent PC3 cells were treated with WIN(5-30 micrometers). We further observed sustained up regulation of ERK1/2, and inhibition of PI3k/Akt pathways in WIN-55,212-2 treated cells. Inhibition of ERK1/2 abrogated WIN induced cell death suggesting that sustained activation of ERK1/2 leads to cell-cycle dysregulation and arrest of cells in G0/G1 phase subsequently leading to an induction of apoptosis. Further, WIN treatment of cells resulted in a dose-dependent increase in Bax/Bcl-2 ratio in such a way that favors apoptosis. The induction of apoptosis

proceeded through down regulation of caspases 3, 6, 7, and 9 and cleavage of PARP. Based on these data we suggest that cannabinoid receptor agonists should be considered as novel agents for the management of prostate cancer.

DTIC

*Cancer; Marijuana; Prostate Gland; Targets; Therapy*

**20070027483** General Accounting Office, Washington, DC USA

**Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune**

Crosse, Marcia; Anderson, Bonnie; Doran, Karen; Bogart, George; Desaulniers, Helen; Hamann, Cathleen; Organeck, Danielle; Price, Roseanne; Ritchie, Christina; Ryba, Stuart; May 2007; 82 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467704; GAO-07-276; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the early 1980s, volatile organic compounds (VOCs) were discovered in some of the water systems serving housing areas on Marine Corps Base Camp Lejeune. Exposure to certain VOCs may cause adverse health effects, including cancer. In 1999, the Department of Health and Human Services' (HHS) Agency for Toxic Substances and Disease Registry (ATSDR) began a study to examine whether individuals who were exposed in utero to the contaminated drinking water are more likely to have developed certain childhood cancers or birth defects. ATSDR has projected a December 2007 completion date for the study. The National Defense Authorization Act of Fiscal Year 2005 required GAO to report on past drinking water contamination and related health effects at Camp Lejeune. In this report, GAO describes the following: (1) efforts to identify and address the past contamination; (2) activities resulting from concerns about possible adverse health effects and government actions related to the past contamination; and (3) the design of the current ATSDR study, including the study's population, time frame, selected health effects, and the reasonableness of the projected completion date. GAO reviewed documents, interviewed officials and former residents, and contracted with the National Academy of Sciences to convene an expert panel to assess the design of the current ATSDR study.

DTIC

*Contamination; Health; Physiological Effects; Potable Water; Trichloroethylene; Water; Water Pollution; Wells*

**20070027499** Mount Sinai Hospital, Toronto, Ontario Canada

**Genetic and Molecular Analysis of the Mechanisms by Which TSC Regulates Neuronal Differentiation**

McNeill, Helen; Feb 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0154

Report No.(s): AD-A467744; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have previously shown that loss of TSC pathway components alters the timing of neuronal differentiation in the Drosophila eye and wing imaginal disc. To determine the mechanisms underlying this regulation of neuronal differentiation, we have 1) further defined the subtypes of photoreceptors that respond to loss of TSC, 2) tested in silico candidates for the regulation of differentiation in the eye, and 3) optimized conditions for an RNAi screen. Our preliminary data indicate that loss of TSC does not control neural differentiation through 5' TOP elements contained in the mRNA of proneural genes examined (CG11799, echinoid, moleskin, src). Consistent with this conclusion, our genetic analysis of the Drosophilahomolog of polypyrimidine tract binding protein, Hephaestus, indicates that loss of Hephaestus does not alter the timing of differentiation of photoreceptors in the eye. We conclude therefore that alternate mechanisms control this process. Our preliminary epistasisanalysis indicates that S6K is essential for the precocious differentiation seen in TSC clones, while loss of eIF4E does not affect the timing of differentiation.

DTIC

*Genetics; Nervous System; Neurophysiology*

**20070027508** California Univ., Los Angeles, CA USA

**Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression**

Garraway, Isla; Jan 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0230

Report No.(s): AD-A467758; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate carcinogenesis is a multi-step process resulting in the transformation of prostatic epithelial cells into invasive carcinoma and metastasis. In recent years, mouse models have emerged that recapitulate salient features of prostate carcinogenesis found in human disease. These models illuminate the molecular events that result in transformation and disease progression. In addition, mouse models can be used to identify molecular targets and to test chemotherapeutic agents that may alter the course of a disease. The authors have generated a new mouse model to further delineate molecular targets that may



halt cancer progression and/or lead to regression of metastatic disease. To rapidly evaluate a variety of select target genes in the long-term, the authors have created a new transgenic mouse. Crossing the TRAMP mouse with the PSCA-TVA transgenic mouse has resulted in the TRAMP-TVA mouse, which allows for efficient and specific gene transfer of imaging genes into prostate epithelial cells that are destined to form cancer, and that expresses the avian viral receptor, TVA, on prostate cancer cells. This new transgenic mouse should enable specific gene transfer of imaging genes and small hairpin nuclear RNAs (shRNAs) resulting in knockdown of specific targets. TRAMP-TVA mice demonstrate prostatic cellular neoplasia (PIN) lesions at 8 weeks and develop adenocarcinoma at 6-15 months. The authors have been able to demonstrate PSCA-driven expression of the TVA viral receptor in these lesions. Intraperitoneal injection of virus containing the luciferase gene results in luminescence signal in the prostate. Further development of this model will enable the effect of target gene knockdown via RNA.

DTIC

*Birds; Cancer; Diseases; Genes; Imaging Techniques; Mice; Models; Prostate Gland; Targets; Tumors; Viruses*

**20070027509** Massachusetts Univ. Medical Center, Worcester, MA USA

**The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis**

Chen, Chun-Ting; Dec 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0140

Report No.(s): AD-A467759; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate carcinoma is the most common form of cancer in American men. The etiology of prostate cancer is currently unknown. It is known that during progression from low to high-grade carcinoma, the spectrum of cytologic, biological, and genetic features changes. We believe that these changes may be a result of defects in the centrosome, an essential organelle that organizes spindle poles during mitosis and has important roles in cell proliferation, cell polarity, and genetic stability. We have shown that centrosomes are defective in prostate carcinoma and pre-invasive lesions. We also showed that the essential centrosomal protein pericentrin is elevated in both pre-invasive prostate lesions and invasive prostate tumors, induces cancer like lesions when overexpressed and binds AKT, PKA and PKC. In this proposal we will follow up on these observations by: examining pericentrin's oncogenic potential after disrupting its interactions with the kinases AKT, PKA and PKC and determine whether other oncogenes or tumor suppressors act synergistically or antagonistically with pericentrin in prostate cancer.

DTIC

*Cancer; Lesions; Oncogenes; Prostate Gland; Proteins; Suppressors; Tumors*

**20070027514** Texas Univ., Houston, TX USA

**Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers**

Esteve, Francisco J; Jun 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0429

Report No.(s): AD-A467768; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Serum protein profiling using mass spectrometry is a promising approach to identify novel circulating breast cancer markers. In this study, serum was fractionated to deplete highly abundant proteins. After protein digestion, we used liquid chromatography mass spectrometry (LC-MS) to develop diagnostic fingerprints using bioinformatic techniques. Samples were randomized prior to fractionation and mass spectrometry testing. Each fraction was digested with trypsin and subsequently analyzed by LC-MS. Peptides were targeted based on the disease to control peak intensity ratios measured in the averages of all mass spectra in each group and t-tests of the intensity of each individual peak. A series of preprocessing steps (spectral alignment, baseline subtraction, normalization) were employed to produce an expansive list of peptides for further investigation and sequencing. The antibody columns removed 12 of the most abundant proteins in serum. Using LC-MS and bioinformatic analysis we found 17-36 differentially expressed peaks in the Cancer vs. Healthy groups. Efforts are ongoing to identify targeted peptide ion signals using tandem matrix-assisted laser desorption/ionization mass spectrometry (MALDI-MS/MS). Serum fractionation using specific antibody columns followed by LC-MS and bioinformatic analysis is a feasible approach to peptide profiling in healthy women and breast cancer patients.

DTIC

*Breast; Cancer; Circulation; Mammary Glands; Markers; Mass Spectroscopy; Proteome*

**20070027515** Naval Postgraduate School, Monterey, CA USA

**The Demise of Russian Health Capital: The Continuity of Ineffective Government Policy**

Van Wagoner, Jarad L; Mar 2007; 111 pp.; In English

Report No.(s): AD-A467769; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Health capital in Russia is in steep decline. Today the Russian population is decreasing by more than 700,000 per annum. Life expectancy has decreased significantly since it peaked in the mid-1960s. Infectious diseases, including an emerging HIV/AIDS epidemic, are threatening to worsen Russia's health crisis and further overwhelm a dilapidated health care system. Both Soviet and Russian government policies aimed at preserving health capital have consistently failed. Government policies and intervention have contributed to the crisis. The purpose of this research is to find a possible explanation for the continuity in ineffective government policy regarding health care. The analysis indicates that a paternalistic political culture permeates the political process. As a result, the government is free to pursue its own agenda without a significant degree of accountability to the population. Issues affecting health capital are not a priority of the Russian government, which has resulted in short-sighted and uncoordinated government policy and programs that are under-funded. Long-term improvements to Russia's health capital will require a shift in the Russian political culture. State-society relations must evolve to allow and encourage greater interaction between state officials and the general population. Without government accountability or individual responsibility, health capital in Russia will continue to decline.

DTIC

*Health; Medical Services; Policies; Public Health; Russian Federation*

**20070027516** University of Western Michigan, Kalamazoo, MI USA

**Early Detection of Prostate Cancer**

Atashbar, Massood; Bejcek, Bruce E; Jan 2007; 95 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0250

Report No.(s): AD-A467775; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Acoustic wave sensors have been widely used for detection of various chemical and biological species in liquid media. An improved binding of Protein A and IgG molecules on QCM biosensors by modifying the gold surface of the quartz crystal with a 35nm polystyrene film followed by an acidic treatment was accomplished. Also, the increase in the sensitivity of the QCM biosensor with CNT as the chemical interface was studied. Immobilization of the PSA at different concentrations on gold surface was achieved and corresponding sensor responses were registered. Using ELISA technique it was verified that PSA was bound to both the crystals and the 96 well plates. Following this, SH-SAW devices have been designed in a differential configuration to be used as biosensors with high selectivity. These SH-SAW devices were fabricated at the Microfabrication facility at University of Michigan, Ann Arbor. The frequency response of these SH-SAW devices and their performance when used in the oscillator configuration has also been recorded. A complete physical structure which can house the sensor along with the associated analog circuitry has been designed and developed. This structure provides electromagnetic shielding as well as reducing the effects of vibration and motion to the entire sensing system.

DTIC

*Acoustics; Cancer; Detection; Prostate Gland; Signal Detectors*

**20070027517** Texas Univ. at Dallas, Richardson, TX USA

**Molecular Analysis of Neurotoxin-Induced Apoptosis**

D'Mello, Santosh R; Mar 2006; 67 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-99-1-9566

Report No.(s): AD-A467776; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Apoptosis is a cell-suicide process that is required for the normal development of the nervous system, but that can be aberrantly activated in neurodegenerative diseases and following exposure to neurotoxins. The intracellular pathways by which these different physiological and pathophysiological stimuli cause neuronal death has not been characterized. In our original application we proposed the hypothesis that certain components of the signaling pathways activated by different apoptotic stimuli might be shared. Four of these molecules had been implicated in the regulation of neuronal survival. In a request for supplemental funding that was submitted in 2001, we had proposed to extend our investigation to another well studied apoptosis-regulatory molecule - the serine-threonine kinase, Akt. In 2002, we submitted a statement of modification of work as part of our annual report. In 2003, we submitted another request for supplemental funding. The funds were to be used to study a novel and exciting chemical compound called GW6074, which we found had neuroprotective properties. Finally, in 2004 we were provided with yet another supplement to study the mechanism of action of GW5074 and examine

whether this compound could prevent neurodegeneration and improve behavioral outcome in an animal model of Parkinson's disease.

DTIC

*Apoptosis; Cells (Biology); Nervous System*

**20070027523** Pennsylvania Univ., Philadelphia, PA USA

**Deciphering the Molecular Mechanisms of Breast Cancer**

Shiekhattar, Ramin; Mar 2005; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0632

Report No.(s): AD-A467787; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have isolated a holoenzyme complex termed BRCC containing BRCA1, BRCA2, and RAD51. BRCC not only displays increased association with p53 following DNA damage but also ubiquitinates p53 in vitro. BRCC36 and BRCC45 are novel components of the complex with sequence homology to a subunit of the signalosome and proteasome complexes. Reconstitution of a recombinant foursubunit complex containing BRCA1/BARD1/BRCC45/BRCC36 revealed an enhanced E3 ligase activity compared to that of BRCA1/BARD1 heterodimer. In vivo, depletion of BRCC36 and BRCC45 by the small interfering RNAs (siRNAs) resulted in increased sensitivity to ionizing radiation and defects in G2/M checkpoint. BRCC36 shows aberrant expression in sporadic breast tumors. These findings identify BRCC as a ubiquitin E3 ligase complex that enhances cellular survival following DNA damage.

DTIC

*Breast; Cancer; Genes; Genetics; Mammary Glands; Proteins*

**20070027524** Washington Univ., Seattle, WA USA

**Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms**

Gralow, Julie R; Jul 2004; 21 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0449

Report No.(s): AD-A467791; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Overall 5-year survival from breast cancer is now 85% and most surviving women are postmenopausal. Nearly half of postmenopausal American women take estrogen replacement to relieve hot flashes and other symptoms of menopause but this is contraindicated in women with breast cancer. Phytoestrogen supplements can be used as an alternative, but their effect on the risk of cancer recurrence is unknown. Given the mixed results of phytoestrogen studies regarding breast cell stimulation and inhibition in the medical literature the effect of phytoestrogen on postmenopausal breast cancer survivors is unclear. To evaluate the effect of a phytoestrogen supplement on steroid hormones and breast epithelial proliferation 23 disease-free post-therapy postmenopausal women with in-situ or early invasive (Stage 0-11) breast cancer were randomized to either 100mg/d isoflavone tablets or placebo for one year. Hormone levels were measured at baseline 5 months and one year. Changes in menopausal symptoms and vaginal maturation were also measured.

DTIC

*Breast; Cancer; Estrogens; Hormones; Mammary Glands; Modulation; Signs and Symptoms; Steroids*

**20070027528** Pennsylvania Univ., Philadelphia, PA USA

**A Biophysico-computational Perspective of Breast Cancer Pathogenesis and Treatment Response**

Weaver, Valerie M; Mar 2006; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0330

Report No.(s): AD-A467799; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Apoptosis regulates the pathogenesis and treatment responsiveness of breast tumors yet the molecular mechanisms whereby breast cancer cells resist apoptosis remains unknown. We found that coincident with malignant transformation and in association with an increase in collagen deposition, cross-linking and reorganization, the mammary gland becomes incrementally stiffer and that the elastic modulus of the tissues to which breast tumor cells characteristically metastasize varies widely. We used natural collagen and basement membrane (BM) hydrogels as well as synthetic laminin and BM-cross linked polyacrylamide gels with precisely calibrated compliances, and could show that elevated matrix stiffness independently induce mammary cell proliferation, perturb cell-cell integrity, disrupt tissue polarity, and inhibit apoptosis-dependent lumen formation to disrupt mammary tissue morphogenesis. When we varied matrix force within the range we measured for the various metastatic and transformed tissues, we could modify the activity of several key stress response pathways previously linked to

apoptosis regulation% Matrix mediated stress pathway regulation profoundly influenced the apoptosis responsiveness of mammary tissue to a diverse array of exogenous death stimuli including chemotherapeutics such as taxol, immune receptor activators including trail and gamma irradiation Towards delineating a molecular mechanism we were able to demonstrate that matrix stiffness increases the expression and activation of integrins, drives the assembly of mature focal adhesions, and increases Rho GTPase-dependent intracellular contractility. Experiments are now in progress to further explore these findings using novel biomaterials and imaging modalities and organotypic culture manipulations.

DTIC

*Apoptosis; Breast; Cancer; Collagens; Mammary Glands; Pathogenesis*

**20070027529** State Univ. of New York, Albany, NY USA

**Functional Genomic Analysis of Breast Cancer Cell Tumorigenicity Using a Novel Gene Silencing Resource**

Conklin, Douglas S; Apr 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0474

Report No.(s): AD-A467802; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The year 1 aims were primarily concerned with collecting shRNA constructs so that a small number that have inhibitory effects on breast cancer progression in vivo models could be identified. We have collated a set of encoded hairpins targeting genes overexpressed in ErbB-2 positive breast tumors. We have also spent considerable effort testing the compatibility of several assays for cellular correlates of tumorigenicity with high throughput gene transfer. To date we have retrieved 65 shRNA constructs targeting 51 of the genes overexpressed ErbB2-positive breast cancer cells and tested them for effects on cell proliferation in a screen in BT474 cells. Year 2 of funding resulted in tests of the specificity of the shRNAs' negative impact on the growth of ErbB-2 positive breast cancer cells. Effects of these shRNAs on normal cells and other breast cancer cell lines identified approximately 20 shRNAs that specifically inhibit ErbB-2 positive breast cancer cells target genes. Several of these gene targets are known to be important to a variety of cancers. Two novel genes are interesting because they give new insight into a pathway that can be exploited as a potential therapeutic target.

DTIC

*Breast; Cancer; Functional Analysis; Mammary Glands*

**20070027530** California Univ., Los Angeles, CA USA

**Radiation-Induced Immune Modulation in Prostate Cancer**

McBride, William H; Jan 2007; 43 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0126

Report No.(s): AD-A467803; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This effort is to determine if radiation affects presentation of prostate specific antigen (PSA) through endogenous and exogenous pathways by dendritic cells (DCs) and to devise novel strategies to translate radiation-induced cell death into the generation of tumor-specific immunity. The goal is to improve the therapeutic outcome from radiation therapy. Radiotherapy is normally thought of as being immune suppressive because it kills radiosensitive lymphocytes. Our hypothesis, in contrast, is that it also affects immune cell function and this has profound effects on the immune system and the development of anti-tumor immunity. We chose PSA as antigen for this study. However, because of the high risk nature of the experiments and the high PSA expression levels in prostate cancer patients that might interfere with its efficacy, we have also develop a back-up system using survivin as an antigen, since it also is overexpressed in prostate cancer. One aim of this proposal is to devise strategies to avoid radiation-induced immunosuppression and to translate radiation tumor cytotoxicity into beneficial tumor immunity with combination treatments of IL-3 and/or GM-CSF. Our studies on combined treatments of radiotherapy and IL-3, and on the effects of radiation on PSA presentation by DCs are presented, along with other milestones that have been attained.

DTIC

*Cancer; Immunity; Modulation; Prostate Gland; Radiation Effects*

**20070027533** Stanford Univ., Stanford, CA USA

**Imaging Primary Prostate Cancer and Bone Metastasis**

Chen, Xiaoyuan; Apr 2006; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0143

Report No.(s): AD-A467811; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall objective of the proposed research is to develop positron emitter labeled bombesin (BBN) analogs with high

affinity for the GRP receptor GRPR for microPET imaging of both androgen dependent and androgen independent prostate cancer xenografted mice. Specific Aims: (1) Design synthesize and characterize positron emitting bombesin analogs labeled with copper-64 or fluorine-18; (2) Conduct in vitro studies of copper-64 and fluorine-18 labeled bombesin analogs to evaluate the effect of modification and radiolabeling on the receptor binding affinity and specificity; (3) Evaluate in vivo efficacy of these novel radiopharmaceuticals in the murine PC-3 and CWR22 human prostate cancer xenograft models. Major Findings: In year 1 we coupled Lys3-BBN with DOTA and labeled the DOTA-Lys3-BBN conjugate with <sup>64</sup>Cu for imaging both subcutaneous PC-3 (GRPR+) and CWR22 (GRPR-) tumors. In year 2 we further tested a series of BBN analogs and fully characterized <sup>64</sup>Cu-DOTA-Aca-BBN(7-14). Studies on metabolic stability for both tracers on organ homogenates showed that <sup>64</sup>Cu-DOTA-[Lys3]BBN is relatively stable. This study demonstrated that both tracers are suitable for targeted PET imaging to detect the expression of GRPR in prostate cancer while <sup>64</sup>Cu-DOTA-[Lys3]BBN may have a better potential for clinical translation.

DTIC

*Bones; Cancer; Images; Imaging Techniques; Metastasis; Prostate Gland*

**20070027534** Johns Hopkins Univ., Baltimore, MD USA

**Proof of Concept for Systematic Collection of Optimal Molecular Quality Anatomically Oriented Normal Prostate from Diverse Age and Race Transplant Donors**

Bova, G S; Dec 2006; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0084

Report No.(s): AD-A467813; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The bulk of valuable molecular research published in prostate cancer to date is based on radical prostatectomy specimens from men with prostate cancer, or on metastatic prostate cancer tissues collected at surgery or autopsy. The majority of normal control tissues for such studies come from the same radical prostatectomy specimens, and less commonly from TURP (transurethral resection of the prostate) samples from men with benign prostatic hyperplasia, cystoprostatectomy specimens in men with bladder cancer, or rarely from autopsy samples collected no sooner than 12-24 hours after death, although documentation is usually absent or scant<sup>2-5</sup>. Using noncancerous areas of radical prostatectomy specimens or samples from men with other GU diseases as normal control tissue has critical drawbacks. Prostate cancer is often multifocal when it arises<sup>6-11</sup>, and there is strong evidence that precancerous changes occur gradually over a period of years in men predisposed to the disease<sup>5,12-14</sup>. Based on these observations, the noncancerous areas of prostates of men with prostate cancer are probably in a state more prone to the development of cancer than men of the same age and race without prostate cancer. Therefore, having a population-based sample of prostates from men of various ages and races is essential for us to understand whether this critical difference exists.

DTIC

*Cancer; Prostate Gland; Transplantation*

**20070027535** California Univ., San Francisco, CA USA

**Exploring Early Detection Methods: Using the Intraductal Approach to Predict Breast Cancer**

Baltzell, Kimberly; Dodd, Marylin; Dec 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0354

Report No.(s): AD-A467814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Nipple aspiration ductal lavage and ductography are methods of obtaining breast fluids from women who are neither pregnant or lactating. Breast cells in these fluids can be classified as either normal or as showing various abnormalities including hyperplasia atypical hyperplasia and cancer. In previous follow-up studies of women who participated in breast fluid and tissue studies it was shown that women with proliferative cytology (hyperplasia or atypical hyperplasia) were significantly more likely to develop breast cancer than women with normal cytologic findings in breast fluids or than women from whom fluid could not be obtained. (Fabian et al. 2000; Wrensch et al. 2001) This study followed an additional cohort of women from Santa Barbara CA that had fluids drawn between 1970-1990. Statistical methods of association were used to determine if women with abnormal cytologic findings developed breast cancer at a higher rate than women with normal cytologic findings or women from whom fluid could not be obtained. Overall 10% (93) of the 946 women developed breast cancer during the follow-up period.

DTIC

*Breast; Cancer; Cytology; Detection; Mammary Glands*

**20070027539** Texas Univ., Houston, TX USA

**Tools for Ultraspecific Probe/Primer Design**

Fofanov, Yurly; Apr 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0040

Report No.(s): AD-A467821; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We offer a novel methodology for rapidly identifying superior-performance DNA probes/primers for use in detecting emerging or engineered pathogens. Our approach will deliver DNA probes and PCR primers that have an unprecedentedly low probability of false positives or confusion by environmental background, and which resist evasion by threat agent engineering. Any detection method that utilizes DNA or RNA probes or primers will benefit greatly by using probes/primers designed with our methodologies. This technology is made possible by novel insights into statistical properties of useful probes, primer pairs, and targets. Such findings have become possible because of dramatic advances in the computational analysis of genomic sequence data. Using our novel approach, background sequences are rigorously (not heuristically, e.g., BLAST) discriminated against. Thus, probes and primers developed using these tools can be known to be at least three mismatches away from the nearest other sequence in an entire set of DNA sequences employed in the calculations. The Phase I studies will demonstrate the advantages of our design technology. In this phase we will (1) perform extensive analysis of several Category A and B pathogens and produce(deliver) the database of all human and/or 'background' 1, 2, 3, and 4 mismatches blind 16-22-mers present in their genomes; (2) transform in house scientific software into a Windows-based application that allows users to perform similar calculations for any custom sequence for 16-19-mers with up to 3 mismatches blind; and (3) perform intensive experimental validation in order to verify candidate sequences and experimentally estimate false discovery rate.

DTIC

*Detection; Microorganisms; Pathogens*

**20070027540** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Development of In Vitro Correlate Assays of Immunity to Infection with Yersinia Pestis**

Bashaw, J; Norris, S; Weeks, S; Trevino, S; Adamovicz, J J; Welkos, S; May 2007; 15 pp.; In English

Contract(s)/Grant(s): Proj-05-4-5A-00R

Report No.(s): AD-A467822; USAMRIID-TR-06-110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Pneumonic plague is a severe, rapidly progressing disease for which there is no effective vaccine. As the efficacy of new vaccines cannot be tested in humans, it is essential to develop in vitro surrogate assays that are valid predictors of immunity. The F1 capsule antigen stimulates a protective immune response to most strains of *Y. pestis*. However, strains of *Y. pestis* that are F1(-) but still virulent have been isolated, and an in vitro assay, the results which can predict protection against both F1(+) and F1(-) strains, is needed. The virulence antigen (V) is an essential virulence factor of *Y. pestis* and stimulates protective antibodies. We investigated potential correlates of plague immunity that are based on anti-V Ab-mediated neutralization of *Yersinia*-induced macrophage cytotoxicity. The neutralizing activity of sera from mice vaccinated with an F1-V fusion candidate vaccine was determined. The decrease in the level of the apoptosis-specific enzyme caspase-3 significantly predicted survival in one- and two-dose vaccination experiments. Sera from F1-V vaccinated nonhuman primates were evaluated with MPhis assays based on caspase-3 and on other markers manifested at the different stages in cell death. Using murine- and human-derived MPhis in microscopic and fluorescence activated cell sorting-based live/dead staining assays of terminal necrosis, we demonstrated a strong association between in vitro neutralization of macrophage cytotoxicity induced by sera-treated *Yersinia* and in vivo protection against lethal infection. These results provide a strong base for the development of reliable in vitro correlate bioassays which are predictive of protective immunity to plague.

DTIC

*Assaying; Immunity; In Vitro Methods and Tests; Infectious Diseases; Vaccines*

**20070027541** Helsinki Univ., Helsinki, Finland

**Novel Molecular Interactions and Biological Functions of the Neurofibromatosis 2 Tumor Suppressor Protein, Merlin**

Carpen, Olli; Aug 2006; 59 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0469

Report No.(s): AD-A467823; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The project studies molecular functions of neurofibromatosis 2 tumor suppressor protein merlin and compares the role of phosphorylation in regulation of merlin and structurally related ezrin. The role of different importin subunits in nuclear targeting of merlin was tested. Merlin bound several importin subunits in a non-selective manner. Merlin was shown to bind tubulin via two different regions one located in the FERM-domain and one at the C-terminus. Intramolecular association and phosphorylation of S518 residue regulated tubulin binding. Merlin promoted microtubule polymerization in vitro and in vivo.

Loss of merlin caused marked changes in microtubule organization and dynamics. Studies on merlin and HEI10 a cell cycle regulator clarified the interaction mechanism and showed a role for merlin in regulation of the integrity of HEI10. Phosphorylation studies identified a second protein kinase A binding site in merlin. Finally studies assessing the role of Src-induced tyrosine phosphorylation of ezrin were initiated.

DTIC

*Molecular Interactions; Phosphorylation; Proteins; Tumor Suppressor Proteins*

**20070027542** Thomas Jefferson Univ., Philadelphia, PA USA

**Artificial Pancreas for Control of BG and Insulin Levels in Hospitalized Patients with Diabetes and Stress Hyperglycemia**

Joseph, Jeffrey I; Feb 2007; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0004

Report No.(s): AD-A467824; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This final report describes the data collected to evaluate the performance of two glucose sensor technologies (an interstitial fluid glucose sensor and a vascular glucose sensor) in perioperative surgical patients with diabetes. To date all 10 patient studies specified in the statement of work have been completed. A description of the data and a formal description of the analyses to be performed are presented herewith. All analyses will be completed in the next six months at which time an addendum to this report will be submitted.

DTIC

*Glucose; Hyperglycemia; Insulin; Metabolic Diseases; Pancreas; Patients*

**20070027545** Southwest Research Inst., San Antonio, TX USA

**Targeted Therapies for Myeloma and Metastatic Bone Cancers**

Vail, Neal; Feb 2007; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-C-0004

Report No.(s): AD-A467829; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Developed two procedures for preparing nanoparticles and demonstrated their ability to repeatedly produce nanoparticles with narrow distribution in the target particle size range of 70-200nm and smaller, if necessary. Synthesized and fully characterized PLA-b-PEG-Maleimide block copolymers to facilitate the attachment of bone-targeting ligands to polymer nanoparticles via thiol coupling. Improved lyostability of polymer nanoparticles, with and without PEG modification. Developed methods to radiolabel polymer nanoparticles, the first time, to our knowledge, this has been done. Encapsulated two proteasome inhibitors, MG-132 and PS-1, and determined their in vitro release profiles. Developed proteasome activity assay to determine activity of encapsulated drug. Developing in vitro assay to determine affinity of bone-targeting nanoparticles to hydroxyapatite substrates.

DTIC

*Bones; Cancer; Metastasis; Polymers; Therapy*

**20070027548** Harvard Univ., Cambridge, MA USA

**Scavenger Receptors and Resistance to Inhaled Allergens**

Kobzik, Lester; Feb 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0289

Report No.(s): AD-A467837; No Copyright; Avail.: Defense Technical Information Center (DTIC)

After OVA sensitization and aerosol challenge, SR-AI/II and MARCO-deficient mice exhibited greater eosinophilic airway inflammation and airway hyper responsiveness compared to wild-type mice. A role for simple SRA-mediated antigen clearance (scavenging) by lung macrophages was excluded by observation of comparable uptake of fluorescent OVA by wild-type and SRA-deficient lung M(phi)s and DCs. In contrast, airway instillation of fluorescent antigen revealed significantly higher traffic of labelled DCs to thoracic lymph nodes in SRA-deficient mice than in controls. The increased migration of SRA-deficient DCs was accompanied by enhanced proliferation in thoracic lymph nodes of adoptively transferred OVA-specific T cells after airway OVA challenge. The data identify a novel role for SRAs expressed on lung DCs in down-regulation of specific immune responses to aero-allergens by reduction of DC migration from the site of antigen uptake to the draining lymph nodes.

DTIC

*Asthma; Respiratory Diseases*

**20070027555** Dana Farber Cancer Inst., Boston, MA USA

**The Development of Novel Small Molecule Inhibitors of the Phosphoinositide- 3-Kinase Pathway through High-Throughput Cell-Based Screens**

Sellers, William R; Feb 2006; 22 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0169

Report No.(s): AD-A467846; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The PTEN tumor suppressor gene is localized to the 10q23 interval and biallelic inactivation of PTEN has been demonstrated in prostate cancer cell lines, and in human primary and metastatic prostate cancers. In mice, inactivation of PTEN leads to prostate hyperplasia, PIN, and microinvasive cancers. Thus, PTEN is a bona fide tumor suppressor with special relevance to prostate cancer. We previously demonstrate that loss of PTEN protein was strongly associated with high-grade Gleason tumors and Suzuki et. al. showed that 56% of metastatic prostate cancer samples were PTEN null. Thus, loss of PTEN appears to correlate with clinical parameters known to be associated with poor outcome. These data suggest that small molecule inhibitors that act to reverse the transformed phenotype induced by loss of PTEN may find significant efficacy in lethal forms of prostate cancer. Loss of PTEN function leads to activation of the PI3K pathway, phosphorylation and activation of Akt and the subsequent aberrant phosphorylation and hence constitutive localization of the FOXO transcription factors to the cytoplasm of PTEN null cells. Based on these findings, we developed a novel, high-throughput cell-based screen using FKHR localization in PTEN null cells as a read-out. This screen has been conducted and numerous new lead compounds were identified. This grant focused on the evaluation of these lead molecules, their activity in in vitro and in vivo models, as well as their possible cooperation with other therapeutics targeting the same pathway.

DTIC

*Cancer; Inhibitors; Molecules; Prostate Gland; Proteins*

**20070027556** State Univ. of New York, Stony Brook, NY USA

**Characterization of the Role of Breast Tumor Kinase (BRK) in Breast Cancer Cells Non-responsive to EGFR-targeted Agents**

Nimnual, Anjaruwee; Jul 2006; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0448

Report No.(s): AD-A467849; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Epidermal growth factor (EGF) receptor tyrosine kinases (erbB family) EGFR (erbB1) and HER2 are highly expressed in breast cancer and are associated with poor prognosis. A number of EGFR and/or HER2-targeted agents are being investigated for breast cancer treatment. Brk (Breast Tumor Kinase) is a nonreceptor tyrosine kinase that has been shown to enhance the mitogenic signaling of EGF induce phosphorylation of erbB 3 and interact with AKT. In this study we aim to investigate whether Brk can promote cells to become refractory to EGFR-targeted drugs. PI-3 kinase/AKT pathway mediates EGF-induced cell growth and survival and is involved in cellular resistance to anti-cancer drugs/AKT pathway is regulated by multiple activators downregulation of the EGFR alone may not lead to its inhibition. We will investigate whether Brk promotes growth and survival as well as PI3K/AKT activity in cells treated with EGFR-targeted agents.

DTIC

*Breast; Cancer; Mammary Glands; Tumors; Tyrosine*

**20070027557** California Univ., San Francisco, CA USA

**Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases**

Rosenberg, Jonathan; Jan 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0175

Report No.(s): AD-A467851; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This annual report for the Physician Research Training Award focuses on progress in the genetic analysis of circulating hormone refractory prostate cancer micrometastases. As metastatic tissue is often inaccessible in advanced prostate cancer patients, analysis of circulating tumor cells may provide understanding of the biology of hormone refractory prostate cancer as well as chemotherapy resistance. Oligonucleotide array comparative genomic hybridization allows the assessment of genetic changes that may occur in the process of metastasis and chemotherapy resistance. Genomic profiling using this technology will go beyond cell counting, and circumvent technical complexities related to working with RNA. Work performed over the last year has perfected techniques to deal with small amounts of DNA isolated using the Vitatex cell isolation system. Preliminary data suggests that reproducible genomic alterations are observed in the circulating tumor cells isolated from patients with metastatic hormone refractory prostate cancer. During year 3, having ironed out the methodology of pursuing this work, we will ramp up collection of peripheral blood on patients with chemotherapy-na(ve and



chemotherapy-refractory hormone refractory prostate cancer to isolate circulating tumor cells and perform genetic analyses.  
DTIC

*Cancer; Chemotherapy; Circulation; Deoxyribonucleic Acid; Gene Expression; Hormones; Metastasis; Prostate Gland; Refractories*

**20070027559** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference**

Geisbert, Thomas W; Hensley, Lisa E; Kagan, Elliott; Yu, Erik Z; Geisbert, Joan B; Daddario-DiCaprio, Kathleen; Fritz, Elizabeth A; Jahrling, Peter B; McClintock, Kevin; Phelps, Janet R; Jun 15, 2006; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467854; USAMRIID-RPP-05-449; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Background. Ebola virus (EBOV) infection causes a frequently fatal hemorrhagic fever (HF) that is refractory to treatment with currently available antiviral therapeutics. RNA interference represents a powerful, naturally occurring biological strategy for the inhibition of gene expression and has demonstrated utility in the inhibition of viral replication. Here, we describe the development of a potential therapy for EBOV infection that is based on small interfering RNAs (siRNAs). Methods. Four siRNAs targeting the polymerase (L) gene of the Zaire species of EBOV (ZEBOV) were either complexed with polyethylenimine (PEI) or formulated in stable nucleic acid-lipid particles (SNALPs). Guinea pigs were treated with these siRNAs either before or after lethal ZEBOV challenge. Results. Treatment of guinea pigs with a pool of the L gene-specific siRNAs delivered by PEI polyplexes reduced plasma viremia levels and partially protected the animals from death when administered shortly before the ZEBOV challenge. Evaluation of the same pool of siRNAs delivered using SNALPs proved that this system was more efficacious, as it completely protected guinea pigs against viremia and death when administered shortly after the ZEBOV challenge. Additional experiments showed that 1 of the 4 siRNAs alone could completely protect guinea pigs from a lethal ZEBOV challenge. Conclusions. Further development of this technology has the potential to yield effective treatments for EBOV HF as well as for diseases caused by other agents that are considered to be biological threats.  
DTIC

*Guinea Pigs; Protection; Ribonucleic Acids; Therapy; Viruses*

**20070027561** Boston Univ., Boston, MA USA

**Mechanisms of Alpha-synuclein Aggregation and Toxicity**

Wolozin, Benjamin; Sep 2004; 126 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0781

Report No.(s): AD-A467856; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Alpha-synuclein is a protein implicated in the pathophysiology of Parkinson's disease. The purpose of this proposal is to study the regulation of synuclein aggregation by metals, the interaction of synuclein with other proteins associated with its pathophysiology and the effects of aggregated alpha-synuclein on the function of neuronal mitochondria. During the current year, we have identified several novel interactions of Alpha-synuclein, including binding to the proteasome and selective inhibition of Mitochondrial complex 1. We have also identified a number of novel pathological changes associated with alpha-synuclein aggregation, including phosphorylation of tau protein and up-regulation of DJ-1 protein. Finally, our studies identify novel chemical and molecular strategies for inhibiting toxicity induced by aggregated alpha-synuclein.  
DTIC

DTIC

*Diseases; Mitochondria; Proteins; Toxicity*

**20070027570** National Cancer Inst., Frederick, MD USA

**An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition**

Nguyen, Tam L; Schoehn, Guy; Weissenhorn, Winfried; Hermone, Ann R; Burnett, James C; Panchal, Rekha G; McGrath, Connor; Zaharevitz, Dan W; Aman, M J; Gussio, Rick; Bavari, Sina; Apr 30, 2005; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 02-4-3U-057; Y3-CM-1005-05

Report No.(s): AD-A467875; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The matrix protein VP40 is an indispensable component of viral assembly and budding by the Ebola virus. VP40 is a monomer in solution, but can fold into hexameric and octameric states, two oligomeric conformations that play central roles

in the Ebola viral life cycle. While the X-ray structures of monomeric and octameric VP40 have been determined, the structure of hexameric VP40 has only been solved by three-dimensional electron microscopy (EM) to a resolution of approximately 30Å. In this paper, we present the refinement of the EM reconstruction of truncated hexameric VP40 to approximately 20Å and the construction of an all-atom model (residues 44-212) using the EM model at approximately 20Å and the X-ray structure of monomeric VP40 as templates. The hexamer model suggests that the monomer-hexamer transition involves a conformational change in the N-terminal domain that is not evident during octamerization and therefore, may provide the basis for elucidating the biological function of VP40.

DTIC

*Monomers; Proteins; Ribonucleic Acids; Viruses*

**20070027571** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor**

Aitichou, Mohamed; Henkins, Robert; Sultana, Afroz M; Ulrich, Robert G; Ibrahim, M S; Jun 11, 2004; 6 pp.; In English Report No.(s): AD-A467877; RPP-03-147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two electrochemical assays for detecting Staphylococcus aureus enterotoxin A and B genes were developed. The assays are based on PCR amplification with biotinylated primers, hybridization to a fluorescein-labeled probe, and detection with horseradish peroxidase (HRP)-conjugated anti-fluorescein antibody using a hand-held electrochemical detector. The limit of detection (LOD) for both assays was approximately 16 copies of the sea and seb genes. The assays were evaluated in blinded studies, each with 81 samples that included genomic and cloned S. aureus DNA, and genomic DNA from Alcaligenes, Bacillus, Bacteroides, Bordetella, Burkholderia, Clostridium, Comamonas, Enterobacter, Enterococcus, Escherichia, Francisella, Haemophilus, Klebsiella, Listeria, Moraxella, Neisseria, Proteus, Pseudomonas, Salmonella, Serratia, Shigella, Streptococcus, Vibrio and Yersinia species. Both assays showed 100% sensitivity. The specificity was 96% for the SEA assay and 98% for the SEB assay. These results demonstrate the feasibility of performing probe-based detection of PCR products with a low-cost, hand-held, electrochemical detection device as a viable alternative to colorimetric enzyme-linked assays of PCR products.

DTIC

*Detection; Electrochemistry; Escherichia; Genes; Portable Equipment; Staphylococcus*

**20070027574** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine**

Daddario-DiCaprio, Kathleen M; Geisbert, Thomas W; Geisbert, Joan B; Stroehner, Ute; Hensley, Lisa E; Grolla, Allen; Fritz, Elizabeth A; Feldmann, Friederike; Feldmann, Heinz; Jones, Steven M; Oct 2006; 11 pp.; In English Contract(s)/Grant(s): Proj-04-4-7J-012

Report No.(s): AD-A467883; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Marburg virus (MARV) has been associated with sporadic episodes of hemorrhagic fever, including a recent highly publicized outbreak in Angola that produced severe disease and significant mortality in infected patients. MARV is also considered to have potential as a biological weapon. Recently, we reported the development of a promising attenuated, replication-competent vaccine against MARV based on recombinant vesicular stomatitis virus (VSV) expressing the glycoprotein of the Musoke strain of MARV (VSVDeltaG/MARVGP-Musoke). We used this vaccine to demonstrate complete protection of cynomolgus monkeys against a homologous MARV challenge. While these results are highly encouraging, an effective vaccine would need to confer protection against all relevant strains of MARV. Here, we evaluated the protective efficacy of the VSVDeltaG/MARVGP-Musoke vaccine against two heterologous MARV strains, the seemingly more pathogenic Angola strain and the more distantly related Ravn strain. In this study, seven cynomolgus monkeys were vaccinated with the VSVDeltaG/MARVGP-Musoke vector. Three of these animals were challenged with the Angola strain, three with the Ravn strain, and a single animal with the Musoke strain of MARV. Two animals served as controls and were each injected with a nonspecific VSV vector; these controls were challenged with the Angola and Ravn strains, respectively. Both controls succumbed to challenge by day 8. However, none of the specifically vaccinated animals showed any evidence of illness either from the vaccination or from the MARV challenges and all of these animals survived. These data suggest that the VSVDeltaG/MARVGP-Musoke vaccine should be sufficient to protect against all known MARV strains.

DTIC

*Protection; Vaccines; Viruses*

**20070027575** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination**

Fuller, Claudette L; Brittingham, Katherine C; Porter, Mark W; Hepburn, Matthew J; Pettitt, Patricia L; Pittman, Phillip R; Bavari, Sina; Mar 8, 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467884; USAMRIID-TR-06-082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The live vaccine strain (LVS) of *Francisella tularensis* is the only vaccine against tularemia available for humans, yet its mechanism of protection remains unclear. We probed human immunological responses to LVS vaccination with transcriptome analysis using PBMC samples from volunteers at time points pre- and post-vaccination. Gene modulation was highly uniform across all time points, implying commonality of vaccine responses. Principal components analysis revealed three highly distinct principal groupings: pre-vaccination (-144h), early (+18 and +48h), and late post-vaccination (+192 and +336h). The most significant changes in gene expression occurred at early post-vaccination time points ( $\leq$ 48h), specifically in the induction of pro-inflammatory and innate immunity-related genes. Evidence supporting modulation of innate effector function, specifically antigen processing and presentation by dendritic cells, was especially apparent. Our data indicate that the LVS strain of *F. tularensis* invokes a strong early response upon vaccination. This pattern of gene regulation may provide insightful information regarding both vaccine efficacy and immunopathogenesis that may provide insight into infection with virulent strains of *F. tularensis*. Additionally, we obtained valuable information that should prove useful in evaluation of vaccine lots as well as efficacy testing of new anti-*F. tularensis* vaccines.

DTIC

*Immunity; Immunology; Physiological Responses; Vaccines*

**20070027577** Alabama Univ., Birmingham, AL USA

**Endothelial Progenitors as Vectors for Systemic Gene Therapy of Breast Cancer**

Blackwell, Jerry L; Aug 2004; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0116

Report No.(s): AD-A467888; No Copyright; Avail.: Defense Technical Information Center (DTIC)

14. ABSTRACT Gene therapy offers a potentially important treatment for breast cancer, however a noted problem with current vector systems is the lack of efficient and targeted systemic delivery to the primary tumor and disseminated metastases. To address this issue we proposed the use of endothelial progenitor cells (EPCs), which have the propensity of homing to sites of neovascularization characteristic of growing tumors. The success of this approach requires efficient isolation of EPCs and subsequent loading of the EPCs with therapeutic modalities. We hypothesized that EPCs can, after intravascular injection, localize into sites of tumor neovascularization and deliver therapeutic payloads. In this regard, the key findings of this research project are that (1) EPCs can be isolated and enriched from fresh human blood, (2) blood-isolated EPCs can be efficiently loaded with therapeutic adenovirus (Ad) vectors, (4) the oncolytic Ad vectors are able to amplify their therapeutic payloads within the EPCs, (5) loading EPCs with Ad vectors does not inhibit their intrinsic homing activity, and (6) loaded EPCs deliver the oncolytic Ad vectors that exert an effective anti-tumor activity. Overall, the findings of this project support the application of therapeutic EPCs as cellular vehicles for gene therapy of both local and disseminated breast cancer.

DTIC

*Breast; Cancer; Endothelium; Gene Therapy; Mammary Glands; Vector Analysis*

**20070027578** Texas Univ., Dallas, TX USA

**A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population**

Gatchel, Robert; Peterson, Alan; Hunter, Christine; Hunter, Christopher; Goodie, Jeffrey; Oordt, Mark; Feb 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0055

Report No.(s): AD-A467893; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Musculoskeletal system conditions are the leading cause of hospitalization and disability for the U.S. Armed Forces. The department of Defense pays over \$1.5 billion per year to disabled service members, and musculoskeletal conditions account for 40-50% of this amount. This study investigates the effectiveness of an interdisciplinary functional restoration approach to the treatment of Active Duty military from all 4 branches suffering from chronic musculoskeletal pain (CMP). The primary aims of this Functional and Occupational Rehabilitation Treatment (FORT) program include restoring physical function, retaining soldiers on active duty, and increasing the participants abilities to effectively manage their pain. These outcomes, as

well as socioeconomic variables, are evaluated immediately following treatment, and at 6, 12 and 18 months follow-up.  
DTIC

*Military Personnel; Musculoskeletal System; Pain; Populations*

**20070027580** Maryland Univ., Baltimore, MD USA

**Advanced Technologies in Safe and Efficient Operating Rooms**

Park, Adrian E; Feb 2007; 54 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-2-0001

Report No.(s): AD-A467895; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The three major research targets of this study are (a) OR informatics (b) simulation research, and (c) smart image. The purpose of the OR informatics program is to develop, test, and deploy technologies to collect real-time data about key tasks and process elements in clinical operating rooms. The objective of Simulation research is to create a system where a user can interact with a virtual human model in cognitive simulation and have the virtual human respond appropriately to user queries and interventions in clinical situations, with a focus on cognitive decision making and judgment. The objective of smart image is to use real-time 3D ultrasonography and 40- slice high-frame-rate computed tomography (CT) for intraoperative imaging to volume rendered anatomy from the perspective of the endoscope. The overall project reported here was modified to add and additional task related to the DARPA-sponsored, TraumaPod project. The period of this contract was extended to February 28, 2008. This extension was due to the delay in obtaining IRB approval and other administrative matters. Based on the extended period of performance, this project is on time, on schedule, and within performance parameters.

DTIC

*Medical Services; Rooms; Video Signals*

**20070027585** Emory Univ., Atlanta, GA USA

**Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung**

Roman, Jesse; Dec 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0114

Report No.(s): AD-A467902; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Asthma is a chronic lung disease characterized by airway dysfunction. Of the many factors implicated in the pathogenesis of asthma, a strong association exists between prenatal and postnatal exposure to environmental tobacco smoke (ETS). This is particularly true in infancy and in childhood where ETS exposure is associated with a higher incidence or prevalence of asthma, and with measures of decreased flow in the airways, bronchial hyperresponsiveness, and increased respiratory infections. It has been speculated that the relationship between ETS and asthma is secondary to reduced airway flow caused by tobacco-induced prenatal alterations in airway architecture and/or bronchial reactivity. However, the exact mechanisms by which prenatal ETS promotes airway dysfunction in children remain unelucidated. The authors hypothesize that prenatal exposure to nicotine, a major component of tobacco that transverses the placenta, is largely responsible for the development of asthma in children born of mothers who smoke. Specifically, they hypothesize that nicotine is recognized by specific cellular proteins called nicotinic acetylcholine receptors (nAChRs) that are expressed by lung cells termed fibroblasts and pulmonary neuroendocrine cells (PNEC). In fibroblasts, this interaction triggers the exaggerated expression of a connective tissue protein called fibronectin. In PNECs, nicotine stimulates cell growth and the excessive secretion of neuropeptides that affect airway formation and lung growth, and that stimulate smooth muscle cells to contract. In this fashion, nicotine can affect airway development and promote disease during childhood. This proposal will test the hypothesis in animal models of lung development and hyperreactive airways.

DTIC

*Acetyl Compounds; Acetylcholine; Asthma; Choline; Exposure; Fetuses; Lungs; Nicotine; Pathogenesis; Peptides*

**20070027586** Dana Farber Cancer Inst., Boston, MA USA

**The Development of Novel Small Molecule Inhibitors of the Phosphoinositide- 3-Kinase Pathway through High-Throughput Cell-Based Screens**

Sellers, William R; Feb 2007; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0169

Report No.(s): AD-A467904; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The PTEN/MMAC/TEP-1 tumor suppressor gene (hereafter referred to as PTEN) is a target of somatic mutation in

prostate cancer as well as in endometrial cancer, glioblastoma and melanoma (reviewed in (Sansal and Sellers, 2004)) Biallelic loss of PTEN has been demonstrated in both primary and metastatic prostate tumors (reviewed in (Sansal and Sellers, 2004)). In metastatic disease, PTEN loss approaches 50%-60% (Suzuki et al., 1998). Together, these data suggest that loss of PTEN is an important step for those prostate tumors associated with a lethal outcome. Moreover, the loss of PTEN has been intimately linked to deregulation of the PI3K pathway connecting growth and survival signals both to the regulation of the mTOR kinase as well as to the regulation of the FOXO transcription factors. A significant effort is now being expended in the pharmaceutical industry in trying to develop regulators of the PI3K pathway (or more specifically inhibitors) that can reverse the molecular consequences of PTEN loss.

DTIC

*Inhibitors; Neoplasms*

**20070027587** Columbia Univ., New York, NY USA

**Program Project on the Pathogenesis and Treatment of Parkinson's Disease**

Przedborski, Serge; Dec 2006; 211 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0002

Report No.(s): AD-A467905; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This proposal represents the authors' continuing efforts to investigate the molecular mechanisms of Parkinson's disease (PD), a progressive neurodegenerative disorder that affects about 1 million people in the USA alone. Recent evidence suggests that inflammation plays a major role in the progressive nature of this disease. Thus, they are investigating the contributions of several pro-inflammatory enzymes that they found up-regulated in microglia following the use of 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP), the neurotoxin that is the cornerstone of PD research. They found that the number of substantia nigra pars compacta (SNpc) dopaminergic neurons (DA) in MPTP-treated IL-1 beta and IL-1R1 knockout mice did not differ from their nonknockout litter mates. This suggests that IL-1 beta and IL-1R1 may not be involved in the inflammatory response related to the necrotic form of neuronal death characteristic of the acute MPTP dosing schedule. However, they did note that cyclooxygenase-2 (COX-2) and cPLA2 are both up-regulated in SNpc DA neurons following acute MPTP. Because the acute MPTP dosing schedule is quite harsh, Core B characterized a subacute MPTP model of PD and found that this model exhibits at least 3 forms of neuronal death in the SNpc that are time-dependent: necrosis, apoptosis, and autophagy. This subacute model is closer to human PD in that it does not present an immediate end-stage situation characteristic of many neurotoxin-based PD models. The authors also have found in this subacute model that the number of SNpc DA neurons in MPTP-treated IL-1 beta and IL-1R1 knockout mice did not differ from their nonknockout litter mates during the inflammatory process, which is somewhat confusing. Thus, they are now using their neuronal/glial cultures and their neuronal- and glial-conditioned media to sort out the mechanisms involved in the initiation of the inflammatory response related to SNpc DA neuronal death.

DTIC

*Cells (Biology); Death; Diseases; Enzymes; Hypotheses; Mice; Nervous System; Pathogenesis*

**20070027588** Saint Luke's Hospital Center, New York, NY USA

**Unique Approaches to Androgen Effects on Prostate Cancer**

Rosner, W; Kahn, S M; Feb 2007; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0228

Report No.(s): AD-A467907; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sex hormone-binding globulin (SHBG) is a plasma protein that binds androgens and it acts as a transducer of androgen signaling at the plasma membrane of prostate cancer cells. The human prostate cancer cell line LNCaP in addition to having a receptor for SHBG (RSHBG) produces its own SHBG. We devised an inducible system to study SHBG protein expression in LNCaP cells and expressed tagged versions of SHBG in LNCaP cells that will also be useful for future studies on its biologic function. We present a complex and novel picture of extrahepatic human SHBG gene expression including 21 different SHBG gene transcripts generated by alternative splicing 17 of which are newly described and the use of three independent SHBG gene promoters including a novel promoter PN. We used microarray technology to investigate the effect of SHBG on the DHT response of LNCaP cells and found evidence for RSHBG signaling and SHBG modulation of AR activity. Further extended studies of the role of SHBG in prostate signaling and the modulation of SHBG expression in prostate cancer are warranted.

DTIC

*Cancer; Hormones; Males; Prostate Gland; Sex*

**20070027589** Army Center for Environmental Health Research, Fort Detrick, MD USA

**Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats**

Lewis, John A; Rao, K M; Castranova, Vince; Vallyathan, Val; Dennis, William E; Knechtges, Paul L; Feb 5, 2007; 39 pp.; In English

Contract(s)/Grant(s): IAG0307NIOH00; Proj-FH2

Report No.(s): AD-A467914; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Inhalation of diesel exhaust particles (DEP) is characterized by lung injury and inflammation with significant increases in the numbers of polymorphonuclear leukocytes and alveolar macrophages. This influx of cellular infiltrates is associated with the activation of multiple genes, including cytokines and chemokines, and the production of reactive oxygen species. The pathogenesis of the lung injury is not fully understood, but alterations in the presence or abundance of a number of proteins in the lung have been observed. The present study investigates global alterations in the proteome of bronchoalveolar lavage fluid taken from rats 1, 7 or 30 days after exposure to 5, 35, or 50 mg/kg of animal weight of DEP. Analysis by surface-enhanced laser desorption/ionization-time of flight mass spectrometry (SELDI-TOF) identified two distinct peaks that appeared as an acute response post-exposure at all doses in all animals. These two peaks, with mass to charge ratios (m/z) of 9,000 and 10,100 were identified as anaphylatoxin C3a and calgranulin A by additional mass spectral investigation using liquid chromatography coupled to mass spectrometry (LC/MS).

DTIC

*Combustion Products; Diesel Engines; Exhaust Emission; Exhaust Gases; Exposure; Lungs; Mass Spectroscopy; Proteome; Rats*

**20070027590** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model**

Heine, Henry S; Bassett, Jennifer; Miller, Lynda; Hartings, Justin M; Ivins, Bruce E; Pitt, M L; Fritz, David; Norris, Sarah L; Byrne, W R; Apr 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467918; TR-06-100; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An anthrax-spore aerosol infection mouse model was developed as a first test of in vivo efficacy of antibiotics identified as active against Bacillus anthracis. Whole-body, LD50 aerosol challenge doses in a range of  $1.9 \times 10^3$  to  $3.4 \times 10^4$  with spores of the fully virulent Ames strain were established for three inbred and one outbred mouse strain (A/J, BALB/c, C57BL and Swiss Webster). The BALB/c strain was further developed as a model for antibiotic efficacy. Time-course microbiological examination of tissue burdens in mice after challenge showed that spores could remain dormant in the lungs while vegetative cells disseminated to the mediastinal lymph nodes and then to the spleen accompanied with bacteremia. For antibiotic efficacy studies, BALB/c mice were challenged with 50-100 LD50 of spores followed by intraperitoneal (i.p.) injection of either ciprofloxacin 30 mg/kg (q12h), or doxycycline 40 mg/kg (q6h). A control group was treated with PBS q6h. Treatment was begun 24 h after challenge in groups of 10 mice for 14 or 21 days. The PBS-treated control mice all succumbed (10/10) to inhalation anthrax infection within 72 h. Sixty-day survival rates for ciprofloxacin and doxycycline-treated groups were 8/10, 9/10 for 14-day treatment and 10/10, 7/10 for 21-day treatment. Delayed treatment with ciprofloxacin initiated 36- and 48-h postexposure resulted in 80% survival and was statistically no different than early postexposure (24 h) treatment. This mouse model correlates closely with clinical observations of inhalational anthrax in humans and with earlier antibiotic studies in the non-human primate inhalational-anthrax model.

DTIC

*Aerosols; Antibiotics; Atmospheric Models; Bacillus; Mice*

**20070027593** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination**

Day, Jr, William A; Rasmussen, Suzanne L; Carpenter, Beth M; Peterson, Scott N; Friedlander, Arthur M; Feb 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467921; TR-06-039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A transposon site hybridization (TraSH) assay was developed for functional analysis of the B. anthracis genome using a mini-Tn10 transposon which permitted analysis of 82% of the pathogen's genes. The system, used to identify genes required for generation of the infectious anthrax spore, spore germination and optimal growth on rich medium, was predictive of the contribution of two conserved hypothetical genes for the phenotypes examined.

DTIC

*Bacillus; Gene Expression; Genes; Germination; Infectious Diseases; Microorganisms; Mutations; Pathogens*

**20070027597** California Univ., San Francisco, CA USA

**DNA Damage and Genomic Instability Induced by Inappropriate DNA Re-replication**

Green, Brian M; Li, Joachim J; Apr 2007; 80 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0409

Report No.(s): AD-A467931; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Chromosomal rearrangements and changes in copy number at various genomic loci are hallmarks of cancer cells and may be very early steps in tumorigenesis. The origins of genomic insults are poorly understood and this proposal aims to characterize one potential source of genomic instability inappropriate DNA re-replication. In a normal eukaryotic cell cycle the chromosomal DNA of a cell is replicated once and only once during S phase to ensure that each daughter cell receives exactly one complement of genomic material. By perturbing the regulation of several proteins involved in replication initiation our laboratory has been able to conditionally induce varying amounts of re-replication in yeast cells. We have demonstrated that re-replication induces a rapid and significant decrease in cell viability and a cellular DNA damage response. We elected to focus our studies of genome instability on gene amplification because of its clinical importance in breast cancer. We have shown that re-replication is a potent inducer of gene amplification that generates structures similar to amplicons seen but poorly understood in tumors. The high frequency at which these amplification structures are generated is specific to re-replication as similar structures are not observed when S phase DNA replication is impaired or DNA is directly damaged. We thus propose that re-replication arising from loss of replication control is a potential source of the genomic instability important for tumorigenesis.

DTIC

*Cancer; Damage; Deoxyribonucleic Acid; Genome*

**20070027598** Minnesota Univ., Minneapolis, MN USA

**Role of Obesity in Prostate Cancer Development**

Cleary, Margot P; Mar 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0292

Report No.(s): AD-A467932; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prospective epidemiological studies indicate that obesity increases the risk for prostate cancer. Also, mortality from prostate cancer is increased with elevated body weights and obesity recently was reported to be associated with higher prostate cancer grade at diagnosis and with higher recurrence rates. However, it is difficult in human studies to adequately assess effects of body weight or the effect of body weight change at specific ages on prostate cancer. Recent introduction of the TRAMP (transgenic adenocarcinoma mouse prostate) mouse provides a model that shares many characteristics with human prostate cancer. In the present study we are assessing the effect of obesity induced at different ages on the development of prostate cancer in TRAMP mice. Obesity is induced in TRAMP mice by injections with gold-thioglucose (GTG) at either 6, 16 or 26 weeks of age. Body weight is monitored and longitudinal blood samples are obtained to monitor serum leptin levels. Mice are followed until 46 weeks of age. The 26-week cohort study is complete and preliminary analyses of the data indicate no effect of body weight on prostate tumor development although pathology results have not been obtained. Mice in the 6- and 16- week cohorts are currently being followed.

DTIC

*Cancer; Obesity; Prostate Gland*

**20070027599** Texas Univ. Health Science Center, San Antonio, TX USA

**Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia**

Kumar, A P; Ghosh, Rita; Arevalo, Nicole; Gardner, Lori; Feb 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0275

Report No.(s): AD-A467933; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The PI's laboratory has relocated to the University of Texas Health Science Center San Antonio TX. This is a report of the work that was conducted at AMC Cancer Research Center Denver CO between March 1 and June 30, 2005. We have submitted a report describing the work performed in Y1 of the project in Feb 2005. This 4 month (February 26th 2005 to June 30th 2005) report describes the research accomplishments primarily associated with the Task I as outlined in the approved statement of work. As mentioned in the Y1 report we terminated the experiment involving feeding antioxidant supplemented diet in May 2005 (as described in our Y1 report). At the termination of the study (16 weeks) serum, prostate and other organs were collected from all the animals. The efficacy of the combination of antioxidants was assessed by histological evaluation of the prostate and modulation of antioxidant enzymes. Data indicate that 90% of the animals in the control group developed high grade PIN while only 10% of the animals in the experimental group developed high grade PIN. In contrast 90% of the

animals on the experimental diet developed low grade PIN. This suggests that a combination of antioxidants can reduce or delay the appearance of high grade PIN in Noble rats. Detailed studies to understand the mechanism of action of these antioxidants as proposed are currently in progress.

DTIC

*Antioxidants; Cancer; Diets; Epithelium; Health; Prevention; Prophylaxis; Prostate Gland*

**20070027600** Texas Univ. Health Science Center, San Antonio, TX USA

**Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia**

Kumar, A P; Ghosh, Rita; Lucia, M S; Bhaskaran, Shylesh; Rivas, Paul; Feb 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0275

Report No.(s): AD-A467934; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Clinically significant prostate cancer usually occurs in men who are 65 and older although precursor lesions are known to exist many years prior to cancer diagnosis. Histopathological changes referred to as Prostatic Intraepithelial Neoplasia (PIN) are considered to be the most likely precursor of prostate cancer. The mechanism(s) involved in progression of indolent to active disease remains elusive although a role for age-related increase in oxidative stress has been proposed. There are a variety of reactive oxygen species (ROS) that ultimately cause oxidative stress and any particular oxidant has not been identified as being primarily involved. We rationalized that a combination of antioxidants may be necessary to neutralize the different classes of ROS to prevent the progression of latent precursor foci to active cancer. Therefore we devised a combination of antioxidants with varied antioxidant properties to determine whether such supplementation could prevent the progression of PIN in Noble rats that are stimulated to develop PIN with hormones. Results from this study show for the first time that dietary intervention with a combination of antioxidants caused a highly significant decrease ( $p < 0.0004$ ) in high grade PIN formation compared to animals on control diet possibly through modulation of proliferation/apoptosis induction. These data provide evidence regarding the involvement of oxidants in the progression of precursor lesions and the need to evaluate combinations of antioxidants as prostate cancer preventive agents.

DTIC

*Antioxidants; Cancer; Diets; Epithelium; Health; Prevention; Prophylaxis; Prostate Gland*

**20070027601** Nova Southeastern Univ., Fort Lauderdale, FL USA

**Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption**

Sobell, Mark B; Peterson, Alan; Sobell, Linda C; Hunter, Christopher; Hunter, Christine; Jan 2007; 132 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0015

Report No.(s): AD-A467935; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project evaluates a brief smoking cessation intervention for use in primary care settings. The Brief Counselor Assisted Program (BCAP) combines motivational interviewing, behavioral counseling and nicotine replacement therapy with an emphasis on reducing alcohol consumption as a strategy for minimizing weight gain related to smoking cessation. Participants are randomly assigned to either BCAP or to a Self-Guided Program (SGP) where they receive a pamphlet discussing the most effective behavioral change strategies for tobacco cessation, how to minimize weight gain, and how to plan for and deal with possible relapses. The nicotine patch and bupropion (Zyban) are available to all participants. Participants in the BCAP attend two 30-minute clinic appointments and have two counseling sessions by phone over a period of 8-10 weeks, where tobacco cessation skills are integrated with weight and alcohol reduction strategies. Current smokers at 3-month follow-up, blocked by original group assignment, are randomized either to receive no further counseling or to attend one clinic booster session focusing on dealing with their individual obstacles to change. All participants will be followed up for 12 months. At the end of the second project year, all project materials had been developed and approved and recruitment was ongoing.

DTIC

*Alcohols; Smoke; Tobacco*



**20070027602** Cincinnati Univ., OH USA

**Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military**

Millhorn, David E; Schlager, John J; Feb 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-2-0016

Report No.(s): AD-A467938; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Following their service in the first Gulf War, veterans were faced with an increased incidence of amyotrophic lateral sclerosis (ALS). Most recently, concern has been raised that military service per se could result in an elevated risk for ALS. ALS is a rapidly progressing, invariably fatal neurodegenerative disease, and despite exhaustive studies, the possible genetic or environmental causes remain largely unknown. Early symptoms of the disease are often similar to those of other, less severe neurodegenerative diseases, which can complicate and delay the diagnosis. No validated clinically relevant biomarkers exist to assist the physician in a more precise diagnosis of the disease. No therapies exist to cure the disease, and the mean time of survival after diagnosis of ALS is 4-5 years. In light of this problem, there is a pressing need for the identification of new ALS biomarkers that allow an early, specific diagnosis and that have the potential for the development of future therapies. This study compares serum samples from individuals diagnosed with (ALS) to serum samples from matched individuals who did not develop ALS. The authors aim to identify candidate serum biomarkers that are unique for ALS and a subset of diagnostic serum biomarkers for early detection of ALS prior to the appearance of overt symptoms. The significance of a positive identification of protein biomarkers for ALS is indisputably great. However, to date no validated clinically relevant biomarkers have been found to allow a more specific diagnosis of ALS at an earlier stage. Previous efforts to identify ALS associated biomarkers have often focused on the identification of genes and proteins characteristic for familial ALS, yet validated biomarkers for sporadic ALS, which accounts for as much as 90-95% of all ALS cases, have yet to be identified. Subjects will be identified through the National Registry of Veterans with ALS; serum samples will be obtained from the DoD Serum Registry.

DTIC

*Biomarkers; Blood; Diagnosis; Markers; Peptides; Proteins; Serums*

**20070027603** National Academy of Sciences - National Research Council, Washington, DC USA

**Support for the Resident Research Associateship Program with the U.S. Army Medical Research and Materiel Command**

Nyquist, Judith K; Mar 2007; 71 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-2-0002

Report No.(s): AD-A467939; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Medical Science; Scientists*

**20070027604** Notre Dame Univ., IN USA

**Apoptosis and Tumor Progression in Prostate Cancer**

Tenniswood, Martin; Feb 2006; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0114

Report No.(s): AD-A467940; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the period covered by this application we have standardized an efficient methodologies for isolating cells from primary tumors expressing RFP by fluorescence activated cell sorting (FACS) and by laser capture micro-dissection (LCM). We have completed a comprehensive micro-array based bioinformatics effort to identify genes whose expression is modulated by Casodex to characterize the molecular events underlying the effects of Casodex on AR+ cell lines (LNCaP and PC-346C cells). The changes in gene expression detected by micro-array were validated by QT-PCR using SYBR green. The results of these experiments are also being compared to the changes in gene expression seen in the PC-346RFP primary tumors (and metastases) from animals chronically treated with Casodex. We have also demonstrated that there is a threshold dose response to Casodex in these cell lines. Results of the dose response revealed considerable differences in expression changes of target genes between Casodex treatments of 50 or 100 M in comparison to control. One of these genes, the cell cycle inhibitor p21 which has been recently shown to have multiple transcript variants also demonstrates differential regulation of the transcripts at the two concentrations. One of the variants, p21B, has been implicated in apoptosis and displays upregulation at concentrations of Casodex that induce cell death. Ingenuity pathway analysis suggest that this gene may be dually regulated by p53 and AR at the higher dose of Casodex.

DTIC

*Apoptosis; Cancer; Prostate Gland; Tumors*

**20070027605** Minnesota Univ., Minneapolis, MN USA

**Methylselenium and Prostate Cancer Apoptosis**

Lu, Junxuan; Feb 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0007

Report No.(s): AD-A467941; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research is to gain a better understanding of the biochemical pathways and molecular targets for the selective induction of apoptosis signaling and execution of prostate cancer (PCa) cells by methyl selenium. We hypothesized that methyl selenium inhibits PI3K-AKT survival pathway leading to the activation of caspase-dependent apoptosis execution in PCa cells. Data generated support PI3K-AKT pathway activity as a determinant of the apoptosis sensitivity of PCa cells to a prototype methyl Se MSeA which can be further modulated by ERK1/2. AKT and ERK1/2 differentially modulated cytochrome c involvement in MSeA-induced extrinsic (major) and intrinsic caspase cascades. We have pursued a novel lead for using selenium as a chemosensitizer for cancer therapeutic drug-induced apoptosis in androgen independent PCa cells. We have also discovered a synergistic enhancement of apoptosis effect of TRAIL (an anti-cancer biological) by the genotoxic selenium through p53-mediated actions. The chemosensitizer activity of selenium is expected to improve quality of life of prostate cancer patients because of increased efficacy and reduced dosage needed. Seven publications are credited to the support by this grant award. Validation of these findings in animal models is currently in progress.

DTIC

*Apoptosis; Cancer; Prostate Gland*

**20070027606** Colorado State Univ., Fort Collins, CO USA

**Selenium and Breast Cancer Chemoprevention**

Thompson, Henry J; Dec 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0124

Report No.(s): AD-A467942; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary objective of this project was to determine whether selenium supplementation affected candidate markers of breast cancer risk in a cohort of women at elevated risk for breast cancer. The intermediate biomarkers being studied were: indicators of oxidative damage to cellular macromolecules such as DNA and lipid indicators of IGF metabolic status and cellular indicators of breast cancer risk. We conducted a randomized, placebo-controlled double-blind chemoprevention trial with 150 participants (75 subjects per arm) using a placebo tablet or a tablet containing 200 microg high-selenium brewer's yeast per day, given for a duration of one year. The form and dose of selenium that was being used has been reported to reduce cancer incidence and mortality in lung, prostate and colon. Blood and urine were collected at baseline and after 6 and 12 months of intervention. The feasibility of obtaining breast epithelial cells via nipple aspiration at baseline and the end of the intervention was assessed. Plasma selenium and glutathione peroxidase activity were evaluated in addition to pill counts and self report as markers of compliance.

DTIC

*Breast; Cancer; Chemotherapy; Drugs; Health; Mammary Glands; Markers; Nutrition; Selenium*

**20070027608** Arizona Univ., Tucson, AZ USA

**A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress**

Hakim, Iman A; Chow, H-H; Harris, R B; Garland, L; Rodney, S; Tobar, M; Cordova, C; Strebing, A; Goodman, L; Mikhael, D; Feb 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0053

Report No.(s): AD-A467944; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The authors' overall goal is to develop a safe and feasible model for the chemoprevention of a wide range of tobacco-related diseases. Their immediate goal, addressed over a 4-year study period, is to determine the effects of high tea consumption on the biological markers of oxidative stress that mediate lung cancer risk. They are conducting a 6-month randomized, controlled, double-blinded chemopreventive trial with subjects who have chronic obstructive pulmonary disease (COPD) and who were, or are, chronic smokers. The subjects are being randomized to green or black tea preparations or a control intervention (matching placebo). Levels of 8-hydroxydeoxyguanosine and 8-F2-isoprostanes are being used to measure DNA damage and lipid damage, respectively. Changes in biomarkers of oxidative damage are being measured in urine, blood, and exhaled breath condensate. The study protocol was approved by all parties in September 2003. Recruitment and screening of participants for eligibility started in October 2003. By the end of December 2006, 275 participants had signed the consent form and were screened for confirmation of COPD eligibility (i.e., spirometry for lung function). Thirteen subjects were not eligible and 262 subjects were enrolled in the study. Ninety-six of the participants dropped out of the study in the

first week. The main reported causes of drop-out were as follows: could not stop drinking coffee, did not like the taste of the tea, and caffeine intolerance. A total of 158 subjects completed the 1-month run-in and were randomized to one of the study arms: green tea, black tea, or placebo. All randomized subjects provided blood and urine samples, exhaled breath condensate, and buccal cell samples during the 6-month intervention period. To date, 114 subjects have completed the study and 19 subjects are actively enrolled in it. The authors expect that adherence to a regular pattern of tea is feasible and quantifiable in this high-risk population.

DTIC

*Biomarkers; Cancer; Carcinogens; Health; Lungs; Markers; Oxidation; Tea Lasers*

**20070027610** University of Southern California, Los Angeles, CA USA

**Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites**

Ingles, Sue Ann; Dec 1, 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0111

Report No.(s): AD-A467946; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Dietary fat has been implicated as a potential promotional factor leading to progression of small, latent, non-metastatic prostate tumors to invasive, metastatic lesions. One possible mechanism is conversion of n-6 polyunsaturated fatty acids to inflammatory compounds produced by the lipoxygenase (LOX) family of enzymes. The authors are examining whether genetic variants in the n-6 fatty acid LOX pathways are associated with the risk of prostate cancer in a population-based, case-control study of advanced prostate cancer among African-Americans and whites in Los Angeles County. In the first two years of the study, they genotyped five LOX gene polymorphisms, including 12-LOX Gln261Arg and Ser322Asn, 15-LOX-2 Gln656Arg, 5-LOX Lys254Glu, and the 5-LOX promoter Sp1 motif polymorphism. Preliminary analyses indicate that the 12-LOX gene Gln261Arg polymorphism may be related to prostate cancer risk in both African-Americans and whites. In the third year, they will investigate whether genetic variation in specific LOX pathways, in combination with diet, contributes to prostate cancer risk. The findings could provide a scientific foundation upon which to design dietary intervention trials and may allow them to design strategies for reducing the disparity in prostate cancer burden between African-Americans and other ethnic groups.

DTIC

*Africa; Cancer; Diets; Fatty Acids; Genes; Genetics; Lipid Metabolism; Polymorphism; Prostate Gland; Races (Anthropology); Risk; Tumors*

**20070027611** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax**

Vietri, Nicholas J; Purcell, Bret K; Lawler, James V; Leffel, Elizabeth K; Rico, Pedro; Gamble, Christopher S; Twenhafel, Nancy A; Ivins, Bruce E; Heine, Henry S; Sheeler, Ryan; May 16, 2006; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467948; USAMRIID-RPP-05-451; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prevention of inhalational anthrax after *Bacillus anthracis* spore exposure requires a prolonged course of antibiotic prophylaxis. In response to the 2001 anthrax attack in the USA, approximately 10,000 people were offered 60 days of antibiotic prophylaxis to prevent inhalational anthrax, but adherence to this regimen was poor. We sought to determine whether a short course of antibiotic prophylaxis after exposure could protect non-human primates from a high-dose spore challenge if vaccination was combined with antibiotics. Two groups of 10 rhesus macaques were exposed to approximately 1,600 LD<sub>50</sub> of spores by aerosol. Both groups were given ciprofloxacin by orogastric tube twice daily for 14 days, beginning 1-2 h after exposure. One group also received three doses of the licensed human anthrax vaccine (anthrax vaccine adsorbed) after exposure. In the ciprofloxacin-only group, four of nine monkeys (44%) survived the challenge. In contrast, all 10 monkeys that received 14 days of antibiotic plus anthrax vaccine adsorbed survived ( $P = 0.011$ ). Thus postexposure vaccination enhanced the protection afforded by 14 days of antibiotic prophylaxis alone and completely protected animals against inhalational anthrax. These data provide evidence that postexposure vaccination can shorten the duration of antibiotic prophylaxis required to protect against inhalational anthrax and may impact public health management of a bioterrorism event.

DTIC

*Antibiotics; Immunology; Infectious Diseases; Prophylaxis*

**20070027618** California Univ., San Francisco, CA USA

**Midkine Promoter-Driven Adenovirus as Potential Therapy for NF1**

Ding, Vivanne; Dec 1, 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0153

Report No.(s): AD-A467964; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We proposed to test the possibility of using midkine promoter driven adenovirus (AdMk) to selectively kill neurofibroma cells. It is suggested from the literature that midkine is expressed at higher levels in cells and sera of NF1 patients. We initially obtained a version of the AdMk and tested its cytopathic effect on a neurofibroma cell line ST88. However a more recent publication indicated that this virus would be too toxic for normal cells as well. We then obtained from our new collaborator several different modified adenovirus and tested their cytopathic effects. Promoter activities of the midkine and Cox2 are also assayed in several cell lines.

DTIC

*Adenoviruses; Cells (Biology); Nervous System; Therapy*

**20070027619** Wake Forest Univ., Winston-Salem, NC USA

**Platelet Activating Factor: A Growth Factor for Breast Cancer**

Daniel, Larry W; Sep 1, 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0682

Report No.(s): AD-A467966; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Women with a diet rich in fish oils are less likely to develop breast cancer. Recent studies have shown that the ratio of two families of essential fatty acids is important in regulating many cellular processes. Nutrition is extremely important in determining this ratio since both the separate families are obtained only from the diet. The omega 3 family is enriched in fish and grains and the omega 6 family is enriched in the meats and oils typical in modern diets. The strategy of this proposal was to study the molecular mechanisms that control this effect. We focused on the synthesis of platelet activating factor (PAF). We have shown that PAF can increase the growth of breast cancer in cell cultures. Our hypothesis is that the ratio of omega 3 and omega 6 fatty acids influences the synthesis of PAF. This idea came from the fact that these fatty acids must be removed from the precursor of PAF for PAF synthesis to occur. The goal of this proposal was to test this idea and provide the knowledge that would stimulate further clinical trials using fatty acid supplementation to prevent recurrent disease.

DTIC

*Activation; Breast; Cancer; Mammary Glands; Nutrition; Platelets*

**20070027620** Tulane Univ., New Orleans, LA USA

**Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes**

Abbel-Mageed, Asim B; Agrawal, Krishna C; Crawford, Jr, Byron; Feb 1, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0210

Report No.(s): AD-A467967; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We propose to identify the functional characterization of two novel cancer-specific, metastasis-related genes whose constitutive expression may be pivotal for prostate cancer progression. Due to hurricane Katrina, we were able to gain access to research laboratories in end of April, 2006. Due to prolonged power outages in our building (approximately 7 months), we have lost all of DNA constructs, cell lines, frozen tissue sections, cell lines, research supplies. In addition, all of our laboratory personnel were relocated to other cities following hurricane Katrina. Accordingly, we spent considerable amount of time (June, 2006 through January, 2007) cleaning up labs, replacing laboratory supplies and equipments, and hiring lab personnel. Over the past three months we were able to re-generate Seq1 and Seq 2 DNA construct using approaches shown above. We have characterized the full-length cDNAs of the Seq1 and Seq2 genes using at least three 5 and 3 rapid amplification of cDNA ends (RACE) commercial kits (Invitrogen Carlsbad, CA, BD Bioscience (Clontech Inc), and Seegene, Rockville, MD). We have also subcloned cDNAs in expression plasmids and were sequence verified for orientation and recombinant protein expression, in vitro translation, and antibody production. However, our research plans of development of antibodies and validation of expression in tissue sections were disrupted by hurricane Katrina and destruction of all of our laboratory materials and supplies and experimental animals. To accomplish this, we have requested a one year extension to complete the remaining tasks.

DTIC

*Cancer; Genes; Histology; Metastasis; Prostate Gland*

**20070027621** Stanford Univ., Stanford, CA USA

**Development of Methodology to Maintain Primary Cultures of Normal and Malignant Human Prostatic Epithelial Cells in Vivo**

Peehl, Donna M; Feb 1, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0188

Report No.(s): AD-A467968; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our objective is to develop a realistic preclinical model of prostate cancer by developing methodology that supports the survival, growth and differentiation of primary cultures of prostate cells in mice. During Year 1, we focused on the method of implantation and the implantation site as the most critical elements in achieving this goal. In Year 2, we took into consideration growing evidence that stem cells are the only cells capable of regenerative growth in vivo, and started developing methodology to isolate stem cells and grow them in primary cultures. We continued these efforts in Year 3, but were not able to accomplish our goal of growing these stem cell primary cultures in vivo because of staffing problems. Staff is now in place and we will resume our in vivo studies under a No Cost Extension in Year 4.

DTIC

*Cancer; In Vivo Methods and Tests; Prostate Gland*

**20070027622** Mount Sinai School of Medicine, New York, NY USA

**Evaluating an Interactive, Multimedia Education and Decision Program for Early-Stage Prostate Cancer Patients in a Randomized Controlled Trial**

Diefenbach, Michael A; Feb 1, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0179

Report No.(s): AD-A467969; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This 3-arm randomized controlled trial evaluates the efficacy of a CD-ROM based multimedia prostate cancer education system (PIES). PIES is an educational software that provides patients with information about prostate cancer and its treatment through an intuitive interface, using video, animation, text, and voice-over text. All text is tailored to a person's information seeking preference. Participants (N = 312) are patients diagnosed with localized prostate cancer who will be randomized into three experimental conditions: a) Standard care, involving the provision of standard NCI print material about prostate cancer, Group 1; b) PIES software without tailoring component, Group 2; c) and PIES software with tailoring component, Group 3. Assessments will be taken prior to exploring the software/brochures, immediately after completing the software/brochure, and 6-weeks post baseline. The study design allows for the evaluation of the efficacy of the multimedia intervention against traditional care; the influence of tailoring versus not tailoring information within a multimedia context; and for an evaluation of the moderating effect of monitoring on the efficacy of the groups.

DTIC

*Cancer; Decision Making; Education; Multimedia; Patients; Prostate Gland*

**20070027623** Illinois Univ., Chicago, IL USA

**Role of Growth Hormone in Prostate Cancer**

Swanson, Steven M; Feb 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0201

Report No.(s): AD-A467973; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have established a GH-deficient prostate cancer model (Tag/Ghdr/dr rat) indicating that a reduction in GH and/or IGF-I can significantly inhibit prostate carcinogenesis in this model in contrast to GH wild-type controls (Probasin/Tag, Tag/Gh+/+). Tag/Gh+/+ Tag/Ghdr/dr and age-matched non-Tag controls were sacrificed at 10, 25 and 52 weeks of age. While real-time RT PCR and immunohistochemical analysis revealed the significantly increased levels of prostate GHR and the dramatically reduced levels of prostate IGF-1R (P<0.0001) in Tag/Gh+/+ during prostate cancer progression the loss of prostate GHR and the increase of IGF-1R were observed in Tag/Ghdr/dr. However there was no significant change in either serum or prostate IGF-1 level that can be correlated with prostate cancer progression or the resistance of Tag/Ghdr/dr to prostate carcinogenesis. These findings are consistent with the hypothesis that GH signaling plays a significant role in prostate carcinogenesis and suggest that GH antagonists may be effective agent against prostate cancer.

DTIC

*Cancer; Growth; Hormones; Pituitary Hormones; Prostate Gland*

**20070027625** Lund Univ., Sweden

**Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease**

Brundin, Patrik; Li, Jia-Yi; Anisimov, Sergey; Paul, Gesine; Mar 2007; 22 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): W81XWH-04-1-0366

Report No.(s): AD-A467975; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our own results suggest that a risk of teratoma formation inversely correlates with the duration of the in vitro differentiation protocol (Brederlau & Correia et al., 2006). While the yield of hESC-derived DA neurons is not a limiting factor of transplantation success anymore, the major problems associated with the actual application of hESC-based therapies for PD are associated with 1) poor survival of mature DA neurons and 2) risk of teratoma and tumor formation in the site of transplantation. The former is caused by the presence of residual undifferentiated/mitotic cells amongst the transplanted cells. We have refined the in vitro differentiation protocol resulting in a balance of proliferation and differentiation in the cultures and yielding 3-D structures (Transplantable Units, TUs) suitable for transplantation without further dissociation. We have also refined the technique allowing rapid handling and reliable intracerebral delivery of TUs in model animals; resulting in an improved cell survival. Finally we have identified the substantia nigra pars compacta-specific factor Fibroblast growth factor 20 (FGF20) as a factor affecting both differentiation and proliferation of hESC-derived DA progenitors in a dose-dependant manner.

DTIC

*Diseases; Embryos; Grafting; Stem Cells*

**20070027626** Johns Hopkins Univ., Baltimore, MD USA

**Maintenance of Glucose Homeostasis through Acetylation of the Metabolic Transcriptional Coactivator PGC-1alpha**

Puigserver, Pere; Feb 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0214

Report No.(s): AD-A467976; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this proposal is to test the hypothesis that acetylation of PGC-1alpha by the Acetyl Transferase GCN5 associated proteins, Pc3 and WDR18, is a key regulatory modification that controls hepatic glucose production. This investigation has a define scope to specifically test how these proteins control the acetylation status of PGC-1alpha and what is the functional effect in blood glucose levels. The major findings of this Research Technical Report are that we have generated specific siRNAs that specifically knock-down Pc3 and WDR18 and control PGC-1alpha transcriptional function. Moreover, we have generated PGC-1alpha acetylation mutants, surprisingly GCN5 still repress these mutant indicating that other sites are also involved. The significance of these results are that we have identified two proteins, Pc3 and WDR18, that control PGC-1alpha activity and that previous acetylation sites identified in PGC-1alpha are no responsible for GCN5-mediated repression of PGC-1alpha. This leads to further effort to identify the specific sites on PGC-1alpha that are mediating the effects of GCN5 to control hepatic glucose production.

DTIC

*Acetylation; Enzymes; Glucose; Homeostasis; Maintenance; Metabolism*

**20070027627** Madigan Army Medical Center, Takoma, WA USA

**Incorporating New Technology to Create a Comprehensive Realistic Training Environment for the 91W**

Miller, Joseph P; Sep 2005; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MIPR-05M5047

Report No.(s): AD-A467977; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The level of competence of the combat medic (91W) is varied and below the standard of civilian paramedics and Special Forces medics. These soldiers often have minimal clinical experience when assigned directly out of Advanced Individual Training (AIT). When training does occur, it is often on individual subsets of knowledge and does not allow practice of these multiple skills together, in sequence or in a combined scenario with the medic's entire unit in tactical maneuvers. Our proposal is to incorporate medical simulation into a clinically and tactically relevant program for training combat medics. Our goal is to incorporate short didactic sessions, immediate skills stations, case-based experiential learning in both simulation and live tissue models into a hybrid course for combat medics and all brigade medical providers from the combat life-saver to the FST surgeon. It consists of four major parts; didactics, task/skills stations, case-based scenarios from actual wartime environments and an FTX. The FTX portion is unique in that it can be performed by a group of battalion medics only, be incorporated into a brigade sized FTX to include FST and rotary winged evacuation or be a combination of any of the brigade medical assets. We developed a course curriculum covering the critical principles of combat casualty care. Although good and constantly improving, today's simulators are not the same as live patients. Using an IRB/IACUC approved protocol, procedural skills will

be trained on live animals in a controlled environment during the FTX portion of the training. This FTX will attempt to bring in all the variables the 91W will encounter in a tactical environment.

DTIC

*Combat; Education; Medical Services; Military Operations; Transfer of Training*

**20070027628** Mount Sinai School of Medicine, New York, NY USA

**ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer**

Cesaretti, Jamie A; Feb 2007; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0172

Report No.(s): AD-A467978; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this training grant project is to determine whether the prevalence of ATM carriers among prostate cancer patients treated with radiotherapy that develop erectile dysfunction and urinary morbidity is greater than the prevalence of ATM heterozygosity among patients that do not develop this complication. Regardless of the scientific outcome of the proposal the PI will be left with a vast experience in translational research from which to form new hypotheses and research strategies as he begins his career as an independent physician scientist. To assure a well-rounded experience, the school of medicine will insure that the PI will participate for the first two years of the funded period in Mount Sinai's rigorous clinical research training program. The NIH sponsored program will give the PI formal instruction in Clinical Research and Policy Evaluation, Epidemiology and Biostatistics, Basic Science for the Clinical Investigator, Cultural, Illness, and Community Health Outcomes, Behavioral Medicine, and Ethical Issues in Clinical Research. Also the PI, while at Mount Sinai, will make significant progress in establishing collaborative relationships with well-established prostate cancer researchers and will continue this approach in order to expand the scope of the outlined proposal throughout the funding period of this grant.

DTIC

*Cancer; Clinical Medicine; Epidemiology; Prostate Gland; Radiation Therapy; Urine; Urology*

**20070027630** Hutchinson (Fred) Cancer Research Center, Seattle, WA USA

**Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis**

Knudsen, Beatrice S; Jun 2006; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0159

Report No.(s): AD-A467982; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The hypothesis of this grant proposal is that androgen-ablative therapy paradoxically increases growth factor secretion from bone stromal cells and that this may stimulate the growth of prostate cancer metastases. Based on the presence of androgen receptor regulatory elements in the promoter regions of the Interleukin-6 (IL-6) and hepatocyte growth factor/scatter factor (HGF/SF) genes and the presence of nuclear factor IL-6 binding sites in the promoter of the HGF gene, it is the premise of this project that IL-6 and HGF genes may serve as paradigms of genes that are increased in expression under androgen-suppressed conditions. However, initial experiments failed to reveal regulation of HGF and IL-6 by androgen suppression. An analysis of global gene regulation in castrated mice demonstrated that 159 genes were regulated and that Insulin growth Factor Binding Protein-5 demonstrated the most consistent increase in expression. The support provided by the grant fostered the PI's career development to an independent investigator in the field of prostate cancer metastasis to bone. There were several publications supported by the funds from this grant.

DTIC

*Bones; Cancer; Immune Systems; Interleukins; Metastasis; Prostate Gland*

**20070027635** New York Hospital-Cornell Medical Center, New York, NY USA

**Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis**

Lin, Sharron X; Feb 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0229

Report No.(s): AD-A468005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is fundamentally important to understand the underlying mechanisms regulating prostate cancer (PCa) metastasis. Despite the increased PSMA expression found in more advanced stage of PCa, little is known about the functional role of PSMA in PCa progression. Work accomplished for the period of the report has (1) generated the fluorescently labeled anti-PSMA antibodies for monitoring PSMA expressions in live PCa cells, (2) established the cell model systems with reduced

PSMA expression for studying PSMA functions, (3) identified fibronectin as a specific extracellular matrix for enhanced LNCaP attachment and (4) performed 2-D wound healing assays to examine the role of PSMA in PCa cell migration. Results from these studies demonstrated and further supported the idea that PSMA is involved in PCa cell adhesion and migration, therefore will enhance our understanding of molecular regulatory mechanisms of PCa. Knowledge about the action of PSMA in cell adhesion and migration during PCa metastasis will have a direct impact on the improvement for design better-targeted approaches for treating patients suffering from metastatic prostate cancer.

DTIC

*Antibodies; Antigens; Cancer; Enzyme Activity; Enzymes; Membranes; Metastasis; Prostate Gland*

**20070027637** North Shore-Long Island Jewish Health System, Great Neck, NY USA

**Testing the Effectiveness of the North Shore - LIJ Health System's Bioterrorism Response Program to Identified Surveillance Data**

Rowe, Thomas W; Mar 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-2-0022

Report No.(s): AD-A468008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research was of the project was to measure the importance of timely notifications of potential infectious disease outbreaks, provided by electronic syndromic surveillance system, compared to the manual case-review system.

DTIC

*Biomedical Data; Diseases; Health; Infectious Diseases; Information Systems; Surveillance*

**20070027638** Texas Univ., Houston, TX USA

**IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities)**

Hong, Waun K; Herbst, Roy; Mar 2007; 233 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0027

Report No.(s): AD-A468009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The projects in this proposal specifically target several signal transduction pathways known to be critical for NSCLC pathogenesis including the EGFR pathway and the more downstream ras/raf/Mek/ERK pathway. These projects combine targeted approaches using molecular and imaging techniques to validate activity against a target and monitor response using imaging modalities specific to the receptor using either small molecules or targeted peptide approaches. The Developmental Research projects explore new areas including 1) the issue of high morbidity malignant pleural effusion thereby bringing the pulmonologists into the treatment of advanced disease with molecular therapies; and 2) prevention of lung cancer in youth through a highly interactive, entertaining CD-ROM program.

DTIC

*Cancer; Imaging Techniques; Lungs; Markers; Patients; Targets; Therapy*

**20070027639** Massachusetts Univ. Medical Center, Worcester, MA USA

**Centrosome-Based Mechanisms, Prognostics and Therapeutics in Prostate Cancer**

Doxsey, Stephen J; Dec 2006; 359 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0124

Report No.(s): AD-A468010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Centrosomes are tiny structures critical for organizing mitotic spindles and segregating chromosomes during mitosis. We (and another group) were the first to discover that centrosomes were abnormal in nearly all malignant human tumors. Our recent observations show that centrosome defects and genomic instability can be artificially induced by elevating the levels of the centrosome protein pericentrin and that pericentrin was elevated in prostate carcinomas. Based on these observations, we proposed that centrosome dysfunction may be a critical factor in prostate cancer progression that could explain most phenotypic changes that occur during progression of prostate carcinomas. The specific aims of the original proposal were designed to test several features of this model. 1. Are centrosome defects present in early prostate cancer and can they predict aggressive disease? 2. Do pericentrin's oncogenic features result from the interaction with PKA, PKB/Akt and/or PKC? 3. Can prostate tumor cells be arrested in the cell by overexpression of a pericentrin domain that blocks the cell cycle? We anticipate



that this work will lead to new prognostic markers and novel cancer-specific therapeutic targets for aggressive prostate cancer, the form that is most critical in terms of diagnosis, treatment and health care expenditure.

DTIC

*Cancer; Chromosomes; Mitosis; Prostate Gland; Spindles*

**20070027640** Illinois Univ., Chicago, IL USA

**Ethanol and Mesolimbic Serotonin/Dopamine Interactions via 5HT-1B Receptors**

Yan, Quingshan; Mar 2007; 99 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0187

Report No.(s): AD-A468012; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose was to investigate whether activation of 5-HT1B receptors within the ventral tegmental area (VTA) facilitated dopamine (DA) transmission in the ipsilateral nucleus accumbens (NAcc) and potentiated ethanol-induced increases in NAcc DA by 5-HT1B receptor-mediated GABA mechanisms. The data derived from microdialysis studies performed in rats and 5-HT1B receptor knockout mice, and those obtained from superfusion experiments consistently showed that activation of VTA 5-HT1B receptors facilitated mesolimbic DA transmission and enhanced the stimulatory effects of ethanol on mesolimbic DA neurons. These enhancements may be a consequence of additive effects resulting from indirect disinhibition of VTA DA neurons due to the receptor activation-induced inhibition of VTA GABA release. Moreover, the results showed that blockade of VTA 5-HT1B receptors attenuated ethanol-induced increases in mesolimbic DA transmission, suggesting the involvement of the receptor activation in mediating ethanol's DA activating effects. However, VTA GABA may not be involved in this 5-HT1B receptor-mediated effect since the data from in vivo and in vitro experiments showed that ethanol did not affect VTA GABA transmission. The data also showed that ethanol, when directly applied to VTA slices, increased somato-dendritic DA release, suggesting that the stimulatory effects of ethanol on VTA DA neurons observed in vivo may be associated, at least in part, with its direct actions within the VTA. Our data may explain in part why 5-HT1B receptors have been reported to be associated with alcohol abuse in both human genetics and in animal models, and to play a role in regulating alcohol voluntary intakes.

DTIC

*Cells (Biology); Dopamine; Ethyl Alcohol; Nervous System; Sense Organs; Serotonin*

**20070027642** Northeastern Ohio Univ. Coll. of Medicine, Rootstown, OH USA

**Prevalence and Outcomes of Restless Legs Syndrome Among Veterans**

Bourguet, Claire C; Feb 2007; 95 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0082

Report No.(s): AD-A468016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Restless Legs Syndrome (RLS) is a commonly under diagnosed organ cause of insomnia. There is evidence that insomnia leads to psychic distress which impacts health care utilization. Purpose: To examine a proposed model which links RLS to insomnia, and insomnia to reduced mental health and increased utilization. Scope: To estimate the prevalence of RLS, insomnia, mood disorders, and substance abuse; quantify the proportion of mood disorders and substance abuse which are attributable to RLS and insomnia; document the diagnosis of RLS and insomnia; and estimate the association of RLS and insomnia to health care utilization and health related quality of life. Methods: A cross-sectional survey of a representative sample of Ohio VA clients using telephone interviews and data extracted from medical records. One year follow-up of health care utilization using postal questionnaire and medical records. Results: The prevalence of RSL and insomnia are high (22% and 16% respectively) as are mental health disorders (major depression, 20%; anxiety disorder, 12%; phobias, 14%; panic attack, 6%; alcohol dependence, 3%). Less than 5 % of RLS was documented in the medical record. RLS is associated with insomnia (PR = 1.5, p<.001) and 20% of the insomnia may be attributed (PAR) to RLS. As RLS is untreated in this population, the burden of insomnia might be reduced by 20% with effective treatment of RLS.

DTIC

*Insomnia; Signs and Symptoms*

**20070027643** Brigham and Women's Hospital, Boston, MA USA

**Genomic Approaches for Detection and Treatment of Breast Cancer**

Elledge, Stephen J; Jul 2006; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0197

Report No.(s): AD-A468017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A key part of our research plan has been the development and use of retroviral vectors expressing RNA interference RNAs

to identify human genes involved in causing or restraining cancer. In our first progress report we described our efforts to develop shRNA libraries and showed they could be used to identify tumor suppressors. Ultimately our goal is to screen of complex pools of shRNA expressing retroviruses each marked with a bar code that allows the results of the screen to be read out by microarray hybridization. We demonstrated this could be accomplished in enrichment screens for shRNAs that caused cellular transformation and growth in soft agar. However, a key goal has been to identify shRNAs that debilitate or kill cancer cells. In order for this to be possible in complex pools, it is imperative that each vector knock down its target with high penetrance. We have successfully achieved this level of knockdown and can now see particular shRNA expressing viruses drop out of complex pools. We are also developing bar code hybridization methods that allow us to detect over 80% of the viruses in pool. We hope to push this to over 90% using double bar codes. Together the high knockdown vectors together with the bar code hybridization has allowed us to achieve the central goal of this Award. We have taken advantage of our improvements to perform a variety of screens relevant to cancer. These include lethality screens to identify genes that cancer cell lines rely upon to proliferate and survive. We also are performing screens that are identifying genes whose loss gives rise to resistance to tyrosine kinase inhibitors. Finally we are continuing our efforts to identify tumor suppressors in human mammary epithelial cells. We have expanded this to identify oncogenes in the same system. In parallel we are attempting to generate a system through which we can explore the autoimmune phenotype of breast cancer patients. We have generated the peptide display libraries required fo

DTIC

*Breast; Cancer; Genome; Mammary Glands*

**20070027646** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Vulnerary Factors to Improve Bone Healing**

Hollinger, Jeffrey O; Apr 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0084

Report No.(s): AD-A468020; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective for the work was to process rabbit bone specimens from the Institute of Surgical Research, foliowed by sectioning and staining of the samples No patents application were filed The rabbit bone samples were received fixed in 70% alcohol Bone was cut longitudinally (Figure 1A) and cross-sectionally (Figure 2A) on a diamond band saw and thereafter processed (dehydrated and infiltrated with xylene) according to the following schedule: 1 70% ETOH for 4 hours 2 80% ETOH for 2 hours 3 95% ETOH for 6 hours 4 Fresh 95% ETOH for 4 hours 5 100% ETOH for 6 hours 6 Fresh 100% ETOH for 4 hours 7 Xylene for 6 hours 8 Fresh Xylene for 6 hours.

DTIC

*Bones; Healing; Medical Science*

**20070027647** Ohio State Univ., Columbus, OH USA

**The Effect of COX-2 Inhibitors on the Aromatase Gene (CYP19) Expression in Human Breast Cancer**

Shapiro, Charles L; Dec 2006; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0589

Report No.(s): AD-A468021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Aromatase (CYP19) is responsible for estrogen biosynthesis, and CYP-19 and cyclooxygenase-2 (COX-2) are both overexpressed in human breast cancers. Prostaglandin activates the CYP19 promotor and increases gene expression therefore we hypothesized that celecoxib, a selective COX-2 inhibitor, will decrease PG and decrease the expression of CYP19. To test this hypothesis, celecoxib was administered to breast cancer patients after the initial core biopsy tumor tissue and then tumor tissue was collected at the definitive surgery on OSU protocol 0125. A total of 8 breast cancer patients were enrolled until December 20, 2004 when the cardiovascular risks associated with celecoxib were made public. Accrual was suspended and the restarted in July 2005 with a revised protocol and consent form describing the cardiovascular risks. The trial was closed November 13, 2006 due to lack of accrual. There were no adverse events recorded during celecoxib administration. With only 8/34 (23%) of patients enrolled, there have no analysis of gene expression of CYP19. This trial failed to accrue, in part, over concerns about the cardiovascular risks.

DTIC

*Breast; Cancer; Gene Expression; Inhibitors; Mammary Glands*

**20070027648** California Univ., Berkeley, CA USA

**New Structural Approaches to Understanding the Disease Related Forms of the Prion Protein**

Wemmer, David E; Jan 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0476

Report No.(s): AD-A468023; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The mouse prion protein peptide (residues 89-143 with the substitution of Leu for Pro at residue 101) induces prion disease in sensitized mice. Samples of this peptide isotopelabeled with  $^15\text{N}$  were prepared by expression of a fusion in *E. coli* cleaved to yield an unmodified peptide and then fibrillized. Hydrogen exchange was allowed to occur in the fibrils for periods from 1 hour to 6 weeks repeating initial experiments to verify the exchange behavior. The extent of exchange was monitored using peak intensities in  $^15\text{N}$ - $^1\text{H}$  HSQC nuclear magnetic resonance spectra in DMSO/D $_2\text{O}$ /TFA solutions. The results are consistent with previous measurements that we did. Analogous experiments were also done with unlabeled peptide in fibrils with the analysis done by mass spectroscopy. Fragmentation was improved relative to previous experiments by using a combination of two proteases. With the improved coverage it was possible to show that the same protected regions as determined by NMR could be identified.

DTIC

*Diseases; Proteins*

**20070027649** Oregon Health Sciences Univ., Portland, OR USA

**Domain Specific Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on erbB Positive Breast Cancer**

Shamieh, Lara S; May 2006; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0412

Report No.(s): AD-A468024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Herstatin an autoinhibitor of ErbB receptors is produced from an alternatively spliced HER-2 mRNA. Retention and read-through of intron 8 leads to the production of the inhibitory secreted ligand which contains a novel receptor binding domain (RBD) encoded by the intron. Both herstatin and its intron-encoded RBD bind to all four members of the ErbB receptor family. Herstatin also binds to both the IGF-IR and the Insulin Receptor (IR) albeit with approximately 10- fold reduced affinity compared to EGFR and HER-2. Examination of signaling and growth in parental MCF7 breast carcinoma cells and MCF7 cells stably transfected with herstatin revealed that herstatin expression resulted in altered signaling and reduced IGF-I- or Insulin-stimulated proliferation in vitro. These studies demonstrate that in addition to binding to and blocking activation of the EGF receptor family herstatin binds to the IGF-IR and IR and modulates IGF-I- stimulated proliferation and survival signaling either through direct interaction with the IGF-IR or indirectly by modulating crosstalk with the EGF family of receptors. In summary herstatin is a unique ligand of both the EGF and IGF-I receptor families that functions to modulate the action of these receptors and may be critical in controlling the progression of ErbB positive breast cancer.

DTIC

*Breast; Cancer; Mammary Glands*

**20070027652** Sky Ltd., Napa, CA USA

**Screening Doses for Induction of Cancers Calculated with the Interactive RadioEpidemiological Program (IREP)**

Kocher, David C; Apostoaei, Julian A; Mar 2007; 83 pp.; In English

Contract(s)/Grant(s): DTRA01-03-C-0064; Proj-CS

Report No.(s): AD-A468029; DTRA-TR-07-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents tabulations of equivalent doses of ionizing radiation, referred to as screening doses, that correspond to an estimated probability of causation of specific cancers of approximately 50% at the upper 99% credibility limit. Screening doses for 32 cancer types were calculated with the Interactive RadioEpidemiological Program, which is used by the Department of Veterans Affairs in adjudicating claims for compensation for cancer by veterans of military services.

DTIC

*Breast; Cancer; Dosage; Epidemiology; Mammary Glands*

**20070027655** Hutchinson (Fred) Cancer Research Center, Seattle, WA USA

**Developing Models to Facilitate the Appropriate Selection and Effective Targeting of Candidate Antigens for Specific Cellular Immunotherapy of Prostate Cancer**

Greenberg, Philip D; Dec 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0152

Report No.(s): AD-A468034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Immunologically targeting prostate cancer has received increasing attention, [1- 3], in part because collateral normal tissue injury is an acceptable toxicity. However, many questions must be resolved, including the nature of antigens that can be effectively targeted, the requisite T cell response, and the relationship between tumor development and progression and the immune system. Many candidate human prostate cancer antigens have been identified, including PSA, PSMA, PAP, PSCA, and TARP [2, 4-11]. These targets, and others suggested by analysis of differential gene expression [6, 12-15], include cytosolic, transmembrane, and secreted proteins, which interface differently with the immune system. Predicting which one or class of antigens might be most effectively targeted is difficult to resolve in human trials, and thus the use of relevant mouse tumor models might provide essential insights into prostate cancer immunobiology that can then be translated to human clinical trials. The Transgenic Adenocarcinoma of the Mouse Prostate (TRAMP) model, developed by our collaborator Norm Greenberg, appears particularly useful as a foundation for addressing these questions. The TRAMP model is focused on a mouse strain genetically engineered to express from a minimal rat probasin promoter the pro-oncogenic SV40 early genes in prostatic epithelium in a developmentally and hormonally regulated fashion [16]. Transgene expression, associated with puberty and increased androgen levels, can be detected in prostate tissue as early as 4 weeks of age [17]. Disease begins as prostatic intraepithelial hyperplasia (PIN), and progresses to well-differentiated adenocarcinoma as early as 12 weeks [17, 18], to moderately differentiated over the next 6-weeks, and to poorly differentiated carcinoma by 24-30 weeks. Distant metastases, by both hematogenous and lymphatic spread, have been detected as early as 12 weeks, and approach 100% by 24-30 weeks of age [18].

DTIC

*Antigens; Cancer; Prostate Gland*

**20070027657** Fox Chase Cancer Center, Philadelphia, PA USA

**MR Imaging Based Treatment Planning for Radiotherapy of Prostate Cancer**

Chen, Lili; Feb 2007; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0023

Report No.(s): AD-A468037; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This work is aimed at MRI-based treatment planning for radiation therapy. The tasks for the third year include (a) develop practical procedures for clinical implementation of MRI simulation; (b) develop guidelines for MRI-based treatment planning dose calculation, and (c) develop quality assurance programs for MRI simulation for prostate cancer treatment. We have developed a technique to create MR-based digitally reconstructed radiographs (DRR) for patient initial setup for clinical applications of MR-based treatment planning for prostate IMRT. The CT and MR images of twenty prostate patients were used for the study. The pelvic bony structures that are relevant for routine clinical patient setup were manually contoured on MRI. The contoured bony structures were assigned a bulk density of 2.0 g/cm<sup>3</sup>. The MRI based DRRs were generated. The accuracy of the MR based DRRs was quantitatively evaluated by comparing MR-based DRRs with CT-based DRRs for these patients. Our results showed that MR-based DRRs utilizing the outlines of relevant bony structures have an accuracy of about 3 mm, which is adequate for initial patient setup. This technique has been used, in combination with the BAT/in-room CT daily target localization techniques, for the clinical implementation of MRI-based treatment planning for prostate IMRT at FCCC.

DTIC

*Cancer; Imaging Techniques; Magnetic Resonance; Prostate Gland; Radiation Therapy*

**20070027658** Johns Hopkins Univ., Baltimore, MD USA

**Interactions between Dietary Factors and Inflammation in Prostate Carcinogenesis**

DeMarzo, Angelo M; Dec 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0138

Report No.(s): AD-A468039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We are investigating whether inflammation can enhance prostate carcinogenesis in a rat model of dietary charred meat carcinogen induced cancers, and, whether antioxidant and other chemopreventative compounds can reduce prostate cancer in this model. We published a manuscript of some of the key data used for preliminary data in the original grant proposal. We completed part of aim 1 by treating PhIP treated Fisher rats with broccoli tea extract and celecoxib and discovered that both

broccoli tea extract and the non-steroidal anti-inflammatory agent celecoxib prevents mutations in all lobes of the prostate in response to PhIP treatment. We also discovered that PhIP treatment causes widespread epithelial atrophy in the rat ventral prostate that precedes the development of PIN. We completed a long term study related to task 3 in which we will defined the baseline number and extent of PIN and intraductal cancer lesions in the 52 week model to be used for the remainder of the studies in task 3.

DTIC

*Cancer; Carcinogens; Diets; Prostate Gland; Tumors*

**20070027659** Boston Univ., Boston, MA USA

**Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide**

Krengel, Maxine; Sullivan, Kimberly; Feb 2007; 57 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0118

Report No.(s): AD-A468046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

GulfWar (GW) veterans continue to complain of short term memory and mood problems many years following their return from the Persian Gulf. Suspected causes for these health complaints continue to be investigated and include additive and/or synergistic effects of the varying combinations of exposures to pesticides, pyridostigminebromide(PB), low-level nerve agents, and psychological trauma. Many pesticides are neurotoxicants as are PB and nerve agents. Two subsets of these chemicals, organophosphates(OP) and carbamates, are known to produce chronic neurological symptoms at sufficient exposure levels. It is the goal of this study to further evaluate the role of pesticides in the development of symptoms reported by GW veterans. This will be accomplished by performing neuropsychological assessments with a group of military pesticide applicators. It is hypothesized that pesticide applicators with high exposures will perform significantly worse on cognitive and neurological measures than a group of GW military personnel with very little pesticide exposure. It is also hypothesized that multiple chemical exposures (PB, pesticides) will prove to be synergistic and/or additive in terms of decreased cognitive and neurological functioning and increased physical symptoms.

DTIC

*Bromides; Central Nervous System; Gulfs; Neurology; Persian Gulf; Pesticides; Psychology; Signs and Symptoms; Warfare*

**20070027662** Alabama Univ., Birmingham, AL USA

**Mechanisms of p53-Mediated Apoptosis**

Harms, Kelly L; Mar 2007; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0349

Report No.(s): AD-A468053; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The p53 tumor suppressor is the most commonly mutated gene in human breast cancer. Upon genotoxic stress, p53, a sequence-specific transcription factor, induces target genes that mediate many cellular activities such as cell cycle arrest and apoptosis. While the mechanism by which p53 induces apoptosis is unclear, this pathway has rich potential as a target for cancer therapies. Thus, the purpose of this proposal is to characterize the molecular basis of p53-mediated apoptosis. Throughout this funding period, I have found that the N-terminal transcriptional activation domain 1 (AD1) and the C-terminal basic domain (BD) of p53 is inhibitory, while activation domain 2 (AD2) is required for transactivation of IGFBP3 by p53. Interestingly, lack of AD1 and the BD is paralleled in nature, and the naturally occurring p53 isoforms activate the IGFBP3 promoter. Importantly, p53 containing the inhibitory functional domains can be activated to induce IGFBP3 when histone deacetylases (HDACs) are inhibited by HDAC inhibitors. Furthermore, I found that HDAC2 specifically inhibits p53 activity by inhibiting p53-DNA binding activity. Since histone deacetylase (HDAC) inhibitors are in clinical trials for cancer therapies, my results shed insight into how HDAC inhibitors may be used as breast cancer therapies.

DTIC

*Apoptosis; Breast; Cancer; Mammary Glands; Toxicity*

**20070027663** Virginia Univ., Charlottesville, VA USA

**High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer**

Hossack, John A; Feb 2007; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0240

Report No.(s): AD-A468054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this work we improve upon conventional Digital Rectal Examination (DRE) and PSA blood test by using ultrasound elasticity imaging. A latex sheath over the transrectal ultrasound probe is slightly inflated with water to provide a source of

moderate pressure. The elasticity image is generated by cross-correlating successive raw radio frequency image data sets for incrementally increasing pressure. Strain, and consequently elasticity, can be calculated from the displacement image. Our second objective is to use a new freehand 3D acquisition approach to obtain 3D image data sets. This approach uses a slightly modified transducer and an image motion tracking technique. Preliminary phantom based results are presented in this report. Excellent progress has been made with respect to the Statement of Work and first three of four total Specific Aims. A transducer has been specified and is on order. As promised, this transducer is designed to possess unsurpassed prostate scanning resolution by virtue of its exceptionally high frequency up to 14 MHz. Prototype phantoms and complete ultrasound test instrumentation has been assembled. Preliminary ultrasound image speckle reduction work has been performed. Preliminary, dimensionally accurate, 3D prostate phantom images have been produced.

DTIC

*Anatomy; Cancer; Diagnosis; Elastic Properties; High Resolution; Lasers; Physical Examinations; Prostate Gland; Ultrasonics*

**20070027664** California Univ., Los Angeles, CA USA

**Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer**

Reiter, Robert; Tran, Chau; Jan 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0202

Report No.(s): AD-A468055; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have recently demonstrated that a monoclonal antibody against prostate stem cell antigen (PSCA) can exert anti-tumor activity in a xenograft animal model, suggesting oncogenic activity of PSCA in prostate cancer. Therefore our goal is to elucidate the role of PSCA in the development of prostate cancer. A better understanding of PSCA function and its antibody activity will enable rational patient selection and trial design, all of which are particularly relevant to subsequent clinical trials of PSCA antibody. There were difficulties in using the LAPC9 xenograft cells to study the effect of suppressing PSCA, but we have since established conditions for infecting LAPC9 xenograft tumor cells in vitro, and confirmed knockdown ability of siPSCA lentivirus. We have examined PSCA<sup>-/-</sup>/Nkx3.1<sup>-/-</sup> double knockout mice at early time point and find no difference in the lagged time to PIN formation compared to control group. We have also recognized the difficulty in generating the PSCA<sup>-/-</sup> /conditional PTEN<sup>-/-</sup> compound mice, and have engaged in an alternative approach by using the tissue recombination assay.

DTIC

*Antibodies; Antigens; Cancer; Carcinogens; Clinical Medicine; Prostate Gland; Stem Cells; Therapy; Tumors; Viruses*

**20070027665** Jackson Lab., Bar Harbor, ME USA

**A BCR-ABL Kinase Activity-Independent Signaling Pathway in Chronic Myelogenous Leukemia**

Li, Shaoguang; Feb 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0239

Report No.(s): AD-A468056; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The BCR-ABL tyrosine kinase inhibitor imatinib mesylate (Gleevec) is the preferred treatment for human chronic myeloid leukemia (CML), but does not cure mice with BCR-ABL-induced acute lymphoblastic leukemia (ALL), similar to CML lymphoid blast crisis. The inability of imatinib to cure CML in mice leads us to hypothesize that a BCR-ABL kinase activity-independent pathway also plays a critical role in the development of this disease. We identified Src kinases as key molecules in this BCR-ABL kinase activity-independent pathway, and they are essential for leukemic cells to survive imatinib treatment and for CML transition to lymphoid blast crisis. Inhibition of both SRC and BCR-ABL kinase activities affords complete B-ALL remission. However, leukemic stem cell pathways must be targeted for curative therapy of Ph<sup>+</sup> leukemia. We have identified CML stem cells in mice, and found that these cells are insensitive to imatinib therapy. Our study suggests that Src kinases may be effective in inhibiting leukemic stem cells, and combination therapy using a BCR-ABL/Src inhibitor and an anti-stem cells agent would be beneficial to CML patients. Our work will provide a new therapeutic strategy for CML.

DTIC

*Enzyme Activity; Leukemias; Stem Cells*

**20070027666** Texas Univ., Houston, TX USA

**Vasculature-Specific Adenovirus Vectors for Gene Therapy of Prostate Cancer**

Krasnykh, Victor; Feb 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0200

Report No.(s): AD-A468057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In Year 3 of the project we have completed Task 3 and began the work in Task 4 (as per approved Statement of Work). As a result, we have rescued, propagated and characterized a panel of adenovirus vectors that are now ready for the in vivo studies that will conclude the project. To facilitate the monitoring of tumor growth and regression in these studies, we have also developed cell lines expressing dual reporters that are suitable for non-invasive in vivo imaging of tumors.

DTIC

*Adenoviruses; Cancer; Diseases; Gene Therapy; Prostate Gland*

**20070027667** California Univ., Berkeley, CA USA

**New Structural Approaches to Understanding the Disease Related Forms of the Prion Protein**

Wemmer, David E; Jul 2006; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0476

Report No.(s): AD-A468058; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The mouse prion protein peptide (residues 89-143 with the substitution of Leu for Pro at residue 101) induces prion disease in sensitized mice. Samples of this peptide, isotope labeled with <sup>15</sup>N, have been prepared by expression of a fusion in E.coli, cleaved to yield unmodified peptide, and then fibrillized. Hydrogen exchange was allowed to occur in the fibrils for periods from 1 hour to 6 weeks. The extent of exchange was monitored using peak intensities in <sup>15</sup>N-1H HSQC nuclear magnetic resonance spectra in DMSO/D<sub>2</sub>O/TFA solutions that had previously been assigned. The exchange data show a high fraction of amides are protected, with a core set (residues 104-109 and 117-135) exchanging very slowly (<10% exchange in 6 weeks). Some biphasic exchange was observed for residues between 110 and 116 suggesting a conformationally heterogeneous region, possibly relating to strain behavior. Samples of unlabeled, uniformly <sup>13</sup>C/<sup>15</sup>N labeled and selectively <sup>13</sup>C labeled peptide were prepared for solid state NMR experiments.

DTIC

*Diseases; Escherichia; Nuclear Magnetic Resonance; Peptides; Proteins*

**20070027672** Massachusetts Univ. Medical Center, Worcester, MA USA

**Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C**

Carraway, Robert E; Dobner, Paul; Hassan, Sazzad; Jan 2007; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0242

Report No.(s): AD-A468073; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose is to define the relationships between neurotensin (NT) and protein kinase C (PKC) isotypes and to investigate the mechanism by which flavonoids (FLAV) inhibit NT-induced signaling in PC3 cells. The long-range scope is to determine the significance of NT as a participant in the negative effects of high fat intake on PC incidence and growth, and the positive effects of diets containing large amounts of FLAV. Our results show that NT-induced growth signaling in PC3 cells involves and requires the activation of several PKC isotypes, that arachidonic acid release and lipoxygenase activity participate in the signaling process, that cellular metabolism and ATP levels are important inputs to NT receptor function, and that activated PKC feeds back to regulate the ability of NT receptor to bind and to initiate signaling. These findings have implications regarding general mechanisms of G protein-linked receptor function and the design of new agents to block NT-induced growth signaling in PC.

DTIC

*Cancer; Enzymes; Neurotransmitters; Phosphorus; Prostate Gland; Proteins*

**20070027676** McGill Univ., Montreal, Quebec Canada

**Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland**

Foulkes, William; Sep 2006; 83 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0033

Report No.(s): AD-A468077; No Copyright; Avail.: Defense Technical Information Center (DTIC)

At the Montreal site, 240 participants (195 cases) have consented to participate and 230 participants (185 cases) had their

blood drawn. The pedigrees for cases and some controls have been drawn. Ishihara charts were shown to all cases and controls and the results were recorded. At the Switzerland site, case ascertainment is complete and 250 patients have been contacted; 185 have had a consultation with a DNA sampling. As the X chromosome gene has proved to be elusive, we have focused our attention on candidate genes and have studied CHEK2, PALB2, BRCA1, BRCA2 as well as other candidate genes in this series of cases. We have identified several novel mutations in CHEK2 and PALB2, but none of these mutations appear to be thus far associated with prostate cancer risk. Other known mutations, such as BRCA1: 187delAG and BRCA2: 6174delT do not appear to be more frequent in men with prostate cancer. Our work did not support the initial suggestion that some Ashkenazi Jewish men with prostate cancer carried a prostate cancer-associated allele on chromosome 7q. Prostate cancer genetics remains a difficult area of research; our work has mainly eliminated various candidate genes rather than identify causative mutations in prostate cancer susceptibility genes.

DTIC

*Cancer; Chromosomes; Genetics; Linkages; Oncogenes; Populations; Position (Location); Prostate Gland; Quebec; Switzerland*

**20070027681** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity**

Carra, John H; Wannemacher, Robert W; Tammariello, Ralph F; Lindsey, Changhong Y; Dinterman, Richard E; Schokman, Rowena D; Smith, Leonard A; Mar 26, 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468099; TR-07-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ricin is a potent toxin associated with bioterrorism for which no vaccine or specific countermeasures are currently available. A stable, non-toxic and immunogenic recombinant ricin A-chain vaccine (RTA 1-33/44-198) has been developed by protein engineering. We identified optimal formulation conditions for this vaccine under which it remained stable and potent in storage for up to 18 months, and resisted multiple rounds of freeze-thawing without stabilizing co-solvents. Reformulation from phosphate buffer to succinate buffer increased adherence of the protein to aluminum hydroxide adjuvant from 15 to 91%, with a concomitant increase of nearly threefold in effective antigenicity in a mouse model. Using Fourier-transform infrared spectroscopy, we examined the secondary structure of the protein while it was adhered to aluminum hydroxide. Adjuvant adsorption produced only a small apparent change in secondary structure, while significantly stabilizing the protein to thermal denaturation. The vaccine therefore may be safely stored in the presence of adjuvant. Our results suggest that optimization of adherence of a protein antigen to aluminum adjuvant can be a useful route to increasing both stability and effectiveness, and support a role for a 'depot effect' of adjuvant.

DTIC

*Antigens; Countermeasures; Stability; Toxins and Antitoxins; Vaccines*

**20070027690** Army Research Lab., Aberdeen Proving Ground, MD USA

**Assessment of Detection and Refinement Strategies for de novo Protein Structures using Force Field and Statistical Potentials**

Lee, Michael S; Olson, Mark A; Jan 2007; 14 pp.; In English

Contract(s)/Grant(s): Proj-RIID-02-4-1R-069

Report No.(s): AD-A468130; ARL-TR-06-078; No Copyright; Avail.: Defense Technical Information Center (DTIC)

De novo predictions of protein structures at high resolution are challenged by the problem of detecting the native conformation from false energy minima. In this work, we provide an assessment of various detection and refinement protocols on a small subset of the second-generation all-atom Rosetta decoy set (Tsai, et al. *Proteins* 2003, 53, 76-87) by using an all-atom force field and a heavy-atom statistical potential. Detection schemes include minimization followed by conformational scoring and short-time molecular dynamics simulations. Refinement methods include temperature-based replica exchange molecular dynamics and a new computational unfold/refold procedure. Our results indicate that simple detection without any refinement is the best protocol for finding most native-like structures in the decoy set. The refinement techniques that we tested were generally unsuccessful in improving detection; however, they provided marginal improvements to some of the decoy structures.

DTIC

*Field Theory (Physics); Molecular Structure; Proteins*



**20070027691** Southwest Research Inst., San Antonio, TX USA

**Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data**

Kinkler, E S; Convertino, Victor A; Gordon, Donald J; Holcomb, John B; Salinas, Jose; Jun 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-2-0015

Report No.(s): AD-A468131; SWRI-10.10433; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study is designed to acquire near continuous physiologic measurements, beginning at the earliest practical time after injury, on large numbers of injured patients with severe trauma. The study will utilize commercially available FDA-certified monitoring equipment, operating in a fleet of ground EMS ambulances currently serving a large metropolitan area with multiple trauma centers. First Responders may represent the earliest opportunity to acquire meaningful medical data in injury cases. This data will be correlated with significant clinical outcomes within the first 24 hours of admission and entered into a research database. This is the second annual report for the subject project. During the reporting period, upgrade of five project ambulances was completed and pre-hospital patient data was acquired and processed for 29 cases. Analysis supports the hypothesis that ground EMS systems can provide earlier inception of data recording than helicopter services. A new physiological monitor device was deployed in an expanded fleet of ambulances and research to facilitate data collection and interpretation using the new device was initiated. Phase 2 of the subject project was initiated and planned work was re-directed based on results of early investigations. Work is underway to accelerate and expand data collection operations and to enhance data collection and analysis processes.

DTIC

*Data Acquisition; Emergencies; Hospitals; Injuries; Telemedicine*

**20070027699** Antigen Express, Inc., Worcester, MA USA

**Intra-Prostate Cancer Vaccine Inducer**

Humphreys, Robert E; Feb 2005; 36 pp.; In English

Contract(s)/Grant(s): 281XWH-04-1-0279

Report No.(s): AD-A468160; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Substantial progress has been made in creating a simple, feasible method to induce an anti-cancer immune response in prostate cancers or metastases by manipulating the regulation of the immune response. Cancer cells are transformed into antigen presenting cells by inducing of the MHC class II molecules and suppressing the co-induced immunoregulatory Ii protein with antisense or siRNA methods. The resulting anticancer immune response is profound, curing up to 80% of mice with established prostate tumors, transplanted into their normal prostates. The important achievement of this past year has been to design, synthesize and validate two second generation reagents, for mice and humans, that are more potent, simpler to use, and set the stage for definite preclinical validation in mice, and with human tumors in tissue culture. Substantial improvement on the reagent of the original grant proposal was achieved by a) tripling the expression of the reverse gene construct which suppresses Ii protein expression, and b) by both chemical and plasmid genetic forms of small inhibitory RNA, which achieve the same end, but with surprising potency. These substantial technical advances (under Task 1 and 2) set the stage for advancement toward clinical trails (when justified by data from next year's effort).

DTIC

*Cancer; Lymphocytes; Prostate Gland; Ribonucleic Acids; Vaccines*

**20070027731** Scripps Institution of Oceanography, La Jolla, CA USA

**Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems**

Deheyn, Dimitri; Latz, Michael; May 9, 2007; 108 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0164

Report No.(s): AD-A468406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Overall this project has been successful having reached most of the goals originally proposed for the funding period. Screening of light producing organisms (Research Area 1) has been completed in diverse environments, including the Caribbean that was added on a later date. The screening has led to describing the general change with geographical latitude of pigmentation, chemiluminescence and fluorescence in organisms. This has led to documentation of organisms producing light of different color, which could stimulate future research of specific interest for the AFOSR. Also, as a result from this screening, a new Green Fluorescent Protein (GFP) and also been identified from the higher invertebrate (Protochordate) Amphioxus, the most developed invertebrate closest to vertebrate. The discovery of this new GFP (named amphigFP) raised

questions on extent of occurrence of this protein in the Animal Kingdom, considering that GFP had so far been described only from lower invertebrates like jellyfish, corals and some crustaceans.

DTIC

*Animals; Biochemistry; Bioluminescence; Chemiluminescence; Fluorescence; Organisms*

**20070027747** Stanford Univ., Stanford, CA USA

**Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging**

Xing, Lei; May 2006; 229 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0023

Report No.(s): AD-A468461; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Idea Award (DAMD17-03-1-0023, entitled 'Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging') was awarded to the principal investigator (PI) for the period of May 1, 2003 - April 30, 2006. This is the final report for the grant. The goal of this project is to establish biologically conformal -- as opposed to anatomically conformal -- IMRT as a viable modality through integration with 3T magnetic resonance spectroscopic imaging (MRSI) to more effectively kill prostate tumor cells. The underlying hypothesis driving this work is that the MRSI-guided IMRT will provide substantially improved dose distributions required to achieve greater local tumor control while maintaining, or reducing, complications to sensitive structures. The specific aims of the project are: (1) To establish a robust procedure for registering and mapping of MR spectroscopic data to CT/MRI images for prostate irradiation. (2) To develop an inverse planning system for MRSI-guided IMRT prostate treatment and demonstrate the feasibility of concurrent dose escalation to intraprostatic lesion(s) through a set of phantom studies and at least two previously treated prostate cases who had undergone CT/MRSI scans. Under the generous support from the U.S. Army Medical Research and Materiel Command (AMRMC), the PI has contributed significantly to prostate cancer research by applying physics and engineering knowledge to prostate cancer research. A number of significant conference abstracts and refereed papers have resulted from the support. The preliminary data obtained under the support of the grant has also enabled the PI to start new research initiatives, in particular, in adaptive prostate radiation therapy. The past year's research activities of the PI are highlighted in the following.

DTIC

*Cancer; Imaging Techniques; Magnetic Resonance; Prostate Gland; Reusable Heat Shielding; Spectroscopy*

**20070027755** State Univ. of New York, Stony Brook, NY USA

**Novel and Efficient Synthesis of the Promising Drug Candidate Discodermolide**

Parker, Kathyln A; Feb 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0300

Report No.(s): AD-A468483; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the first year of this grant, we have demonstrated proof of principle for both of the premises on which the project is built. We have shown that a macrolide that is available in large quantities can be degraded to provide a building block for a value-added polyketide, specifically discodermolide. Because of difficulties with the original scheme, we applied Corey's cis diene synthesis in this preparation; this proved to be a superior method. We have also shown that chiral, syn anti stereotriad building blocks may be efficiently accessed from a chiral allylic alcohol that was prepared by asymmetric catalysis. This is a practical new approach to these useful intermediates that should have many applications.

DTIC

*Drugs; Steroids*

**20070027757** Brigham and Women's Hospital, Boston, MA USA

**p63 in Development and Maintenance of the Prostate Epithelium**

Signoretti, Sabina; Mar 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0365

Report No.(s): AD-A468492; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this project is to define the role of p63 in the development and maintenance of the prostate epithelium by utilizing both in vivo and in vitro models. In our first year of work, we have successfully constructed the targeting vector for the generation of the p63-Cre-ERT2 knock-in mice to be used for genetic lineage tracing. The p63-Cre-ERT2 vector has been transferred to the DFCI Gene Targeting Core Facility and electroporation in the ES cells will be performed shortly. The strategy for screening of ES cells for homologous recombination has been already designed and probes for Southern Blot analysis have been generated and successfully tested. In addition, we have made progress in exploring the molecular

mechanisms through which p63 regulates development of the prostate epithelium. Specifically, the use of siRNA against p63 has been optimized in various cell lines and, most importantly, p63 shRNA inducible cell lines (including iPrEC) have been generated. Preliminary results obtained utilizing these reagents show that down regulation of p63 in iPrEC cells consistently causes a decrease in cell viability.

DTIC

*Cancer; Epithelium; In Vitro Methods and Tests; In Vivo Methods and Tests; Maintenance; Prostate Gland; Ribonucleic Acids*

**20070027759** Armed Forces Inst. of Pathology, Washington, DC USA

**Cadmium, Zinc, and Selenium Levels in Carcinoma of the Human Prostate**

Sarafanov, Andrey; Centeno, Jose A; Apr 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0407

Report No.(s): AD-A468497; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to examine associations between zinc (Zn), selenium (Se) and cadmium (Cd), on development of prostate cancer. The objectives of this project are: 1) to establish the reliability of using formalin-fixed paraffin embedded (FFPE) prostate tissue by comparing levels of Zn, Se and Cd between FFPE and fresh-frozen unfixed prostate tissues; 2) to enhance our knowledge of prostate cancer environmental etiology by examining the association of Cd, Zn, Se with the development and progression of cancer using FFPE tissues; 3) to enhance the use of the AFIP National Tissue Repository of archival tissues. First objective has been successfully accomplished based on the development of a method which uses high-resolution inductively-coupled mass-spectrometry (ICP-MS) for the analysis of Zn, Cd, Se including arsenic (As) and iron (Fe) in FFPE prostate tissue. Our results have demonstrated that in comparison with fresh tissue, Fe, Se and As do not show much difference in the FFPE tissue. On the other hand, Zn and Cd resulted in ~40% and ~60% loss, respectively, requiring using the correction factors to assess their content in the original tissue. The technique can be useful in various studies for analysis of archival FFPE tissue, and provides a basis for fulfilling the next aim of the project, the

DTIC

*Cadmium; Cancer; Prostate Gland; Selenium; Zinc*

**20070027764** Miami Univ., FL USA

**cSrc and Her2 Signaling Pathways Cooperate with Estrogen to Promote ER Phosphorylation, Ubiquitination and Proteolysis in ER Negative Breast Cancers**

Chu, Isabel; Mar 2007; 68 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0392

Report No.(s): AD-A468502; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancer is the most frequent cancer in women. One third of new breast cancers do not express estrogen receptor (ER) protein and these have a worse prognosis than ER positive breast cancers. The ER is a ligand activated transcription factor. Estrogen:ER binding stimulates rapid Src activation that feeds back to phosphorylate the ER and increases its transcriptional activity. Estrogen binding to the ER rapidly activates ubiquitin-dependent ER proteolysis which in turn regulates ER activity. The data that I present here suggest that Src activates ER proteolysis. Src inhibition impaired estrogen stimulated ER ubiquitylation and proteolysis. The weakly ER positive, MDA-MB-361 and ER negative, BT-20 breast cancer lines both have high Src activity. ER was increased by estrogen deprivation, proteasome inhibition. Src inhibitors impaired ER ubiquitylation and degradation both in vivo and in vitro. Src levels or activity were increased in primary ER negative breast cancers compared to ER positive. We proposed that Src, when recruited by ligand dependent or independent ER activation, leads to ER or co-activator phosphorylation to regulate ubiquitin-dependent ER degradation. Some ER negative breast cancers are estrogen responsive: they express ER mRNA but ER protein levels are undetectable due to accelerated Src mediated ER proteolysis. Oncogenic RTK and Src activation may alter phosphorylation of the ER or of key co-regulators to activate both ER proteolysis and ER target gene transcription. The elucidation of mechanisms underlying ER loss in ER negative breast cancer may indicate why these cancers are so clinically aggressive. Pathways identified may yield new targets for molecular based therapies for this treatment-resistant form of breast cancer.

DTIC

*Breast; Cancer; Estrogens; Mammary Glands; Phosphorylation*

**20070027765** La Jolla Inst., CA USA

**Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin**

Samad, Fahumiya; Sep 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0497

Report No.(s): AD-A468503; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Clinical studies suggest that obesity increases the risk for breast cancer and there is convincing evidence that post-menopausal breast cancer risk is highly correlated with serum estrogen levels. One potential link between obesity and breast cancer risk is increased estrogen production by the adipose tissue itself. The adipose tissue produces the enzyme aromatase which catalyses the biosynthesis of estrogen from androgen and also 17-beta-hydroxysteroid dehydrogenase (17-beta HSD) important for the conversion of estrone to estradiol. Our studies have identified two key molecules (insulin and leptin) in obesity that regulates aromatase and 17-beta HSD synthesis in adipose tissues and in adipocytes. The identification of these target molecules that may ultimately induce estrogen production in the setting of obesity may provide a unique therapeutic preventive strategy to reduce systemic estrogen levels and thereby reduce post-menopausal breast cancer risk associated with obesity.

DTIC

*Adipose Tissues; Breast; Cancer; Estrogens; Insulin; Mammary Glands; Obesity; Risk*

**20070027766** British Columbia Cancer Research Centre, Victoria, British Columbia Canada

**Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum**

Nelson, Brad H; Jan 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0733

Report No.(s): AD-A468504; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have developed a mouse model for ovarian cancer that allows monitoring of tumor-specific T cell clones as they encounter ovarian tumors in vivo. We 'tagged' the neu oncogene with two defined T cell epitopes so as to confer recognition by available T cell receptor (TCR) transgenic T cells. When expressed in the murine ovarian tumor cell line ID8, epitope-tagged neu (designated neuOT1/OT2) induces the formation of aggressive ovarian adenocarcinomas that express the epitope tags and hence are recognizable by adoptively transferred TCR transgenic T cells. We successfully made the neuOT1/OT2 expression construct and stably expressed it in an aggressive subclone of the ID8 cell line, designated ID8-G7, which was derived by serial in vivo passage of the original ID8 line. When injected intraperitoneally into syngenic mice, ID8-G7 cells expressing neuOT1/OT-II give rise within one month to disseminated ovarian cancer with extensive ascites (Aim 1). CD8+ (OT-I) T cells specific for neuOT1/OT-II proliferate extensively after adoptive transfer into tumor-bearing hosts and, remarkably, induce complete tumour regression within 10 days in a dose-dependent manner (Aim 2). We also showed that the dose-dependency of this response can be mitigated by use of autoimmune-prone Cbl-b-deficient CD8+ T cells (Aim 3). Finally, we demonstrated that ascites from these tumours contains a soluble factor that enhances the proliferation of primary and cultured T cells, which may explain the striking proliferative responses seen in Aim2. Future studies will attempt to identify this soluble factor.

DTIC

*Cancer; Diseases; Genetics; Immunity; Mice; Ovaries; Tumors*

**20070027770** Vanderbilt Univ., Nashville, TN USA

**Development of an Automated Modality-Independent Elastographic Image Analysis System for Tumor Screening**

Ou, Jao J; Miga, Michael I; Feb 2007; 76 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0221

Report No.(s): AD-A468508; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project is to further develop modality-independent elastography as a system that is able to reproducibly detect regions of increased stiffness within the breast based on pre- and post- compression input images of the anatomy. As stated in the proposal, the original specific aims are concerned with enhancement of the method, investigation of texture and statistical analyses for evaluating the success of the method, and engineering of a device that can generate proper forces on mock setups within current available clinical imaging systems. To date, progress on each of these aims has been made in handling increased computational complexity, developing and testing metrics for the evaluation of reconstructions, and the fabrication of a compression chamber tested on a tissue-like polymer phantom.

DTIC

*Breast; Cancer; Image Analysis; Mammary Glands; Tumors*

**20070027772** Cold Spring Harbor Lab., New York, NY USA

**A MicroRNA Cluster as a Potential Breast Cancer Oncogene**

Hannon, Gregory J; Mar 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0270

Report No.(s): AD-A468511; No Copyright; Avail.: Defense Technical Information Center (DTIC)

microRNAs (miRNAs) are small, regulatory RNAs that silence target genes by repressing translation and destabilizing mRNAs (1). Recent studies have demonstrated the importance of miRNAs in molecular mechanisms for the oncogenic and tumor suppressor pathways (2) (3) (4). We have identified a novel oncogenic miRNA polycistron, mir17-92, as a potential human oncogene in B-cell lymphomas (5). Since mir17-92 is overexpressed in a subset of breast tumor samples, we explored the role of mir17-92 in the tumorigenesis of breast tumor. Mir-17-92 is able to collaborate with c-myc to accelerate breast tumor formation, and we are further characterizing the molecular mechanisms for this oncogenic collaboration. In addition, we have recently identified a miRNA component of the p53 pathway. mir-34 family microRNAs are direct transcriptional target of p53, and are able to induce growth arrest in both primary cells and tumor cell lines. Since p53 pathway is an important tumor suppressor mechanism in breast cancer development, we will further look into the roles of mir-34 miRNAs in preventing tumorigenesis in breast epithelia.

DTIC

*Breast; Cancer; Carcinogens; Mammary Glands; Oncogenes; Ribonucleic Acids; Tumors; Viruses*

**20070027773** Fox Chase Cancer Center, Philadelphia, PA USA

**Mechanisms and Chemoprevention of Ovarian Carcinogenesis**

Patriotis, Christos; Feb 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0064

Report No.(s): AD-A468512; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Due to its asymptomatic development and frequent diagnosis at advanced stages ovarian cancer is the most deadly among the gynecological cancers. A better understanding of the early molecular events leading to the disease is of utmost importance for the development of strategies for its efficient early diagnosis and prevention which could improve patient survival and quality of life. We have shown that DMBA-induced mutagenesis in the rat ovary combined with gonadotropin hormone-mediated enhanced mitogenesis of the ovarian surface epithelium gives rise to lesion 5 ranging from preneoplastic to early neoplastic and advanced ovarian tumors which resemble the human disease. The goal of the study is to use this animal model to study the molecular mechanisms behind ovarian oncogenesis and to conduct a preclinical trial for its chemoprevention. The aims of the study are: 1) Determine the molecular genetic mechanisms behind ovarian oncogenesis in the DMBA/gonadotropin-animal model; 2) Determine the efficacy of the COX-1 inhibitor SC-560 to prevent the appearance and/or progression of DMBA-induced ovarian lesions; and 3) Study the in vivo mechanisms of the putative chemopreventive effect of COX-2 inhibition. Genomic and mutation analyses as well as other molecular biology assay 5 will be employed to accomplish the objectives of the study.

DTIC

*Cancer; Carcinogens; Ovaries*

**20070027774** Dana Farber Cancer Inst., Boston, MA USA

**Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3**

Zhao, Jean J; Feb 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0341

Report No.(s): AD-A468513; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our research described here is relevant to the pathogenesis and a potential novel therapy for breast cancers. The PIK3CA is the most commonly mutated oncogene in breast cancer and loss of the tumor suppressor PTEN occurs frequently in patients suffering from this disease. The most significant accomplishment during the first year of funding is the generation of the oncogenic PIK3CA transgenic animal model which will allow us to determine the oncogenic role of PIK3CA in tumor initiation progression maintenance and metastasis etc. It should also significantly facilitate preclinical testing for the development of PI3K inhibitors for targeted therapy. Our final goal of simultaneous inactivation of PTEN and activation of PIK3CA will not only provide a new perspective on the relationship of the two key oncogene and tumor suppressor PIK3CA and PTEN and the signaling pathway under their control in cell regulation and oncogenic transformation but also a potential novel therapy to all patients plagued with the common tumorigenic mutations.

DTIC

*Activation; Breast; Cancer; Dosage; Lethality; Mammary Glands; Mutations*

**20070027775** Mayo Clinic, Rochester, MN USA

**PARK2, a Large Common Fragile Site Gene, is Part of a Stress Response Network in Normal Cells That is Disrupted During the Development of Ovarian Cancer**

Smith, David I; Zhu, Yu; Jan 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-0082

Report No.(s): AD-A468514; No Copyright; Avail.: Defense Technical Information Center (DTIC)

PARK2 (Parkin) is an extremely large gene that spans greater than 1.3 megabases of genomic sequence within chromosomal band 6q26. This gene is derived from within the distal end of the highly unstable FRA6E (6q26) common fragile site (CFS). CFSs are large chromosomal regions that are highly unstable, found in all individuals, and prone to deletions and other aberrations, especially in developing cancer cells. The central two questions that we want to address with this work are what role does inactivation of Parkin and other large CFS genes play in the development of ovarian cancer and whether these genes function as part of a stress response network. In order to address these two questions, we have analyzed the effect of re-introducing Parkin (and several other large CFS genes) into ovarian cancer cell lines that do not express it. We have now shown that the re-introduction of Parkin, and several other CFS genes, is associated with greater sensitivity to the induction of apoptosis. This is consistent with our hypothesis that the inactivation of these genes contributes to ovarian cancer development. We have now identified 20 extremely large genes like Parkin that reside within CFS regions. To determine if these genes are randomly inactivated during cancer development, we have utilized realtime RT-PCR analysis to measure the expression of a number of these genes including Parkin in panels of cancer cell lines and primary tumors for cancers of the prostate, ovary, breast, brain and liver. This analysis reveals a decidedly non-random inactivation of the expression of these genes in different cancers. In addition, we've found that there is a greater inactivation of expression of the large CFS genes (and greater numbers of these genes inactivated) in cancers that are generally more aggressive and have a poorer overall clinical prognosis.

DTIC

*Cancer; Genes; Ovaries*

**20070027776** Duke Univ., Durham, NC USA

**Biological Basis for Chemoprevention of Ovarian Cancer**

Berchuck, Andrew; Oct 2006; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0666

Report No.(s): AD-A468515; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To achieve a better understanding of the etiology of ovarian cancer we have initiated a case-control study that considers genetic susceptibility epidemiologic risk factors and acquired genetic alterations. Subjects are interviewed in their homes and about 950 cases and 950 controls have been accrued thus far. Blood and cancer samples have been collected and molecular analyses of polymorphisms in single genes including most recently the androgen receptor have been performed. We also have performed an Illumina array experiment with 1 536 haplotype tagging single nucleotide polymorphisms in about 150 candidate genes. This data presently is being analyzed. We also have played a leadership role in establishing an international consortium in which groups are working together to validate initial positive associations. An initial ovarian cancer chemoprevention trial with levoneoresterel in chickens demonstrated a protective effect and we have shown that progestin mediated apoptosis in the ovarian epithelium is mediated by transforming growth factor-beta. In vitro data has suggested that vitamin D analogues may also represent appealing chemopreventives. A chemoprevention trial in chickens that incorporates both progestins and vitamin D analogues is near completion. These studies have the potential to increase our ability to identify high-risk women and to lead to the development of chemoprevention strategies that might decrease mortality from this disease.

DTIC

*Cancer; Ovaries*

**20070027777** Howard Univ., Washington, DC USA

**Short-Term Exercise and Prostate Cancer Prevention in African American Men**

Taylor, Teletia R; Apr 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0366

Report No.(s): AD-A468516; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study seeks to examine the impact of exercise on serum factors related to prostate cancer in African-American men. Aims and Objectives: 1. To recruit 40 African-American men between the ages of 40 and 70 who are at increased risk for developing prostate cancer and randomize them into an exercise intervention or control group. 2. To examine the effect of 12 days of aerobic exercise over 4 weeks on PSA levels in African-American men who have PSA levels under 4.0 ng/ml. 3. To

examine the effect of 12 days of aerobic exercise on free and total testosterone insulin IGFI and SHBG levels in African-American men. A total of 40 African-American men between the ages of 40 - 70 yrs from the Howard University Cancer Center prostate screening program that have a PSA under 4.0 ng/ml a BMI > 25 and <35 kg/m2 <375 pounds and have been sedentary for at least 6 months (not exercising for more than 20 minutes 2 days a week). The men will be randomized into 2 groups 12 days of aerobic exercise (20 participants) or a control group (20 participants). The 12 days of exercise will consist of 30 minutes of walking on a treadmill at 50 - 60% of maximal heart rate reserve (HRR). Free testosterone lipids glucose insulin SHBG psychosocial measures body weight BMI and body fat anthropometric measurements height and weight will be measured before and after the study.

DTIC

*Africa; Cancer; Human Beings; Males; Physical Exercise; Prevention; Prostate Gland*

**20070027778** Stanford Univ., Stanford, CA USA

**Immunology, Systems Biology, and Immunotherapy of Breast Cancer**

Lee, Peter P; Mar 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0417

Report No.(s): AD-A468517; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This first year of this award has been one of intense infrastructure building. This included recruitment and training of two excellent research associates, two PhD postdoctoral fellows, and one part-time student. I spent several months working closely with Dr. Donna Ferrandino on a human subjects protocol which was approved in August by both the Stanford IRB (protocol ID 4408) and DoD HSRRB (A-13776.2). This enabled us to work closely with our surgery and pathology colleagues to develop an efficient system of identifying, recruiting, and consenting subjects, and to obtain samples from the operating room to pathology and eventually to my laboratory. We tested multiple protocols to maximize recovery of immune cells from tumor and lymph node specimens. We also optimized methods for analysis of fresh and archive samples by flow cytometry, immunohistology, immunofluorescence, function assays, and DNA microarray analysis. The attached annual report is a summary of our progress in relation to my proposed SOW.

DTIC

*Biometrics; Blood; Breast; Cancer; Immunology; Mammary Glands; Physicians; Students*

**20070027779** Oregon Health Sciences Univ., Portland, OR USA

**Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities**

Sahn, David J; Kinney, James; Puntel, Robert; Mar 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0109

Report No.(s): AD-A468518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our partnership of investigators from Madigan Army Medical Center at Fort Lewis Washington and Oregon Health & Science University in Portland will test the hypothesis that trained primary care practitioners or nurses can with telemedicine supervision perform cardiac ultrasound exams on neonates at risk for heart disease and thereby impact time to diagnosis and outcomes. This study is targeted at Military Medical Facilities within TRICARE West and Western Regional Medical Command. It will also include two large Alaska Native Health Care Centers. Echocardiography has had major impact in the management of neonates suspected of having congenital heart disease. The expensive specialized equipment and significant expertise to adequately perform and interpret these studies usually is present only in tertiary level medical centers with a pediatric cardiologist on staff. Initial results of a National Multicenter Neonatal Telemedicine Echo Outcomes Study developed by the Principal Investigator suggest that telemedicine-implemented diagnosis positively affects outcomes in infants suspected of having congenital heart disease. Our partnership has trained 33 non cardiologists to perform neonatal echo and has installed a high bandwidth telecommunications link using the military version of Internet2 NIPRNET. By spring of 2007 we will be overseeing neonatal echo exams from 3 military installations in the NW and in Alaska as well as a large Alaska Native Health Center in Anchorage. We have also arranged to upgrade the scanners used in our network to the latest architecture from Sonosite: the fully digital phased array handheld ultrasound scanner the MicroMaxx.

DTIC

*American Indians; Children; Detection; Diseases; Health; Heart Diseases; Telemedicine; Ultrasonics*

**20070027780** Georgetown Univ., Washington, DC USA

**Prevention of Prostate Cancer by Inositol Hexaphosphate**

Banerjee, Partha P; Feb 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0080

Report No.(s): AD-A468519; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate cancer (PCa) is the most common invasive malignancy and second leading cause of cancer death in men in the USA. Up till now, hormone ablation therapy is the major way to treat PCa. Such therapy only causes a temporary regression and tumor growth resumes within 6-18 months. Therefore, better androgen blockade is not the answer for treating PCa. Rather, research efforts should focus on the therapeutic agents that will inhibit growth factor signaling pathways and thereby inhibit growth. A large number of studies have pointed out that inositol hexaphosphate (IP6) could have beneficial effect on variety of cancers. The specific aims of this proposal are to determine (1) the in vivo effects of IP6 on the growth of PCa (2) the efficacy of IP6 in inhibiting growth factor-induced DNA synthesis of the PCa cells in vitro, and (3) the molecular mechanisms by which IP6 inhibits growth of PCa cells. The information we obtain from these experiments will provide a better understanding of the potential role of IP6 in the prevention of growth of PCa cells. This information will lead to more effective PCa prevention and treatment strategies in human that might prolong the longevity of men with prostate cancer.

DTIC

*Cancer; Inositols; Phosphates; Prevention; Prostate Gland*

**20070027781** Health Research, Inc., Buffalo, NY USA

**GKLF as a Novel Target in Selenium Chemoprevention of Prostate Cancer**

Dong, Yan; Feb 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0009

Report No.(s): AD-A468520; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The present study investigated the functional significance of the zinc finger transcription factor gut-enriched kruppel-like factor (GKLF) in mediating selenium action in the androgen receptor (AR)-null PC-3 human prostate cancer cells. We found that overexpression of GKLF enhances selenium inhibition of DNA synthesis and induction of apoptosis. Furthermore knocking down the expression of GKLF greatly attenuates the growth suppressive and apoptosis inducing activities of selenium. Therefore our data support an important role of GKLF induction in selenium action in the AR-null prostate cancer cells. However we found that in cells expressing a functional AR the disruption of AR signaling is most likely more important than the induction of GKLF signaling for selenium action. Selenium treatment significantly decreases the expression of AR and AR-regulated genes implicated in prostate carcinogenesis (PSA KLK2 ABCC4 DHCR24 and GUCYIA3) in five human prostate cancer cell lines irrespective of their AR genotype (wild-type vs. mutant) or sensitivity to androgen-stimulated growth. Transfection of AR in the androgen-dependent LNCaP cells weakens significantly the inhibitory effect of selenium on cell proliferation and AR target gene expression. Since the vast majority of prostate cancers including those refractory to hormone therapy express a functional AR the disruption of AR signaling is probably more important for selenium action and more relevant to selenium chemoprevention of prostate cancer than the induction of GKLF.

DTIC

*Cancer; Prostate Gland; Selenium; Targets*

**20070027782** Kansas Univ., Kansas City, KS USA

**The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy**

Klemp, Jennifer R; Oct 2006; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468521; DAMD17-03-1-0670; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Significant reductions in quality of life and cognitive function are experienced by women with breast cancer receiving adjuvant chemotherapy. These decrements can be identified in some women even several years following treatment. The majority of relevant research has been based on retrospective data in women with breast cancer. Moreover, current estimates suggest that 25% of breast cancers will be diagnosed in women under age 50, and very little data are available regarding younger women's cognitive function and quality of life during chemotherapy. The goal of the proposed study is to examine change in cognitive function and quality of life in 30 pre-menopausal women with breast cancer receiving chemotherapy. To determine if accelerated menopause is associated with change in cognition and quality of life, serum hormone levels, measures of cognitive function, quality of life variables, and symptoms of depression will be assessed. Measures will be collected at baseline before the initiation of chemotherapy, prior to the third cycle of chemotherapy, and following completion of chemotherapy, but prior to any additional treatment. A better understanding of the association between chemotherapy and



quality of life is essential to provide appropriate preventive approaches and interventions aimed at maximizing the quality of life and health of young women diagnosed with breast cancer.

DTIC

*Breast; Cancer; Chemotherapy; Cognition; Females; Mammary Glands; Social Factors*

**20070027783** Delaware Univ., Newark, DE USA

**Delaware Consortium for Undergraduate Minority Training in Prostate Cancer**

Sikes, Robert A; Usher, David; Feb 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0244

Report No.(s): AD-A468522; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Six academically qualified students 3 each from Delaware St. University (DSU) and Lincoln University were offered slots in the PCR program. Five accepted: 3 from Lincoln and 2 from DSU. Students did 10-week research rotations in addition to attending research seminars and roundtable discussions on the basis of health disparities. This latter topic was not in the initial grant but was received favorably. Students presented research posters in a joint undergraduate research symposium at the end of the summer with almost 200 other students from several summer student research programs. In a poster session at Lincoln University our DoD students swept the prizes for biology I group competition. Students also took their posters to other national meetings. Graduating students from Lincoln University and Del. St. University are applying to Graduate Schools for post-baccalaureate education. One still intends to apply to Medical School. The PI Co-PI and a mentor (Cooper) gave prostate and health disparity lectures at Lincoln University and Delaware State University in 2006. This will continue in 2007. In addition outside speakers of prominence are being recruited to speak in the program.

DTIC

*Cancer; Education; Minorities; Organizations; Prostate Gland; Research Management; Students*

**20070027785** Beth Israel Deaconess Medical Center, Boston, MA USA

**Bisphosphonate-Based Contrast Agents for Radiological Imaging of Microcalcifications**

Palmer, Matthew R; Mar 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0744

Report No.(s): AD-A468525; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An optical imaging system was developed to allow the visualization of novel NIR-tagged radiological contrast agents. A fluorophore-tagged ligand based on alendronate sodium was developed and tested in mice. The system showed strong affinity for physiological calcium and could be further developed as a radiological contrast agent for x-ray mammography.

DTIC

*Images; Imaging Techniques; Radiology; X Rays*

**20070027786** Oregon Health Sciences Univ., Portland, OR USA

**Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on Hormonal Responsiveness of Breast Cancer**

Clinton, Gail M; Jun 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0336

Report No.(s): AD-A468526; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The HER-2 receptor tyrosine kinase (erbB-2) and the estrogen receptor (ER) participate in the establishment and progression of breast cancer. While the anti-estrogen tamoxifen is used as a therapeutic resistance is a clinical problem. Over expression of HER-2 confers resistance to the antiestrogen tamoxifen. The objective was to evaluate the effects of Herstatin a naturally occurring inhibitor of the HER-2 receptor on hormonal responsiveness of breast cancer cells. scope. The effects of Herstatin were tested on MCF-7 and McF-7/HER-2 breast carcinoma cells by stable transfection or treatment with Herstatin in the presence or absence of estrogen. There was no effect of Herstatin on hormonal response of MCF-7 cells with low levels of HER-2 in vivo or in vitro. In McF-7/HER-2 cells, Herstatin enhanced response to estrogen and depressed levels of HER-3. These studies suggest that Herstatin has no effect on hormonal response of MCF7 cells with low levels of HER-2 but may restore hormonal response to breast cancer cells that overexpressHER-2.

DTIC

*Breast; Cancer; Estrogens; Hormones; Mammary Glands*

**20070027787** California Univ., Berkeley, CA USA

**Effects of Extracellular Matrix on DNA Repair in Vivo**

Rizki, Aylin; Sep 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0526

Report No.(s): AD-A468527; No Copyright; Avail.: Defense Technical Information Center (DTIC)

DNA damage in the form of double-strand breaks is caused by exposure to endogenous factors as well as in response to radiation therapy in breast cancer patients. Double-strand breaks can be repaired by homologous recombination or nonhomologous end joining pathways, both of which can lead to error-prone repair. Errors in repair lead to accumulation of mutations that may accelerate the process of tumorigenesis and malignant transformation. Apart from cell cycle effects, little is known about which factors contribute to the determination of double-strand break efficiency or pathway choices in mammalian cells. We previously showed that extracellular matrix signaling can regulate double-strand break repair pathway choice in a human breast epithelial cell line. Furthermore, we find that the kinetics of foci formation by a DNA damage signaling protein after ionizing radiation is altered by extracellular matrix signaling. Here we found that in primary mouse mammary epithelial cells extracellular matrix signaling regulates double-strand repair, as well as the kinetics of damage signaling after ionizing radiation. Having shown that the effects of ECM on DNA damage signaling and repair are generalizable, we will use mouse models with altered extracellular matrix signaling or DNA repair components to genetically dissect this pathway in vivo.

DTIC

*Breast; Cancer; Deoxyribonucleic Acid; In Vivo Methods and Tests; Mammary Glands*

**20070027789** Sloan-Kettering Inst. for Cancer Research, New York, NY USA

**Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy**

Koutcher, Jason A; Jan 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0108

Report No.(s): AD-A468529; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goals of this application are to develop methods to non-invasively differentiate fast and slow growing prostate tumors and also develop methods to evaluate response to anti-angiogenic agents. Validation of the results will be based on tumor growth metastases and microvessel density measurement (anti-angiogenic studies). To date we have focused on optimizing the pulse sequences necessary for lactate detection synthesizing a macromolecular contrast agent and optimizing its use. These goals have been more difficult to achieve but we are now able to localize lactate within a voxel of the tumor with quantitation and have finished synthesizing the macromolecular contrast agent and been using it in studies.

DTIC

*Cancer; Markers; Metastasis; Prostate Gland; Sensitivity; Therapy; Tumors*

**20070027790** Dartmouth Coll., Hanover, NH USA

**Three-Dimensional near Infrared Imaging of Pathophysiological Changes within the Breast**

Yalavarthy, Phaneendra K; Mar 2007; 98 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0328

Report No.(s): AD-A468530; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Diffuse Optical tomography is a non-invasive and non-ionizing medical imaging technique that can image functional properties of biological tissue using Near Infrared (NIR) light. Image reconstruction methods play an important role in characterizing the breast tissue optical properties. New reconstruction methods/algorithms which improve the quantitative and qualitative accuracy of NIR images are developed. At same time, existing methods/algorithms are optimized for the current clinical set up. Algorithms which will take an account of noise characteristics of the instruments were also developed to get an optimal estimate of breast tissue optical properties. Moreover, new methods for effectively using Magnetic resonance image information in NIR image reconstruction procedure were also developed to improve the total outcome of NIR functional images of breast.

DTIC

*Breast; Characterization; Infrared Imagery; Mammary Glands; Near Infrared Radiation; Tomography*

**20070027791** Massachusetts Inst. of Tech., Cambridge, MA USA

**Are Anti-Inflammatory Lymphocytes Able to Induce Remission of Breast Cancer. Addendum**

Erdman, Susan E; Feb 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0460

Report No.(s): AD-A468531; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent studies suggest that inflammation is a key contributor to development of breast cancer in women. Increasing scientific and medical data point to immune cells in particular pro-inflammatory CD4+ effector (TE) cells and anti-inflammatory CD4+regulatory (TR) cells as pivotal mediators in human health and disease. We have previously demonstrated that anti-inflammatory TR cells prevent colorectal cancer (CRC) in mice by suppressing inflammatory growth factors. We show here that transfer of pro-inflammatory TE cells or infection with pro-inflammatory intestinal bacteria *Helicobacter hepaticus* rapidly promotes mammary tumor development in the *ApcMin/+* mouse model and that adoptive transfer of TR cells inhibits development of inflammation-associated mammary tumors induced by either pro-inflammatory cells or intestinal bacteria in those mice. Targeting deleterious host inflammatory responses may be more effective and less toxic than traditional chemotherapeutic approaches to neoplasia. Ability to understand and harness the potency of TR cells to suppress inflammatory carcinogenic processes may prevent and ultimately abolish breast malignancies in women.

DTIC

*Breast; Cancer; Carcinogens; Chemotherapy; Lymphocytes; Mammary Glands*

**20070027793** American Registry of Pathology, Washington, DC USA

**The Significance of Focal Basal Cell Layer Disruption-Induced Immuno-Cell Infiltration in Prostate Cancer Invasion**

Man, Yang-gao; Mar 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0382

Report No.(s): AD-A468534; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Using multidisciplinary approaches, our studies assessed the physical status of prostate basal cell layers and the impact of basal cells on the biological presentation of associated epithelial cells. Our studies showed that focally disrupted basal cell layers had the following unique features (1) significantly lower proliferation; (2) significantly lower p63 expression; (3) significantly higher apoptosis; (4) significantly higher leukocyte infiltration and stromal reactions.

DTIC

*Cancer; Epithelium; Infiltration; Prostate Gland*

**20070027794** Cincinnati Univ., OH USA

**Antagonism of Taxol Cytotoxicity by Prolactin: Implications for Patient Resistance to Chemotherapy**

Ben-Jonathan, Nira; Mar 2007; 13 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0359

Report No.(s): AD-A468538; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this investigation is to examine the protective effects of prolactin (PRL) against anti-cancer drugs. Three specific aims were formulated: 1) To characterize the protective effects of PRL against several anticancer drugs 2) To determine anti-apoptotic mechanism(s) and 3) To examine the protective effects of PRL in vivo. Good progress has been made in all objectives as follows. First we have shown the protective effects of PRL against taxol cisplatin and vinblastine in more than one breast cancer cell line. Two we defined the window of time for the action of PRL. Three we have established qualitative and quantitative assays for apoptosis. Due to taxol cytotoxicity initial in vivo studies were unsuccessful. Future research will be redirected to an emphasis on anti-cancer drugs other than taxol and the use of SCID rather than PRL4- mice.

DTIC

*Breast; Cancer; Chemotherapy; Mammary Glands; Patients; Pituitary Hormones*

**20070027795** Cold Spring Harbor Lab., New York, NY USA

**Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer**

Hannon, Gregory J; Mar 2007; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0249

Report No.(s): AD-A468539; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The application of RNAi has transformed the way we approach mammalian cell genetics. Over the past year we have made significant progress in several areas that have enhanced the use of shRNAs as a tool for genetic screens. Our second-generation shRNA retroviral library now covers 32,202 genes (86,128 clones) for human and 30,629 genes (76,896

clones) for mouse genomes. These shRNA can be delivered into cells both in vitro and in vivo using our optimized viral expression vectors. More importantly with these tools we have successfully demonstrated the feasibility of performing genetic screens in mouse and human cells through our pilot efforts. Using the 'synthetic-lethal genetic approach we can now perform drug-induced synthetic-lethal screens by using cancer drugs that are currently in clinical trials. This is important as cancer cells can often become resistant to the toxic effects of chemotherapeutics. Bortezomib (Velcade) is the first targeted therapeutic to the proteasome approved by the FDA for treatment against multiple myeloma and is currently in phase II clinical trials for breast and lung cancers. Our goal is to identify genes that mediate resistance against Velcade that could serve as potential drug targets. RNAi technology is a powerful tool that could potentially be used to study and treat other human diseases through its application to mammalian cell genetics.

DTIC

*Breast; Cancer; Genes; Inhibitors; Libraries; Mammary Glands; Sensitivity*

**20070027800** Massachusetts Inst. of Tech., Cambridge, MA USA

**Development of Novel Bifunctional Compounds that Induce Apoptosis in Prostate Cancer Cells**

Essigmann, John M; Mar 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0183

Report No.(s): AD-A468546; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have designed and synthesized a novel compound (11beta) that efficiently triggers apoptosis in prostate cancer cells such as LNCaP. This bifunctional compound was designed to form DNA adducts that are camouflaged by the androgen receptor making them less readily repaired in AR+ prostate cancer cells. The aims of our studies are to investigate the mechanisms by which 11 is able to trigger apoptosis in target cells. Methods have been developed that permit us to determine the fates of 11 -DNA adducts in treated cells in culture as well as in tumors growing in animal models. Another objective is to identify the signaling events that lead from DNA adducts to activation of the apoptotic program. Finally we have obtained encouraging results from animal experiments that indicate that molecules such as 11 may have clinical potential for the treatment of human tumors.

DTIC

*Apoptosis; Cancer; Prostate Gland*

**20070027810** Chicago Univ., Chicago, IL USA

**Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation**

Arkani-Hamed, Sanaz; Mar 2007; 133 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0329

Report No.(s): AD-A468562; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Mice are widely used in the study of breast cancer to increase understanding of cancer development and to evaluate new therapies. Noninvasive imaging methods are a crucial component of the effective use of mouse models of breast cancer. However prior imaging studies of mammary cancer in mice have focused on large palpable tumors at an advanced stage of invasion that are rarely orthotopic and are poor models for the human cancers commonly seen clinically. Here high resolution MR was used to image spontaneous early and nonpalpable cancers transgenic mouse model of breast cancer. After correlation with histology MRI was able to clearly detect large 5mm tumors small nonpalpable 0.5-1.5mm tumors and even smaller ducts distended with preinvasive ductal carcinoma in situ 300500 microns in diameter with very high sensitivity and specificity. This is the first report of in vivo imaging of early spontaneous mouse mammary cancer. Because of its similarity to human breast cancer in vivo MRI of early orthotopic murine mammary cancer will be an important tool for real time study of the development and progression of breast cancer in vivo. These techniques can be used to develop new therapies that target early breast cancer and to find new ways of detecting early breast cancer.

DTIC

*Breast; Cancer; Detection; Imaging Techniques; Magnetic Resonance; Mammary Glands; Mice*

**20070027812** Mount Sinai School of Medicine, New York, NY USA

**Restoration of Wild-Type Activity to Mutant p53 in Prostate Cancer: A Novel Therapeutic Approach**

Manfredi, James J; Jan 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0109

Report No.(s): AD-A468564; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A summary is presented of research performed during the second year of a project to explore approaches to restore

wild-type function on mutant p53 proteins found in human prostate tumors. p53 mutant proteins derived from prostate tumors are being characterized to determine their suitability. Three specific aims are being pursued. The first is characterizing the interaction of p53 with two distinct classes of its response elements. The second aim is determining the role of mutant p53 proteins in prostate cancer cell proliferation. The final aim is to explore approaches to restore wild-type function to mutant p53 proteins found in prostate cancer. This is a chemical biological approach with the goal of restoring wild-type function to prostate tumor- derived mutant p53 proteins. This research is geared towards preclinical development of a highly targeted therapy for human prostate cancer.

DTIC

*Cancer; Deoxyribonucleic Acid; Mutations; Prostate Gland; Restoration; Therapy*

**20070027813** Pennsylvania Univ., Philadelphia, PA USA

**Preventing Epilepsy after Traumatic Brain Injury**

Dichter, Marc A; Feb 2007; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0020

Report No.(s): AD-A468565; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to determine the safety and tolerability of topiramate (TPM) in the treatment of early seizures following traumatic brain injury (TBI) and to compare the efficacy of TPM to prevent early seizures to the standard of care (phenytoin). A secondary objective is to obtain the data necessary to design a randomized clinical trial to determine if TPM can prevent epilepsy and improve neurological outcome after TBI. In the first two years of the study we formulated the protocol and all documents required by regulatory bodies. These were approved by the IRB at the University of Pennsylvania HSRRB at the US Army and the FDA. The infrastructure for the study was established relevant personnel were hired and the patient recruitment methods interactions with the trauma center neurosurgical services EEG laboratory pharmacy etc. were organized in order to conduct the research. Patient recruitment was begun but after screening more than 100 prospective patients with TBI no patients were able to be admitted to the study as it was constituted for several unforeseen technical reasons. The protocol has been revised to eliminate these obstacles. In addition a NINDS-sponsored workshop on Biomarkers for Epileptogenesis was held and a program of new potential biomarkers was incorporated into the study.

DTIC

*Brain Damage; Epilepsy; Injuries*

**20070027814** State Univ. of New York, Stony Brook, NY USA

**Validation of Quantitative Multimodality Analysis of Telomerase Activity in Urine Cells as a Noninvasive Diagnostic and Prognostic Tool for Prostate Cancer**

Botchkina, Galina I; Adler, Howard L; Aug 2005; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0774

Report No.(s): AD-A468571; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major goal of this project was to develop a clinical trial focused on the validation of diagnostic and prognostic utility of quantitative analysis of telomerase activity in exfoliated cells in urine as a molecular marker and clinical tool for: 1) noninvasive early detection of prostate cancer; and 2) determination of indolent asymptomatic carcinomas that have potential to develop into invasive disease and require treatment. We report here that our research and clinical teams are completely ready to carry out the proposed clinical trial. We have developed and optimized all research and clinical protocols. We have prepared all material resources for large-scale complex analysis of telomerase activity in patients exfoliated cancer cells. We have established a reliable crosscommunication between our clinical and research personnel.

DTIC

*Cancer; Detection; Prostate Gland; Quantitative Analysis; Urine*

**20070027819** Louisiana State Univ., Baton Rouge, LA USA

**Military Nutrition Research: Four Tasks to Address Personnel Readiness and Warfighter Performance**

Ryan, Donna; Mar 2007; 53 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0081

Report No.(s): AD-A468579; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Background: Pennington Biomedical Research Center (PBRC) continues a 19 year collaborative effort with the Department of Defense (DOD) in this research effort. Objectives: To assess and evaluate novel ways to sustain warfighter performance during high intensity missions at home and abroad, under special funded cooperative agreements between the US

Army Medical Research and Materiel Command (USAMRMC) and PBRC, PBRC provides high quality analytical laboratory, nutrition database and metabolic unit support for military nutrition clinical research protocols. Specific Aims: PBRC performed four research tasks as follows: Task 1: Clinical Laboratory for Human Samples; Task 2: Stable Isotope Laboratory; Task 3: Nutrient Database Laboratory; Task Metabolic Unit Project. During the year of this report, the four tasks supported eight projects directed by USARIEM investigators. Study Design: In consultation with the Project Officer at US Army Research Institute of Environmental Medicine (USARIEM), PBRC Task Leaders for Tasks 1 and 2 determine the number, timing, type of sample and type of analysis. Analysis of relevant endpoints in the PBRC Clinical Laboratory and Stable Isotope Laboratory provides information useful for determination of energy expenditure, water turnover, body composition, clinical biochemistry and metabolism. In consultation with the Project Officer, the Task Leader for Task 3 provides assistance with food intake analysis and nutrient composition. In consultation with the Project Officer, the Task Leader for Task 4 provides access to the PBRC Metabolic Unit, where capabilities exist for clinical studies of relevance to energy metabolism using state of the art facilities for metabolic chambers and magnetic resonance spectroscopy.

DTIC

*Medical Science; Military Technology; Nutrition; Personnel; Research and Development*

**20070027820** University of Southern California, Redondo Beach, CA USA

**The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq**

Clark, Richard E; Dec 2006; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-C-0093

Report No.(s): AD-A468582; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prior attempts to use standard 'self report' or interview protocols to extract After Action Review (AAR) descriptions of emergency event decision making and problem solving strategies generated by participants are problematical. Cognitive psychological studies suggest that the resulting information often contains significant errors and omissions (Glaser et al., 1985; Besnard, 2000). These errors are not often recognized by participants who solved important problems in emergency situations and wish to give accurate reports on their solutions because the knowledge they are describing is largely automated and unconscious (Wheatley & Wegner, 2001). The problem is further complicated by the fact that experienced medical personnel mistakenly believe that their reports are complete and accurate and that they solved the problems they are describing in a conscious, willful, deliberate manner (Wegner, 2002). These reporting errors most likely increase in number and severity under time-pressure battlefield situations (Hunt & Joslyn, 2000). This research attempts to improve medical AAR with a novel combination of Cognitive Task Analysis conducted while interviewees moulage simulators (Clark and Estes, 2002; Clark & Estes, 1996; Velmahos et al, 2002). Nine trauma surgeons who have used Argyle-type shunts to repair femoral artery damage have been interviewed separately and together. Data from these interviews are being analyzed for a report that will be written by 12/31/2006. It is hypothesized that our protocol which employed a novel combination of medical Cognitive Task Analysis combined with the moulage of instruments and depictions of the femoral artery will more accurately capture the mix of automated and conscious decisions used to solve critical medical problems faced in battlefield situations.. Each surgeon was interviewed separately and after reviewing the results, each surgeon was asked to correct and improve on the information gathered from the 'other' surgeons.

DTIC

*Decision Making; Iraq; Mental Performance; Problem Solving; Simulators; Tasks*

**20070027821** University of Southern California, Los Angeles, CA USA

**The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq**

Clark, Richard E; Mar 2007; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-C-0093

Report No.(s): AD-A468583; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prior attempts to use standard 'self report' or interview protocols to extract After Action Review (AAR) descriptions of emergency event decision making and problem solving strategies generated by participants are problematical. Cognitive psychological studies suggest that the resulting information often contains significant errors and omissions (Glaser et al., 1985; Besnard, 2000). These errors are not often recognized by participants who solved important problems in emergency situations and wish to give accurate reports on their solutions because the knowledge they are describing is largely automated and unconscious (Wheatley & Wegner, 2001). The problem is further complicated by the fact that experienced medical personnel mistakenly believe that their reports are complete and accurate and that they solved the problems they are describing in a conscious, willful, deliberate manner (Wegner, 2002). These reporting errors most likely increase in number and severity under time-pressure battlefield situations (Hunt & Joslyn, 2000). This research attempts to improve medical AAR with a novel

combination of Cognitive Task Analysis (CTA) conducted while interviewees moulage simulators (Clark and Estes, 2002; Clark & Estes, 1996; Velmahos et al, 2002). Nine trauma surgeons, who have used Argyle-type shunts to repair femoral artery damage, were interviewed, in which they simply described (no CTA) the procedure. A full CTA was conducted with a tenth trauma surgeon with similar experience in the procedure. The interviews were coded and compared with a gold standard protocol. It was hypothesized that our protocol which employed a novel combination of medical Cognitive Task Analysis combined with the moulage of instruments and depictions of the femoral artery will more accurately capture the mix of automated and conscious decisions used to solve critical medical problems faced in battlefield situations.

DTIC

*Decision Making; Emergencies; Injuries; Iraq; Mental Performance; Simulators; Tasks*

**20070028430** Air Force Medical Operations Agency, Falls Church, VA USA

**COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care**

Reichard, G D; Demitry, Peter; Catalino, Joseph; Sep 2004; 31 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466937; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466937>

Delayed recognition and response to health syndromes in the past have highlighted the critical need for real-time surveillance of the health status of forces as an enabling capability for decision makers. Real-time surveillance serves to alert health authorities and make possible rapid, appropriate, and effective responses to limit the adverse impact of occupational and operational threats to health. In support of Force Health Protection, the USAF Surgeon General has recognized a need for early detection of syndromes and epidemics in specific cohorts (subpopulations) over time. Cohort surveillance and monitoring require analytical tools and access to pertinent, timely, and consolidated medical data. The Composite Occupational Health and Operational Risk Tracking system (COHORT) addresses the USAF Surgeon General's need by providing real-time surveillance of the medical care and treatment of specified groups of military personnel across multiple medical health facilities throughout the world. The medical encounter data aggregated by COHORT provide input for timely detection and monitoring of occupational health concerns and disease trends, syndromes, and outbreaks. The early detection made possible by COHORT avails key decision makers the opportunity to formulate appropriate responses in time to make a difference in the outcome.

DTIC

*Health; Medical Services; Military Personnel; Risk; Surveillance*

**20070028432** National Defense Univ., Washington, DC USA

**Weathering the Storm. Leading Your Organization Through a Pandemic**

Prior, Stephen; Armstrong, Robert; Rowan, Ford; Hill-Harmon, Mary B; Nov 2006; 78 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466801; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466801>

A storm is coming. None of us have ever experienced a storm like this. It could arrive very soon. But, as anyone who makes a living as a forecaster will quickly say, On the other hand . . . The storm is, of course, an influenza pandemic. Much has been written in the past few years about the virus known as H5N1 and its potential to develop into a pandemic. Some in the scientific community are questioning whether that will ever happen. If H5N1 does become pandemic, we have no basis for predicting whether it will be this year or 10 years from now. After all, H5N1 was first identified in birds in 1961; the first human cases did not appear until 1997. There is little doubt, though, that eventually something most likely a virus will mutate into a pandemic form. The SARS outbreak in February 2003 is a good example of how a lethal virus can emerge suddenly. We were fortunate that SARS, while contagious, did not become pandemic. The SARS outbreak and the emergence of H5N1 avian influenza provide us with a forewarning of the problems a larger outbreak will pose. It is prudent to use this time before the storm to plan for the societal disruption a pandemic will cause. A pandemic poses problems that most disasters even ordinary public health disasters do not present. First, the time period of the disaster is extended; the 1918 pandemic lasted about 18 months, with three distinct peaks of infection and illness. Another issue with a pandemic is its geographic spread; modern air travel can deliver any pathogen worldwide in a very short time frame. Thus, our planning has to take into account the necessity to change our social behaviors and possibly restrict our movements to limit the pathogen's spread.

DTIC

*Emergencies; Influenza; Management Methods; Storms; Weathering*

**20070028481** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins**

Webb, Robert P; Smith, Theresa J; Wright, Patrick M; Montgomery, Vicki A; Meagher, Michael M; Smith, Leonard A; Mar 16, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-USAMRIID-02-4-3U-064

Report No.(s): AD-A468185; ARL-TR-06-114; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468185>

Recombinant botulinum Hc (rBoNT Hc) vaccines for serotypes C1 and D were produced in the yeast *Pichia pastoris* and used to determine protection against four distinct BoNT C and D toxin subtypes. Mice were vaccinated with rBoNT/C1 Hc, rBoNT/D Hc, or with a combination of both vaccines and challenged with BoNT C1, D, C/D, or D/C toxin. Mice receiving monovalent vaccinations were partially or completely protected against homologous toxin and not protected against heterologous toxin. Bivalent vaccine candidates completely survived challenges from all toxins except D/C toxin. These results indicate the recombinant C1 and D Hc vaccines are not only effective in a monovalent formula but offer protection against both parental and mosaic toxins when delivered as a bivalent vaccine.

DTIC

*Clostridium Botulinum; Protection; Vaccines*

**20070028510** Minnesota Univ., Minneapolis, MN USA

**fRMSDPred: Predicting Local RMSD Between Structural Fragments Using Sequence Information**

Rangwala, Huzefa; Karypis, George; Apr 4, 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0014; NSF-EIA-9986042

Report No.(s): AD-A467651; TR-07-011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effectiveness of comparative modeling approaches for protein structure prediction can be substantially improved by incorporating predicted structural information in the initial sequence-structure alignment. Motivated by the approaches used to align protein structures, this paper focuses on developing machine learning approaches for estimating the RMSD value of a pair of protein fragments. These estimated fragment-level RMSD values can be used to construct the alignment, assess the quality of an alignment, and identify high-quality alignment segments. We present algorithms to solve this fragment-level RMSD prediction problem using a supervised learning framework based on support vector regression and classification that incorporates protein profiles, predicted secondary structure, effective information encoding schemes, and novel second-order pairwise exponential kernel functions. Our comprehensive empirical study shows superior results compared to the profile-to-profile scoring schemes.

DTIC

*Fragments; Predictions; Proteins; Regression Analysis*

**20070028750** Army War Coll., Carlisle Barracks, PA USA

**Post Traumatic Stress Disorder: The Facts**

Murray, Mark A; Feb 22, 2007; 18 pp.; In English

Report No.(s): AD-A467315; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Following the attacks on the Twin Towers of the World Trade Center and the Pentagon on 11 September 2001, the USA began the Global War on Terror (GWOT) on 07 October 2001 in Afghanistan and expanded the war to include Iraq in March of 2003. As a result of GWOT hundreds of thousands of service men and women have been deployed to Iraq and Afghanistan with 3,410 killed and another 24,795 physically wounded as of 22 February 2007. Likewise, thousands of other service men and women of all ranks have been psychologically wounded and subsequently diagnosed with Post Traumatic Stress Disorder (PTSD) or symptoms of PTSD. With the apparent increased awareness and diagnosis among service members, little is actually known and understood about PTSD among aspiring strategic leaders. This strategic research project will examine and hopefully dispel the myths about PTSD for strategic leaders by answering the following basic questions. What is PTSD, historical understanding of PTSD, how does PTSD develop, what are the symptoms of PTSD, how common is PTSD, who is most likely to develop PTSD, what are the consequences of PTSD, what are scientists learning from the research, and how is PTSD treated?

DTIC

*Neuroses; Stress (Biology); Disorders; Warfare*



**20070028795** California Univ., San Francisco, CA USA

**Role of Merlin in the Growth and Transformation of Arachnoidal Cells**

Lal, Anita; Jan 1, 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0221

Report No.(s): AD-A467980; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This proposal is concerned with the functional role of merlin in arachnoidal and meningioma cells. The focus of year 1 was to characterize and develop meningioma-specific NF2 model systems. We have successfully generated three additional meningioma cell lines. The expression of merlin was quantitated at the transcript and protein level in these and arachnoidal cells. The KT21MG1 cell line is merlin-deficient and contains a novel splice site mutation between exon 14 and 15. This alternative splicing results in a 79 bp insertion that encodes for truncated merlin. We have used a tetracycline inducible system, to express wild type merlin and the L64P, S518A and S518D mutant forms of merlin in KT21MG1. Additionally, we have tested the ability of three NF2-specific short interfering RNA (siRNA) to silence merlin. Two siRNAs significantly reduced transcript and protein levels of merlin in arachnoidal cells and the SF6717 meningioma cell line. Stable suppression of merlin in these cell lines has been achieved using the pSUPER retroviral RNAi system. In summary, we have successfully developed three meningioma-specific NF2 model systems. In the subsequent 2 years, we will use these systems to understand the mechanistic role of merlin and to investigate meningioma cell type specific functions.

DTIC

*Cytology; Cells (Biology); Molecular Biology*

**20070028803** California Univ., Davis, CA USA

**State of the Science Meeting: Burn Care: Goals for Treatment and Research**

Palmieri, Tina L; Nov 2006; 158 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0008

Report No.(s): AD-A467898; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Burn State of the Science Research Conference achieved its stated purpose: the identification and prioritization of burn research goals for the next decade and the delineation of the resources needed to achieve those goals. Issues ranging from acute burn care through the rehabilitative period were addressed in a single forum and published in the Journal of Burn Care and Research. Although much progress has been made in burn management, much remains to be learned. Universal definitions, endpoints of care, and grading systems which can be applied for both clinical and basic science research are lacking. Consensus in these areas is vital to conducting meaningful research, but these conclusions need to be validated via basic science, pilot clinical studies, and multicenter randomized trials to define the 'best' burn care. The greatest achievement of the conference was the open interaction it fostered between researchers, clinicians, burn survivors, funding organizations, journal editors, military personnel, and international burn researchers. The findings of this conference will be the basis for the burn research of the future.

DTIC

*Medical Science; Burns (Injuries)*

**20070028912** NASA Johnson Space Center, Houston, TX, USA

**Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations**

Hada, Megumi; Cucinotta, F. A.; Gonda, S. R.; Wu, H.; November 16, 2005; 1 pp.; In English; The 1st Asian Congress of Radiation Research, 16-17 Nov. 2005, Hiroshima, Japan; No Copyright; Avail.: Other Sources; Abstract Only

Energetic heavy ions pose a great health risk to astronauts in extended ISS and future exploration missions. High-LET heavy ions are particularly effective in causing various biological effects, including cell inactivation, genetic mutations and cancer induction. Most of these biological endpoints are closely related to chromosomal damage, which can be utilized as a biomarker for radiation insults. Previously, we had studied chromosome aberrations in human lymphocytes and fibroblasts induced by both low- and high-LET radiation using FISH and multicolor fluorescence in situ hybridization (mFISH) techniques. In this study, we exposed human cells in vitro to gamma rays and energetic particles of varying types and energies and dose rates, and analyzed chromosomal damages using the multicolor banding in situ hybridization (mBAND) procedure. Confluent human epithelial cells and lymphocytes were exposed to energetic heavy ions at NASA Space Radiation Laboratory (NSRL) at the Brookhaven National Laboratory (Upton, NY) or Cs-137 gamma radiation source at the Baylor College (Houston, TX). After colcemid and Calyculin A treatment, cells were fixed and painted with XCyte3 mBAND kit (MetaSystems) and chromosome aberrations were analyzed with mBAND analysis system (MetaSystems). With this technique, individually painted chromosomal bands on one chromosome allowed the identification of interchromosomal aberrations (translocation to unpainted chromosomes) and intrachromosomal aberrations (inversions and deletions within a

single painted chromosome). The possible relationship between the frequency of inter- and intra-chromosomal exchanges and the track structure of radiation is discussed. The work was supported by the NASA Space Radiation Health Program.

Author

*Chromosome Aberrations; Cells (Biology); In Vitro Methods and Tests; Gamma Rays*

**20070029228** NASA Johnson Space Center, Houston, TX, USA

**Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development**

Nickerson, Cheryl A.; Honer zu Bentrup, Kerstin; Ott, C. Mark; [2005]; 11 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Three-dimensional (3-D) cell cultures hold enormous potential to advance our understanding of infectious disease and to effectively translate basic cellular research into clinical applications. Using novel NASA bioreactor technology, the rotating wall vessel (RWV), we have engineered physiologically relevant 3-D human tissue culture models for infectious disease studies. The design of the RWV is based on the understanding that organs and tissues function in a 3-D environment, and that this 3-D architecture is critical for the differentiated form and function of tissues in vivo. The RWV provides large numbers of cells which are amenable to a wide variety of experimental manipulations and provides an easy, reproducible, and cost-effective approach to enhance differentiated features of cell culture models.

Author

*Cell Culturing; Three Dimensional Models; Infectious Diseases; Drugs; Clinical Medicine*

**20070029507** Johns Hopkins Univ., Baltimore, MD USA

**Prostate Cancer Gene Discovery Using ROMA**

Isaacs, William B; Dec 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0189

Report No.(s): AD-A468543; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468543>

The authors hypothesize that a subset of men who develop prostate cancer do so as a result of an inherited chromosomal deletion or amplification, affecting the function of one or more critical prostate cancer susceptibility genes. These chromosomal abnormalities, and the affected gene(s) can be identified using the novel technique, ROMA. Together with their collaborators at Cold Spring Harbor, they have now performed ROMA analysis of 90 prostate cancer patients, each with a strong family history of prostate cancer (having at least two affected first-degree relatives). The majority of these men had either early onset prostate cancer (diagnosis before age 60) or evidence of advanced disease (non-organ confined disease). Over 1,100 copy number polymorphisms (CNPs), including many recurring CNPs, have been observed in these 90 patients. These CNPs include 33 novel CNPs that have never (or rarely) been seen in control samples. Of these 33 novel CNPs, one can rule out a causal role for at least 5 based on lack of cosegregation with disease in families in which multiple affected members have been subjected to ROMA analysis. An additional 15 novel CNPs do not affect the coding sequences of any known genes. Currently, the authors are examining both common and rare CNPs in additional cases and controls for evidence of an association with prostate cancer risk.

DTIC

*Abnormalities; Amplification; Cancer; Chromosomes; Deletion; Polymorphism; Prostate Gland*

**20070029512** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**NMR Analysis of Thiodiglycol Oxidation by Mammalian Alcohol Dehydrogenases**

Novak, Mark J; Brimfield, Alan A; Jan 2006; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468601; USAMRICD-P06-010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468601>

This unit describes a proton nuclear magnetic resonance (<sup>1</sup>H NMR)-based methodology for investigation of thiodiglycol (TDG; Fig. 4.20.1A) transformation by human and equine alcohol dehydrogenases (ADH). An ultraviolet/visible (UV/vis) spectrophotometric method is also described in support of the NMR protocol. Its purpose is to initially indicate if TDG is actually a substrate for the various ADH isozymes before the more complicated NMR protocol is undertaken. Once verified spectrophotometrically that TDG is a substrate for a particular ADH isozyme, <sup>1</sup>H NMR is used to obtain structural and kinetic data on the products as they form. Although interest was established for the study of TDG metabolism with regard to how the hydrolysis of sulfur mustard (Fig. 4.20.1A) may contribute to its toxicity, the protocols in this unit can be applied as general methods for the metabolic study of different water-soluble xenobiotics using ADMs. Access to NMR depends upon the facility

in which an individual researcher works. Most large institutions have a centralized NMR facility where samples are submitted to an appointed scientist or technician. Because the personnel of the NMR facility have control of the instrumentation, they are responsible for acquiring data. This takes the operational aspects of running the NMR out of the hands of the researcher. Smaller research institutions usually have NMR as standard equipment, but they rely on the individual principal investigators and/or students to personally carry out their experiments as operators of the instrument. As such, this unit is being written in context of aiding an investigator who has to personally acquire and interpret the data. There are also multiple manufacturers of NMR spectrometers, each having a unique operational protocol. Therefore, this unit is also written from the standpoint that the specific operational steps in acquiring a spectrum are omitted.

DTIC

*Alcohols; Mammals; Nuclear Magnetic Resonance; Oxidation*

**20070029516** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds?**

Maxwell, Donald M; Brecht, Karen M; Koplovitz, Irwin; Sweeney, Richard E; Jan 2006; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468608; USAMRICD-P06-012; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468608>

The hypothesis that acetylcholinesterase (AChE) inhibition is the mechanism of toxicity of organophosphorus (OP) compounds was examined by mathematically modeling the in vivo lethal effects of OP compounds and determining the amount of variation in OP toxicity that is explained by AChE inhibition. Mortality dose-response curves for several OP compounds (i.e., VX, soman, cyclosarin, sarin, tabun, diisopropylfluorophosphate and paraoxon) exhibited steep probit slopes (> 9.6) in guinea pigs. Steep probit slopes were also observed when the mortality dose-response curves for soman were examined in mice, rats, rabbits and non-human primates. The consistently steep probit slopes of the dose-response curves for highly toxic OP compounds suggested that these compounds have a single specific mechanism of toxicity regardless of the OP compound or the species in which it was tested. Regression analysis indicated that 93% of the 3,280-fold variation in the median lethal doses (i.e., LD50) of OP compounds in rats was explained by the variation in their in vitro rate constants for inhibition of AChE. Conversely, 91% of the 23-fold variation in the ability of the oximes pralidoxime and obidoxime to protect against the toxicity of OP compounds in guinea pigs was explained by the variation in the in vitro ability of oximes to reactivate OP-inhibited AChE. The best explanation for this variety of observations was that the primary mechanism of in vivo toxicity for highly toxic OP compounds is the inhibition of AChE, and the residual unexplained variation in OP toxicity that might be explained by other mechanisms represents < 10% of the total variation in OP toxicity.

DTIC

*Acetyl Compounds; Cholinesterase; Dosage; Organic Phosphorus Compounds; Toxicity*

**20070029517** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Atropine and Other Anticholinergic Drugs**

McDonough, John H; Shih, Tsung-Ming; Jan 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468611; USAMRICD-P05-032; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468611>

The nerve agents are highly toxic organophosphorous (OP) compounds. The agents of greatest concern, along with their chemical names and two-letter military designations, are tabun (o-ethyl N,N-dimethyl phosphoramidocyanidate; GA), sarin (isopropyl methylphosphonofluoridate; GB), soman (pinacolyl methylphosphonofluoridate; GD), cyclosarin (cyclohexyl methylphosphonofluoridate, GF), VX (o-ethyl S- 2-N,N- diisopropylaminoethyl methyl phosphonofluoridate) and a Russian V-type agent designated VR (0-isobutyl S-(2-diethylamino)ethyl methylphosphonothioate). The nerve agents inhibit the cholinesterase (ChE) family of enzymes that includes acetylcholinesterase (AChE) and butyrylcholinesterase (BChE). It is the inhibition of AChE, the enzyme that hydrolyzes the cholinergic neurotransmitter acetylcholine (ACh), that produces the toxic action of nerve agents. Inhibition of BChE activity by itself is not known to produce any toxic effect. Nerve agents bind to the active site of the AChE enzyme, thus preventing it from hydrolyzing ACh. The enzyme is inhibited irreversibly, and the return of esterase activity depends on the synthesis of new enzyme molecules ( 1% per day in humans). All nerve agents penetrate the central nervous system (CNS), with the G-type agents acting more rapidly centrally than the V-type.

DTIC

*Acetyl Compounds; Anticholinergics; Atropine; Autonomic Nervous System; Cholinesterase; Drugs; Inhibitors; Organic Phosphorus Compounds*

**20070029518** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA  
**Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures**  
Sheridan, Robert E; Adler, Michael; Jan 2006; 6 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468612; USAMRICD-P05-004; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA468612>

In primary embryonic spinal cord cultures, synaptic transmission can be conveniently studied by monitoring radiolabeled neurotransmitter release or by recording of electrophysiological responses. However, while the mature spinal cord contains an appreciable number of cholinergic motoneurons, cultures of embryonic spinal cord have a paucity of these neurons and release little or no acetylcholine upon stimulation. To determine whether the proportion of cholinergic neurons in primary mouse spinal cord cultures can be augmented, the effects of several classes of growth factors were examined on depolarization- and Ca<sup>2+</sup>-evoked release of choline/acetylcholine (Ch/ACh). In the absence of growth factors, little or no evoked release of radiolabeled Ch/ACh could be demonstrated. Media supplemented with brain-derived neurotrophic factor (BDNF), ciliary neurotrophic factor (CNTF) or basic fibroblast growth factor (bFGF) were examined for their ability to preserve the population of neurons in culture. CNTF was found to increase the number of surviving neurons and to enhance the release of radiolabeled Ch/ACh; the other factors were without effect. The action of CNTF was transient, and the neuronal population decreased to levels observed in cultures lacking growth factor after 20 days in vitro. The correlation between enhanced neuron survival and increased Ch/ACh release suggests that CNTF protected cholinergic neurons, albeit transiently, from cell death.

DTIC

*Autonomic Nervous System; Cells (Biology); Choline; Cholinergics; Electrophysiology; Mice; Nervous System; Radioactive Isotopes; Spinal Cord; Survival*

**20070029520** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA  
**Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure**  
Braue Jr, Ernest H; Graham, John S; Doxzon, Bryce F; Hanssen, Kelly A; Lumpkin, Horace L; Stevenson, Robert S; Deckert, Robin R; Dalal, Stephen J; Mitcheltree, Larry W; Jan 2007; 12 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468615; USAMRICD-P06-009; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA468615>

Before sulfur mustard (HD) injuries can be effectively treated, assessment of lesion depth must occur. Accurate depth assessment is important because it dictates how aggressive treatment needs to be to minimize or prevent cosmetic and functional deficits. Depth of injury typically is assessed by physical examination. Diagnosing very superficial and very deep lesions is relatively easy for the experienced burn surgeon. Lesions of intermediate depth, however, are often problematic in determining the need for grafting. This study was a preliminary evaluation of two noninvasive bioengineering methodologies, laser Doppler perfusion imaging (LDPI) and indocyanine green fluorescence imaging (ICGH), to determine their ability to accurately diagnose depth of sulfur mustard lesions in a weanling swine model. Histological evaluation was used to assess the accuracy of the imaging techniques in determining burn depth. Six female weaning swine (8-12 kg) were exposed to 400 microliters of neat sulfur mustard on six ventral sites for 2, 8, 30, or 60 minutes. This exposure regimen produced lesions of varying depths from superficial to deep dermal. Evaluations of lesion depth using the bioengineering techniques were conducted at 24, 48, and 72 hours after exposure. After euthanasia at 72 hours after exposure, skin biopsies were taken from each site and processed for routine hematoxylin and eosin histological evaluation to determine the true depth of the lesion. Results demonstrated that LDPI and ICGH were useful tools to characterize skin perfusion and provided a good estimate of HD lesion depth. Traditional LDPI and the novel prototype ICGFI instrumentation used in this study produced images of blood flow through skin lesions, which provided a useful assessment of burn depth. LDPI and ICGH accurately predicted the need for aggressive treatment (30- and 60-minute HD lesions) and nonaggressive treatment (2- and 8-minute HD lesions) for the lesions generated in this study.

DTIC

*Depth; Exposure; Lesions*

**20070029525** Joslin Diabetes Center, Boston, MA USA  
**Diabetes Care and Treatment Project: A Joslin Telemedicine Initiative**  
Bursell, Sven-Erik; Oct 2006; 55 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): DAMD17-03-2-0062  
Report No.(s): AD-A468625; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA468625>

Most of the proposed studies have cleared local and HSRRB approvals and are in various stages of implementation at

participating sites. Those that have yet to be approved are through the planning phase. For completed studies, results have been analyzed and manuscripts are being prepared for submission to academic conferences and peer reviewed journals. The JVN application has been integrated to include both eye care and diabetes care in readiness for integration into AHLTA. Technologically, we have incorporated a new digital video camera for the eye care component of the JVN program; this is currently undergoing clinical validation for diagnostic accuracy for diabetic retinopathy assessment. CDMP development for new modules is being accomplished and we have expanded the patient portal to encompass many more home monitoring devices. CDMP development has also addressed the results of the completed Human Factors Study (Usability Lab).

DTIC

*Metabolic Diseases; Telemedicine*

**20070029530** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase**

Yeung, D T; Smith, J R; Sweeney, R E; Lenz, D E; Cerasoli, D M; Jan 2007; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468634; USAMRICD-P05-028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468634>

Human serum paraoxonase 1 (HuPONI; EC 3.1.8.1) is a calcium-dependent six-fold Beta-propeller enzyme that has been shown to hydrolyze an array of substrates, including organophosphorus (OP) chemical warfare nerve agents. Although recent efforts utilizing site-directed mutagenesis have demonstrated specific residues (such as Phe222 and His15) to be important in determining the specificity of OP substrate binding and hydrolysis, little effort has focused on the substrate stereospecificity of the enzyme; different stereoisomers of OPs can differ in their toxicity by several orders of magnitude. For example, the C +/- P- isomers of the chemical warfare agent soman (GD) are known to be more toxic by three orders of magnitude. In this study, the catalytic activity of HuPONI towards each of the four chiral isomers of GD was measured simultaneously via chiral GC/MS. The catalytic efficiency (kcat/Km) of the wild-type enzyme for the various stereoisomers was determined by a simultaneous solution of hydrolysis kinetics for each isomer. Derived kcat/Km values ranged from 625 to 4130 mM(exp-1) min(exp-1), with isomers being hydrolyzed in the order of preference C + P + > C-P + > C + P- > C-P-. The results indicate that HuPONI hydrolysis of GD is stereoselective; substrate stereospecificity should be considered in future efforts to enhance the OPase activity of this and other candidate bioscavenger enzymes.

DTIC

*Blood; Chemical Warfare; Hydrolysis; Nerves; Serums*

**20070029531** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species**

Sweeney, Richard E; Langenberg, Jan P; Maxwell, Donald M; Jan 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAA019-02-0-0001

Report No.(s): AD-A468638; USAMRICD-P06-005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468638>

A physiologically based pharmacokinetic (PB/PK) model has been developed in advanced computer simulation language (ACSL) to describe blood and tissue concentration-time profiles of the C(plus or minus)P(minus)stereoisomers of soman after inhalation, subcutaneous and intravenous exposures at low (0.8-1.0 x LD50), medium (-3 x LD50) and high (6 x LD50) levels of soman challenge in three species (rat, guinea pig, marmoset). Allometric formulae were used to compute the compartment volumes, blood flow rates, tidal volume and respiratory rate based upon total animal weight. Blood/tissue partition coefficients for soman, initial carboxylesterase and acetylcholinesterase levels and the rate constants for interactions between soman and these enzymes were species-dependent and were obtained from in vitro measurements reported in the literature. The model incorporated arterial and venous blood, lung, kidney, liver, richly perfused, poorly perfused and fat tissue compartments as well as subcutaneous and nasal exposure site compartments. First-order absorption from linearly filled soman deposits into metabolizing exposure site compartments was employed to model subcutaneous and inhalation exposures. The model was validated by comparing the predicted and observed values for c(plus or minus)P(minus)-soman in arterial blood at various times following exposure and by regression analysis. Sensitivity analysis was used to determine the effects of perturbations in the model parameters on the time-course of arterial C(-)P(-)-soman concentrations for different exposure routes. In our evaluation of 28 datasets, predicted values were generally within 95% confidence limits of the observed values, and regression

coefficients comparing predicted and observed data were greater than 0.85 for 95% of the intravenous and subcutaneous datasets and 25% of the inhalation datasets.

DTIC

*Blood Circulation; Computerized Simulation; Exposure; Languages; Perturbation; Pharmacology; Routes; Simulation*

**20070029532** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model**

Mross, Klaus G; Adam, Gina E; Noort, Daan; Zimmer, Jeannot; Jun 2007; 23 pp.; In English

Report No.(s): AD-A468642; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468642>

No abstract available

*Biomarkers; Exposure; Metabolites; Toxic Hazards*

**20070029534** Naval Medical Research Unit No. 3 (US), FPO New York, NY USA

**Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt**

Sanders, John W; Putnam, Shannon D; Gould, Philip; Kolisnyk, John; Merced, Norma; Barthel, Vincent; Rozmajzl, Patrick J; Shaheen, Hind; Fouad, Salwa; Frenck, Robert W; Feb 2005; 7 pp.; In English

Report No.(s): AD-A468659; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468659>

In the fall of 2001, approximately 15,000 U.S. military personnel participated in a military exercise in the northwestern Egyptian desert. To assess the prevalence and impact of diarrhea and enteropathogen distribution, we conducted a post-deployment survey and a case series study. A departure convenience sampling (n = 3725) was used in the post-deployment survey. Overall, 9.3% reported diarrhea, 2.6% sought medical care, and 2.8% stopped or decreased their work for at least a day. Among those reporting diarrhea, 41.7% had symptoms for less than 2 days, 43.5% had symptoms from 2-5 days, and 14.8% had symptoms for more than 5 days. In the case series study, pathogens were identified in 53.6% of the 129 cases enrolled. Pathogens identified included enterotoxigenic E. coli (n = 53), enteroaggregative E. coli (n = 13), Cryptosporidium (n = 9), Campylobacter jejuni (n = 7), noroviruses (n = 7), Shigella flexneri (n = 2), rotavirus (n = 2), and Entamoeba histolytica (n = 2). Among those seeking care for diarrhea, two thirds reported a decreased ability or inability to perform their jobs for at least one day, but overall, diarrhea was much less prevalent than in past surveys in this region, with minimal impact on the mission.

DTIC

*Bacteria; Deployment; Egypt; Military Personnel; Sicknesses; Signs and Symptoms*

**20070029535** Naval Medical Research Unit No. 3 (US), FPO New York, NY USA

**Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of Travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan**

Sanders, John W; Jun 2005; 5 pp.; In English

Report No.(s): AD-A468660; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468660>

To evaluate the relationship between medical knowledge and clinical practice, a survey on travelers' diarrhea was administered to military health care providers attending a professional development and trauma management conference. The survey was administered at the beginning of the conference and 58 of the 76 attendees participated by completing a questionnaire. Respondents were aware of the standard definition of travelers' diarrhea; however, their knowledge about the epidemiology and management of travelers' diarrhea was low. Less than one-third correctly answered questions on etiology and more than two-thirds made incorrect management choices in treatment of mild to moderate watery diarrhea and dysentery. Important knowledge gaps about gastroenteritis were identified and should serve as a basis to develop military-specific clinical guidelines and training programs.

DTIC

*Afghanistan; Epidemiology; Iraq; Procedures; Surveys*

**20070029539** California Univ., San Diego, La Jolla, CA USA

**FGFR4 Downregulation of Cell Adhesion in Prostate Cancer**

Donoghue, Daniel J; Meyer, April N; Drafa, Kristine A; Mar 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81ZWH-06-1-0385

Report No.(s): AD-A468675; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468675>

We have made excellent progress in the preliminary stages of our project to examine the role of FGFR4 G388R in altering cell adhesion in prostate cancer. This includes acquiring expertise in the passage and transfection for gene expression studies using prostate cancer cell lines. A key accomplishment is the demonstration of feasibility of ponasterone; A inducibility of FGFR4 expression in PC3 cells. We hope to successfully create these inducible cells to use in our studies of FGFR4 G388R and its role in prostate cancer progression.

DTIC

*Adhesion; Cancer; Gene Expression; Prostate Gland*

**20070029540** Dartmouth Coll., Hanover, NH USA

**Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging**

Davis, Scott C; Mar 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0367

Report No.(s): AD-A468681; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468681>

Fluorescence molecular tomography is an emerging technology to image the spatial distribution of fluorescence activity in tissue volumes with the potential to reduce false positive readings and eliminate the need for stressful biopsy procedures for many women. However the spatial resolution and quantification capabilities of FMT must be improved before realizing this potential. The funded research aims to improve the imaging capabilities of FMT by incorporating the optical imaging system directly into a clinical MRI for simultaneous image acquisition. Tissue structural information from the MR image is then used to guide the FMT image reconstruction algorithm. This approach is shown to dramatically improve image quality and fluorescence yield quantification in realistic simulated domains and provide noticeable improvements for simple domains in preliminary phantom experiments. Additionally a newly developed algorithm to quantify exogenous absorption is developed and validated.

DTIC

*Breast; Cancer; Fluorescence; Image Reconstruction; Imaging Techniques; Magnetic Resonance; Mammary Glands; Tomography; Tumors*

**20070029543** Arizona Univ., Tucson, AZ USA

**Effects of Modifications in the Laminin-10 Basal Laminina on Prostate Cancer Invasion**

Pawar, Sangita C; Bair, Elisabeth L; Oct 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0611

Report No.(s): AD-A468686; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468686>

In order for prostate cancer to metastasize it must invade through a laminin-511 rich barrier. We have previously shown that the matrix metalloprotease MT1-MMP, which is expressed in prostate cancer but not in normal prostate tissue cleaves the laminin alpha-5 chain into four distinct fragments. This cleavage allows for increased prostate cancer cell migration in vitro. Laminin-511 cleavage also occurs in vivo in human prostate tissue. Cleavage of laminin-511 and release of laminin-511 fragments leads to altered cell function leading to increased cell migration and invasion in in vitro assays. We have demonstrated that prostate cancer cells treated with laminin-511 that has been cleaved by MT1-MMP have increased EGFR phosphorylation compared with cells grown on tissue culture plastic or intact laminin-511 in a Western blot. We have purified a recombinant 45kDa laminin-511 N-terminal cleavage fragment which contains laminin EGF-like domains. Treatment of prostate cancer cells with soluble recombinant fragment demonstrates that the cleaved laminin fragment acts as a matrikine, activating the EGFR on prostate cancer cells in a Western blot. This work demonstrates that increased MT1-MMP expression in prostate cancer not only cleaves the major laminin surrounding prostate cancer to clear a path for migration but also releases active fragments from the laminin-511 that signal for increased migration.

DTIC

*Cancer; Prostate Gland*

**20070029545** Fraunhofer USA, Inc., Newark, DE USA

**Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax**

Hull, Anna K; Criscuolo, Carolyn J; Mett, Vadim; Groen, Herman; Steeman, Wilma; Westra, Hans; Chapman, Gail; Legutki, Bart; Baillie, Les; Yusibov, Vidadi; Jan 13, 2005; 6 pp.; In English

Report No.(s): AD-A468690; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468690>

The unpredictable nature of bio-terrorism compels us to develop medical countermeasures that will enable authorities to treat individuals exposed to agents such as anthrax. We report the feasibility of producing a protective, human-derived, monoclonal antibody directed against the protective antigen (PA) of *Bacillus anthracis* in plants. This was achieved by transient expression using agroinfiltration of *Nicotiana benthamiana* plants. The resulting antibody was able to neutralize toxin activity in vitro and in vivo at a comparable level to that seen for its hybridoma-produced counterpart.

DTIC

*Antibodies; Bacillus; Infectious Diseases; Spores*

**20070029547** Northwestern Univ., Evanston, IL USA

**Molecular Mechanisms in Compromised Endothelial Barrier during Breast Cancer Metastasis**

Chew, Teng-Leong; Mar 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0345

Report No.(s): AD-A468692; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468692>

In this funding period (first of three years) we have fulfilled the scheduled tasks of (1) standardizing the condition for engineering the 3D vasculature network that can consistently produce lumen; (2) generating various viral constructs that can deliver the FRET sensors to 100% of the endothelial cells used in vasculature formation; (3) determining the fluid exchange rate within the 3D collagen matrix that will be critical for any subsequent drug treatment of the endothelial cells in the assay system; (4) co-developing with Improvisation a FRET module that is capable of performing 3D ratio-imaging. We presented here to the best of our knowledge the first ever three dimensional FRET microscopy data. We have also established that the endothelial cells undergo polarization similar to those under physiological condition during in vitro vasculogenesis. Taken together these developments meet and exceed the scheduled tasks outlined in the statement of work and complete the establishment of the 3D FRET assay system needed to study the transient modulation of endothelial signaling events by breast cancer cells during transendothelial migration.

DTIC

*Breast; Cancer; Endothelium; Mammary Glands; Metastasis*

**20070029548** Beth Israel Deaconess Medical Center, Boston, MA USA

**Skeletal Complications in Neurofibromatosis Type 1: The Role of Neurofibromin Haploinsufficiency in Defective Skeletal Remodeling and Bone Healing in NF1**

McHugh, Kevin P; Jan 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0219

Report No.(s): AD-A468693; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468693>

A large proportion of patients with Neurofibromatosis Type 1 display skeletal abnormalities including scoliosis and pseudoarthrosis which are compounded by osteoporosis and poor bone healing. Corrective orthopaedic intervention often fails necessitating multiple revision surgeries followed by prolonged recovery periods. The cell types and pathway by which neurofibromin haploinsufficiency (Nf1 +/-) leads to dysregulation of bone remodeling and healing are unknown. The aim of this study is to identify the cell types expressing Nf1 in normal bone cell physiology and fracture healing. We demonstrate that in normal mouse bones neurofibromin is primarily expressed by cells of the osteoblast lineage. Neurofibromin expression was also induced during osteoblastic differentiation of MC3T3 cells. We found that during fracture repair neurofibromin expression increased in the early stage and was seen at sites of primary bone formation. Taken together these observations indicate that neurofibromin expression is primarily associated with bone-adherent osteoblast lineage cells with minimal expression in other cell types. In addition neurofibromin expression is induced during the formation of the mineralized callus in the endochondral-like formation stage of bone fracture healing. Neurofibromin haploinsufficiency may keep osteoblasts in an immature state. Immature osteoblasts produce large quantities of the osteoclastogenic cytokine RANKL. A high RANKL



environment would shift the balance of bone metabolism in favor of bone resorption and may result in the bone-healing defect seen in NF1 patients.

DTIC

*Bones; Defects; Fractures (Materials); Healing; Musculoskeletal System; Osteoporosis*

**20070029549** Massachusetts General Hospital, Boston, MA USA

**Far Forward Treatment of Hemorrhagic Shock**

Alam, Hasan B; Feb 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-MP-2-0006; N00014-06-1-0192

Report No.(s): AD-A468694; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468694>

Hemorrhagic shock is the leading cause of death in civilian and combat trauma. Even when the injured survive long enough to be transported to a medical facility, hemorrhage still remains the leading cause of preventable late death and complications. Effective hemorrhage control and better resuscitation strategies have the potential of saving lives. However, resuscitation can exacerbate cellular injury caused by hemorrhagic shock. Utilizing the funding provided by the ONR, we have clearly established that resuscitation fluids play a critical role in this injury pattern. Furthermore, we have demonstrated that these adverse effects can be avoided through simple modifications. We have also designed novel strategies for cellular protection. In parallel, advanced hemostatic battlefield dressings have been developed and validated. The goal of this research has been to improve the care of the critically injured, and a number of our findings have already been incorporated into new military doctrine (e.g. use of new hemostatic dressings, limited volume resuscitation), saving numerous lives.

DTIC

*Body Fluids; Hypothermia; Resuscitation; Shock (Physiology)*

**20070029552** Centers for Disease Control and Prevention, Atlanta, GA USA

**Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes**

Carroll, Darin S; Mills, James N; Montgomery, Joel M; Bausch, Daniel G; Blair, Patrick J; Burans, James P; Felices, Vidal; Gianella, Alberto; Iihoshi, Naomi; Nichol, Stuart T; Jan 2005; 6 pp.; In English

Report No.(s): AD-A468732; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468732>

In August 2002, two cases of hantavirus pulmonary syndrome (HPS) were confirmed in Minereros and Concepci n, within the Santa Cruz Department of Bolivia. Extensive alteration of the native ecosystem, from dense forest to pasture or sugarcane, had occurred in both regions. An ecologic assessment of reservoir species associated with the human disease identified a single hantavirus antibody-positive *Oligoryzomys microtis* from Minereros and three hantavirus antibody-positive *Calomys callosus* from Concepci n. In Minereros, the virus from the *O. microtis* was 90% similar to sequences published for Rio Mamor virus. Viral nucleotide sequences from two *C. callosus* were 87-88% similar to the sequence of Laguna Negra virus. The viral sequence from the *C. callosus* was 99% identical to viral sequences obtained from the HPS patient in this area, implicating *C. callosus* as the host and Laguna Negra virus as the agent responsible for the HPS case near Concepci n.

DTIC

*Edema; Habitats; Reservoirs; Signs and Symptoms; Viruses*

**20070029553** Walter Reed Army Inst. of Research, Silver Spring, MD USA

**Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells**

Palmer, Dupeh R; Sun, Peifang; Celluzzi, Christina; Bisbing, John; Pang, Somnang; Sun, Wellington; Marovich, Mary A; Burgess, Timothy; Feb 2005; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-0005

Report No.(s): AD-A468733; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468733>

Dendritic cells (DCs) play a central role as major targets of dengue virus (DV) infections and initiators of antiviral immune responses. Previous observations showed that DCs are activated by infection, presumably acquiring the capacity to promote cell-mediated immunity. However, separate evaluations of the maturation profiles of infected and uninfected bystander cells show that infection impairs the ability of DCs to upregulate cell surface expression of costimulatory, maturation, and major histocompatibility complex molecules, resulting in reduced T-cell stimulatory capacity. Infected DCs

failed to respond to tumor necrosis factor alpha as an additional maturation stimulus and were apoptotic. Interleukin 10 (IL-10) was detected in supernatants from cultures of DV-infected DCs and cocultures of DCs and T cells. Taken together, these results constitute an immune evasion strategy used by DV that directly impairs antigen-presenting cell function by maturation blockade and induction of apoptosis.

DTIC

*Drugs; Infectious Diseases; Viruses*

**20070029554** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure**

Dillman, III, J F; Phillips, C S; Croxton, L M; Sylvester, A J; Moran, T S; Sciuto, A M; Jan 2005; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468734; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468734>

Bis-(2-chloroethyl) sulfide (sulfur mustard, SM) is a carcinogenic alkylating agent that has been utilized as a chemical warfare agent. To understand the mechanism of SM-induced lung injury, we analyzed global changes in gene expression in a rat lung SM exposure model. Rats were injected in the femoral vein with liquid SM, which circulates directly to the pulmonary vein and then to the lung. Rats were exposed to 1, 3, or 6 mg/kg of SM, and lungs were harvested at 0.5, 1, 3, 6, and 24 h postinjection. Three biological replicates were used for each time point and dose tested. RNA was extracted from the lungs and used as the starting material for the probing replicate oligonucleotide microarrays. The gene expression data were analyzed using principal component analysis and two-way analysis of variance to identify the genes most significantly changed across time and dose. These genes were ranked by p value and categorized based on molecular function and biological process. Computer-based data mining algorithms revealed several biological processes affected by SM exposure, including protein catabolism, apoptosis, and glycolysis. Several genes that are significantly upregulated in a dose-dependent fashion have been reported as p53 responsive genes, suggesting that cell cycle regulation and p53 activation are involved in the response to SM exposure in the lung. Thus, SM exposure induces transcriptional changes that reveal the cellular response to this potent alkylating agent.

DTIC

*Chemical Warfare; Exposure; Genes; Genome; Lungs; Rodents; Sulfides; Veins*

**20070029555** National Inst. of Child Health and Human Development, Bethesda, MD USA

**Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea**

Rao, Malla R; Wierzba, Thomas F; Savarino, Stephen J; Abu-Elyazeed, Remon; El-Ghoreb, Nemat; Hall, Eric R; Naficy, Abdollah; Abdel-Messih, Ibrahim; Frenck , Jr , Robert W; Svennerholm, Ann-Mari; Jan 14, 2005; 10 pp.; In English

Report No.(s): AD-A468735; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468735>

We conducted a nested case-control study in 397 rural Egyptian children <36 months of age to assess the correlation between serum levels of antibodies against toxin and colonization factors (CFs) and the risk of homologous enterotoxigenic Escherichia coli (ETEC) diarrhea.

DTIC

*Blood; Children; Escherichia; Protection; Serums; Toxins and Antitoxins*

**20070029558** Walter Reed Army Inst. of Research, Silver Spring, MD USA

**Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum**

Dutta, Sheetij; Haynes, J D; Barbossa, Arnaldo; Ware, Lisa A; Snavely, Jeffrey D; Moch, J K; Thomas, Alan W; Lanar, David E; Apr 2005; 8 pp.; In English

Report No.(s): AD-A468748; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468748>

Antibodies against apical membrane antigen 1 (AMA-1) of Plasmodium falciparum inhibit merozoite invasion into erythrocytes. Invasion-inhibitory polyclonal AMA-1 antibodies inhibit secondary proteolytic processing and surface redistribution of AMA-1 on merozoites. We present evidence supporting inhibition of processing and redistribution as probable causes of inhibition of invasion by polyclonal antibodies. Polyclonal anti-AMA-1 was much more inhibitory than monoclonal antibody (MAb) 4G2dc1 in an invasion assay. Although both polyclonal and monoclonal immunoglobulin G

(IgG) inhibited secondary processing of the 66-kDa form of AMA-1, only polyclonal IgG caused its anomalous processing, inhibited its redistribution, and cross-linked soluble forms of AMA-1 on merozoites. Moreover, Fab fragments of polyclonal IgG that fail to cross-link did not show the enhancement of inhibitory effect over intact IgG, as observed in the case of Fab fragments of MAb 4G2dc1. We propose that although blocking of biologically important sites is a common direct mode of action of anti-AMA-1 antibodies, blocking of AMA-1 secondary processing and redistribution are additional indirect inhibitory mechanisms by which polyclonal IgG inhibits invasion. We also report a processing inhibition assay that uses a C-terminal AMA-1-specific MAb, 28G2dc1, to detect merozoite-bound remnants of processing (20 kDa from normal processing to 48 and 44 kDa and 10 kDa from anomalous processing to a 52-kDa soluble form of AMA-1). The ratio of intensity of 10-kDa bands to the sum of 10- and 20-kDa bands was positively correlated with inhibition of invasion by polyclonal antibodies. This assay may serve as an important immunochemical correlate for inhibition of invasion.

DTIC

*Antibodies; Antigens; Immune Systems; Membranes*

**20070029559** Maryland Univ., Baltimore, MD USA

**Role of Superoxide in the Germination of Bacillus Anthracis Endospores**

Baillie, Les; Hibbs, Stephen; Tsai, Pei; Cao, Guan-Liang; Rosen, Gerald M; Jan 2005; 7 pp.; In English

Contract(s)/Grant(s): EB-2034

Report No.(s): AD-A468749; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468749>

The spore forming Gram-positive bacterium *Bacillus anthracis*, the causative agent of anthrax, has achieved notoriety due to its use as a bioterror agent. In the environment, *B. anthracis* exists as a dormant endospore. Germination of endospores during their internalization within the myeloid phagocyte, and the ability of those endospores to survive exposure to antibacterial killing mechanisms such as superoxide, (O<sub>2</sub><sup>-</sup>), is a key initial event in the infective process. We report herein that endospores exposed to fluxes of O<sub>2</sub><sup>-</sup> typically found in stimulated phagocytes had no effect on viability. Further endospores of the Sterne Strain of *B. anthracis* were found to scavenge O<sub>2</sub><sup>-</sup>, which may enhance the ability of the bacterium to survive within the hostile environment of the phagolysosome. Most intriguing was the observation that endospore germination was stimulated by a flux of O<sub>2</sub><sup>-</sup> as low as 1 micrometer/min. Data presented herein suggest that *B. anthracis* may co-opt O<sub>2</sub><sup>-</sup> which is produced by stimulated myeloid phagocytes and is an essential element of host immunity, as a necessary step in productive infection of the host.

DTIC

*Bacillus; Bacteria; Germination; Infectious Diseases; Inorganic Peroxides; Spores*

**20070029560** Instituto Nacional de Salud Lima, Lima, Peru

**Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru**

Marquino, Wilmer; Ylquimiche, Laura; Hermenegildo, Ygor; Palacios, Ana M; Falconi, Eduwardo; Cabezas, Cesar; Arrospide, Nancy; Gutierrez, Sonia; Ruebush, II, Trenton K; Jan 2005; 6 pp.; In English

Report No.(s): AD-A468752; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468752>

**Abstract.** To assist the Peruvian Ministry of Health in modifying the malaria treatment policy for their north Pacific coastal region, we conducted an in vivo efficacy trial of sulfadoxine-pyrimethamine (SP) and SP plus artesunate (SP-AS) for the treatment of uncomplicated *Plasmodium falciparum* infections. A total of 197 patients were randomized to therapy with either SP (25 mg/kg of the sulfadoxine component in a single dose on day 0) or a combination of SP plus AS (4 mg/kg on days 0, 1, and 2) and were followed for 28 days for symptoms and recurrence of parasitemia. No statistically significant differences between the two groups were observed on enrollment with respect to age, sex, history of malaria, or geometric mean parasite density. A total of 185 subjects completed the 28-day follow-up. Of the 91 subjects treated with SP alone, two had recurrences of parasitemia on day 7 and one on day 21. Of the 94 subjects treated with SP-AS, one had a recurrence of parasitemia on day 21. Fever and asexual parasite density decreased significantly more rapidly and the proportion of patients with gametocytemia on days 3-28 was significantly lower in subjects treated with combination therapy than in those who received SP alone. No severe adverse drug reactions were observed; however, self-limited rash and pruritis were significantly more common and an exacerbation of nausea, vomiting, and abdominal pain were observed significantly more frequently among patients who had received SP-AS. These results have contributed to a National Malaria Control Program decision to change

to SP-AS combination therapy as the first-line treatment for uncomplicated *P. falciparum* malaria in northern coastal Peru in November 2001, making Peru the first country in the Americas to recommend this combination therapy.

DTIC

*Antigens; Immune Systems; Infectious Diseases; Parasitic Diseases; Peru; Signs and Symptoms*

**20070029561** Georgetown Univ. Hospital, Washington, DC USA

**Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles**

Gedil, M A; Steiner, N K; Hurley, C K; Jan 18, 2005; 18 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0898

Report No.(s): AD-A468754; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468754>

Abstract: The KIR2DL4 gene including a portion of exon 1 through exon 9 was sequenced from two families and eight cell lines from the International Histocompatibility Workshop (IHWS). Two known alleles and eight variants were detected. Overall, there were five synonymous and three nonsynonymous changes when the variants were compared to the coding sequences of the most closely related known alleles plus a common frameshift change in five of the variant alleles. Alignment of the new variants with all known alleles showed that the regions encoding the extracellular region and the cytoplasmic tail were the most polymorphic. Two non-synonymous changes, P146H and L161V, occurred in an extracellular immunoglobulin-like domain. Five of the eight variants had a single adenine deletion in the exon encoding the transmembrane region, potentially resulting in a truncated protein lacking the cytoplasmic tail. The distribution of the deletion variant among many KIR2DL4 alleles may explain the high frequency of this variation in the population. Four of the eight consanguineous IHWS cell lines were found to be heterozygous for KIR2DL4 carrying two alleles that differed from one another by a few nucleotide substitutions. Analysis of intron sequences in the families revealed the nature and distribution of interspersed repeat elements which comprise 46% of the KIR2DL4 nucleotide sequence and consist of 12 elements including six SINEs (13.73% of the total length), one LINE (12.41%), and five LTR elements (19.51%). The results revealed the presence of extensive diversity in the KIR2DL4 gene. This is the first extensive report providing both exon and intron data in related individuals.

DTIC

*Antibodies; Genes; Genome; Globulins; Sequencing*

**20070029562** Arizona Univ., Tucson, AZ USA

**Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment**

Nyman, David W; Apr 2004; 26 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0223

Report No.(s): AD-A468755; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468755>

Prostate cancer is the most common non-cutaneous malignancy in men. Radiation therapy is a common treatment for this disease however, most patients receive a similar dose of radiation (70-76 Gy) regardless of individual clinical, pathological, or molecular characteristics of the tumor. The hypothesis of this project is that all prostate carcinomas are unique and that by identifying specific tumor markers or other molecular characteristics using our dynamic tissue culture system (Parrish et al, 2002), we can identify those tumors most sensitive to radiation therapy. The specific aims for the first year were to use prostate biopsy tissue, obtained retrospectively, and adapt our organ culture technique to the requirements of prostate biopsy specimens. We have been able to determine the optimal biopsy core size and tissue culture media conditions. We have also demonstrated that basal cells present in the prostate glandular tissue proliferated over the 72 hour time period of organ culture. We have maximized the length of time that tissue remains viable in our dynamic tissue culture system. We are now ready to begin Aim II of the proposal determining the baseline radiosensitivity of prostate tissue and assessing the roles of p53, bcl-2, and NFkB in the intrinsic radiosensitivity of prostate tissue. We hope to further profile these biomarkers and using them to predict prostate tissue radiosensitivity will aid in the diagnosis and prognosis of this significant cancer. We have received approval by the IRB at the University of Arizona to enroll up to 30 new patients. Dr. Shona Dougherty, Assoc. professor of Rad. Oncology has agreed to be the new Co-PI. We anticipate enrolling as many as 3-5 patients in the following 6 months. We will be processing these tissues for bio-markers as noted above. We expect to complete the project by April 30, 2005.

DTIC

*Cancer; Culture Techniques; Ionizing Radiation; Mathematical Models; Prostate Gland; Radiation Tolerance; Tissue Culturing; Tissues (Biology); Tumors*

**20070029568** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Pulmonary Toxicity of Cholinesterase Inhibitors**

Hilmas, Corey; Adler, Michael; Baskin, Steven I; Gupta, Ramesh C; Jan 2006; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468769; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468769>

The lungs are a major organ system of entry into the body and a target for the toxic effects of organophosphorus (OP) compounds, potent inhibitors of the enzyme acetylcholinesterase (AChE). In general, AChE inhibitors (AChEIs) were developed for a variety of indications, including military, medical, and insecticide applications. Nerve agents, OP chemicals with remarkable toxic activity, were first developed by Germany prior to World War II. Whereas nerve agents were produced primarily for military deployment, other cholinesterase inhibitors were used for treating conditions such as myasthenia gravis and as pretreatments for nerve agent exposure. As powerful inhibitors of AChE, these compounds exhibit profound toxicity on multiple organ systems. This chapter discusses respiratory and pulmonary toxicity through direct inhalation of AChEIs and indirect effects on all aspects of respiration through systemic toxicity. OP nerve agents can be disseminated as liquids or aerosols and are toxic by oral, dermal, or inhalational exposure. The lungs are one of the first organs affected following contact with aerosols and vapors. Lung toxicity by AChEIs is due to the following: (1) parasympathetic muscarinic effects leading to increased glandular secretion throughout the respiratory tract and alveoli, (2) bronchoconstriction from contraction of airway smooth muscle, (3) nicotinic effects on respiratory muscles in the thorax and accessory muscles of the neck causing labored breathing and eventually flaccid paralysis, and (4) central effects resulting in a decrease in respiratory drive.

DTIC

*Cholinesterase; Inhibitors; Pulmonary Functions; Toxicity*

**20070029569** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Effects of Sarin on the Operant Behavior of Guinea Pigs**

Langston, Jeffrey L; Adkins, Angela L; Moran, Anita V; DeFord, Michelle S; Rockwood, Gary A; Jul 19, 2005; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468775; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468775>

The present study evaluated the dose-response effects of subacute exposure to sublethal doses of the organophosphorus (OP) chemical warfare nerve agent (CWNA) sarin (GB) on the operant behavior of guinea pigs. Dietary restricted guinea pigs, trained to respond for food under a progressive ratio (PR) schedule of reinforcement, were injected five times per week (Monday-Friday) for 2 weeks with fractions (0.1, 0.2, and 0.4) of the established LD<sub>50</sub> of GB (42 %g/kg). Changes in body weight, whole blood (WB) acetylcholinesterase (AChE) levels, and operant performances were monitored over the 2 weeks of GB exposure and for an additional 2 weeks following the termination of exposures. There were dose-related changes in body weight and WB AChE levels throughout the exposure and post-exposure periods. Several parameters of PR performance were disrupted during exposure to 0.4 LD<sub>50</sub> GB, however, concurrent weight loss indicated the presence of overt toxicity. PR performance recovered following the termination of exposures. Lower doses (0.1 and 0.2 LD<sub>50</sub>) of GB failed to produce reliable effects on operant performance during the exposure period. Overall responding decreased during exposure to 0.4 LD<sub>50</sub> GB, resulting in reduced response rates and break points. The decrease in overall response rates was attributed to an increase in pausing since there was no decrease in running rate. Motor effects of 0.4 LD<sub>50</sub> GB were evident as an increase in the proportion of lever press durations > 1.0 s. In the present study, doses of GB lower than 0.4 LD<sub>50</sub> produced no marked alteration of operant performance in guinea pigs, although WB AChE levels were maximally inhibited to 20% of control. © 2005 Elsevier Inc. All rights reserved.

DTIC

*Guinea Pigs; Nerves; Sublethal Dosage*

**20070029571** Washington State Univ., Spokane, WA USA

**A Collaborative Study of Sleep, Performance and Health Relationships**

Belenky, Gregory; Van Dongen, Hans; Dec 2006; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0099

Report No.(s): AD-A468800; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468800>

The Sleep and Performance Research Center (SPRC) at Washington State University will conduct laboratory and field studies of sleep loss and performance in normal humans. These studies will provide the scientific basis for the effective

management of sleep to sustain performance in the operational environment, including all 24x7 operations, extended work hours, and shiftwork. They will improve effectiveness, productivity, safety, health and well-being in military and civilian operations, reducing the likelihood of fatigue-related error, incident, accident or catastrophe.

DTIC

*Health; Sleep*

**20070029584** Massachusetts Inst. of Tech., Cambridge, MA USA

**Control of DNA Dehybridization via Nanoparticle Antennas for Antisense Gene Therapy**

Hamad-Schifferli, Kimberly; Jan 2007; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468814>

The goal of this proposal is to develop the use of a nanoscale interface to protein translation machinery to control translation. External magnetic fields excite the nanoscale interface and thus switch on translation of a protein. This technique would enable time-specific control of protein expression, and would enable new techniques in disease diagnosis and therapy. These objectives are in line with the original proposal.

DTIC

*Deoxyribonucleic Acid; Gene Therapy; Nanoparticles; Therapy*

**20070029605** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model**

Graham, John S; Stevenson, Robert S; Mitcheltree, Larry W; Simon, Marcia; Hamilton, Tracey A; Deckert, Robin R; Lee, Robyn B; Nov 8, 2006; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468865; USAMRICD-P06-008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468865>

**OBJECTIVE:** The objective was to examine the efficacy of several treatment regimens in improving wound healing of cutaneous sulfur mustard (HD) injuries. **METHODS:** Wound healing studies were conducted in weanling pigs. Superficial dermal HD injuries were debrided at 48 hours post-exposure using an erbium-doped yttrium aluminum garnet (Er:YAG) laser, followed by application of a treatment adjunct. A variety of noninvasive bioengineering methods were conducted during the post-surgical observation period to examine the various cosmetic and functional aspects of the skin. Histopathology was performed at the end of each study (14 or 21 days post-surgery). **RESULTS:** As noted clinically, re-epithelialization was nearly complete by 7 days post-surgery for many of the sites treated with petrolatum and scarlet red dressings. By 21 days, the skin elasticity of the petrolatum-dressed sites was not significantly different from that of sham-exposed skin. Upon dressing removal on post-surgery day 4, the neoepidermis of allograft- and thin film-dressed sites was partially removed, with resultant petechial hemorrhaging. Mean pathology scores for hydro-colloid-dressed sites were significantly lower than those of untreated HD-exposed sites on postsurgery day 14. **CONCLUSIONS:** Care must be taken during bandage changes, and a non-adherent dressing that could be left in place for a longer period of time (e.g., 7 days) would be beneficial. The use of cultured epithelial allograft material may have a potential role if grown on a completely non-adherent backing and left undisturbed for at least a week. Xeroform Petrolatum and Scarlet Red Ointment dressings are effective and inexpensive treatment adjuncts for HD injuries.

DTIC

*Injuries; Sulfur; Wound Healing; YAG Lasers; Yttrium-Aluminum Garnet*

**20070029687** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

**DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks**

Bhat, K R; Benton, Betty J; Ray, Radharaman; Jan 2006; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468872; USAMRICD-P02-036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468872>

DNA-dependent protein kinase (DNA-PK) phosphorylates several cellular proteins in vitro, but its cellular function and natural substrate(s) in vivo are not established. We reported activation of DNA ligase in cultured normal human epidermal keratinocytes (NHEK) on exposure to the DNA-damaging compound bis-(2-chloroethyl) sulfide. The activated enzyme was identified as DNA ligase I, and this activation was attributed to phosphorylation of the enzyme. Here, we show that the phosphorylation is mediated by DNA-PK and that DNA ligase I is one of its natural substrates in vivo. DNA ligase I

phosphorylation-cum-activation is a response specific to DNA double-strand breaks. We also demonstrate that affinity-purified inactive DNA ligase I is phosphorylated and activated in vitro by HeLa Cell DNA-PK confirming the in vivo observations. The findings specify the roles of DNA-PK and DNA ligase I in mammalian DNA double-strand break repair.

DTIC

*Deoxyribonucleic Acid; Enzymes; In Vivo Methods and Tests; Phosphorus; Phosphorylation; Proteins; Strands; Substrates*

**20070029691** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA  
**Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance**

Brimfield, A A; Novak, Mark J; Hodgson, Ernest; Jan 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-2-008

Report No.(s): AD-A468881; USAMRICD-P05-025; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468881>

Thiodiglycol (2,2'-bis-hydroxyethylsulfide, TDG), the hydrolysis product of the chemical warfare agent sulfur mustard, has been implicated in toxicity of sulfur mustard through the inhibition of protein phosphatases in mouse liver cytosol. The absence of any inhibitory activity when TDG was present in assays of pure enzymes, however, led us to investigate the possibility for metabolic activation of TDG to inhibitory compound(s) by cytosolic enzymes. We have successfully shown that mammalian alcohol dehydrogenases (ADH) rapidly oxidize TDG in vitro, but the classic spectrophotometric techniques for following this reaction provided no information on the identity of TDG intermediates and products. The use of proton NMR to monitor the oxidative reaction with structural confirmation by independent synthesis allowed us to establish the ultimate product, 2-hydroxyethylthioacetic acid, and to identify an intermediate equilibrium mixture consisting of 2-hydroxyethylthioacetaldehyde, 2-hydroxyethylthioacetaldehyde hydrate and the cyclic 1,4-oxathian-2ol. The intermediate nature of this mixture was determined spectro-photometrically when it was shown to drive the production NADH when added to ADH and NAD.

DTIC

*Alcohols; Hydrolysis; In Vitro Methods and Tests; Mammals; Nuclear Magnetic Resonance; Sulfur*

**20070029692** Brown Univ., Providence, RI USA  
**Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments**

Shea, M T; Mar 2007; 74 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0171

Report No.(s): AD-A468883; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468883>

The long-term goal of this research is to provide an effective intervention for the prevention of secondary and escalating effects of poor anger control associated with trauma-related anger problems. The specific objectives are to adapt an evidenced-based Cognitive-Behavioral Intervention (CBI) for the treatment of anger to the specific needs of military personnel returning from hazardous deployments, and to conduct a randomized pilot study providing preliminary data on the efficacy and acceptability of the adapted intervention in this population. The first phase of the study involves administering the current (adapted) version of CBI to n participants, and a clinically relevant comparison condition, Supportive Intervention (SI), to n participants. Based on their experiences treating participants in Phase I, the authors have made some changes in inclusion criteria to target individuals who they believe are most appropriate for the treatment. For Phase II, they will exclude subjects with severe PTSD (CAPS > 70) given their experience that too severe anxiety requires different treatment. They also now assess and require evidence that clinically significant anger problems have persisted for at least 3 months to avoid spontaneous improvement. Progress: Phase I of the study is nearing completion, with 14 participants (12 in CBI and 2 in SI) entering treatment. Anticipated treatment completion rate for CBI is 8 of 12 (66%). Based on Phase I experience, the CBI manual has been extensively modified, and less extensive changes have been made to the SI manual. Protocol changes have been approved by local IRBs and have been submitted to the Department of Defense. The randomized pilot study (Phase II) will begin in the near future.

DTIC

*Combat; Deployment; Disorders; Injuries; Mental Health; Military Personnel; Psychotherapy*

**20070029693** Naval Medical Research Center, Silver Spring, MD USA

**Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine**

Arnaud, Françoise; Hammett, Mike; Asher, Ludmila; Philbin, Nora; Rice, Jennifer; Dong, Feng; Pearce, Bruce; Flournoy, William S; Nicholson, Carol; McCarron, Richard; Jan 2005; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468884; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468884>

HBOC-201, a bovine polymerized hemoglobin, has been proposed as a novel oxygen-carrying resuscitative fluid for patients with hemostatic effects of HBOC-201 in an animal model of HS. A 40% blood loss-controlled hemorrhage and soft tissue injury were performed in 24 invasively monitored Yucatan mini-pigs. Pigs were resuscitated with HBOC-201 (HBOC) or hydroxyethyl starch (HEX), or were not resuscitated (NON) based on cardiac parameters during a 4-h prehospital phase. Afterward, animals received simulated hospital care for 3 days with blood or saline transfusions. Hemostasis measurements included in vivo bleeding time (BT), thromboelastography (TEG), in vitro bleeding time (platelet function; PFA-CT), prothrombin time (PT), and partial thromboplastin time (PTT). Serum lactate was measured and lung sections were evaluated for microthrombi by electron microscopy. During the prehospital phase, BT remained unchanged in the HBOC group.

DTIC

*Blood; Blood Coagulation; Blood Pressure; Cattle; Coagulation; Hemoglobin; Losses; Polymerization; Shock (Physiology); Swine; Transfusion*

**20070029696** Mahidol Univ., Bangkok, Thailand

**Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction**

Singhsilarak, Tasawan; Leowattana, Wattana; Looareesuwan, Sornchai; Wongchotigul, Varee; Jiang, Ju; Richards, Allen L; Watt, George; Jan 2005; 3 pp.; In English

Report No.(s): AD-A468890; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468890>

Orientia tsutsugamushi infection causes scrub typhus, a common zoonosis of rural Asia. Orientia tsutsugamushi was recently detected by a real-time quantitative polymerase chain reaction (qPCR) assay in animal specimens. We evaluated the same qPCR assay in specimens obtained from patients with serologically proven scrub typhus infections. The 47-kDa qPCR assay was more sensitive than was mouse inoculation; it was reactive in whole blood specimens from all 10 isolate-positive patients and in 7 of 17 isolate-negative individuals ( $P=0.003$ , Fisher's two-tailed exact test). As few as 1,076 O. tsutsugamushi copies/microLiter were detected in whole blood. Four of 7 sera from isolate-proven scrub typhus infections were also reactive by qPCR. The assay was unreactive in all 12 individuals without scrub typhus infection. This is the first demonstration of a sensitive and specific real-time qPCR assay for human scrub typhus infection.

DTIC

*Chain Reactions (Chemistry); Clinical Medicine; Infectious Diseases; Polymers; Real Time Operation*

**20070029698** Naval Research Lab., Washington, DC USA

**Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin**

Putnam, Shannon D; Sanders, John W; Tribble, David R; Rockabrand, David R; Riddle, Mark S; Rozmajzl, Patrick J; Frenck, Robert W; Jun 2005; 3 pp.; In English

Report No.(s): AD-A468892; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468892>

Changes in antimicrobial resistance of Escherichia coli among deployed U.S. military personnel being treated for diarrhea were evaluated. Stool samples were collected pretreatment and on days 7, 14, and 28 posttreatment. Resistance to ciprofloxacin was noted in 13.3% of baseline specimens, and rates of resistance against multiple antibiotics increased dramatically from baseline to day 7 and then tapered off to return to pretreatment levels by day 28, except for ciprofloxacin, suggesting that population accumulative usage of fluoroquinolones may result in an incremental increase in resistance rates.

DTIC

*Antibiotics; Antiinfectives and Antibacterials; Escherichia; Microorganisms; Patients*



**20070029699** Naval Medical Research Center, Silver Spring, MD USA

**Microarray-based Resequencing of Multiple Bacillus anthracis Isolates**

Zwick, Michael E; Mcafee, Farrell; Cutler, David J; Read, Timothy D; Ravel, Jacques; Bowman, Gregory R; Galloway, Darrell R; Mateczun, Alfred; Dec 17, 2004; 14 pp.; In English

Report No.(s): AD-A468894; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468894>

We used custom-designed resequencing arrays to generate 3.1 Mb of genomic sequence from a panel of 56 Bacillus anthracis strains. Sequence quality was shown to be very high by replication (discrepancy rate of  $7.4 \times 10^{-7}$ ) and by comparison to independently generated shotgun sequence (discrepancy rate  $< 2.5 \times 10^{-6}$ ). Population genomics studies of microbial pathogens using rapid resequencing technologies such as resequencing arrays are critical for recognizing newly emerging or genetically engineered strains.

DTIC

*Bacillus; Microorganisms; Pathogens*

**20070029700** National Inst. of Allergy and Infectious Diseases, Bethesda, MD USA

**Human Platelets Exhibit Chemotaxis using Functional N-Formyl Peptide Receptors**

Czapiga, Meggan; Gao, Ji-Liang; Kirk, Allen; Lekstrom-Himes, Julie; Jan 2005; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468896; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468896>

Activated platelets participate in inflammatory and microbicidal processes by upregulation of surface selectins, shedding of CD40 ligand, and release of platelet microbicidal proteins and microparticles. Given their myeloid lineage, we hypothesized that platelets express functional N-formyl peptide receptors and respond to the bacterially derived chemotactic peptide N-formyl peptide with gradient-driven chemotaxis. Methods and Results. Here we show specific binding of N-formyl peptides to the surface of activated platelets. Platelet expression and function of the formyl peptide receptor, FPR, was verified by RT-PCR of the differentiated megakaryocyte MEG-01 cell line, immunoblotting of platelet proteins, and calcium mobilization in platelets with formyl peptide binding. Furthermore, we demonstrate gradient-driven chemotaxis of platelets by video microscopy and transwell migration toward formyl peptides. We also show that endogenous formyl peptides, released by eukaryotic mitochondria from necrotic cells, induce chemotaxis using formyl peptide receptors expressed by thrombin-activated platelets. Conversely, supernatants from cells undergoing apoptotic cell death do not induce platelet chemotaxis. Platelet chemotaxis to formyl peptides was blocked with FPR-specific antibody as well as by pertussis toxin inhibition of the formyl peptide G-coupled receptor. Conclusion. These data establish a new role for platelets in host defense and suggest reexamination of their active function in microbicidal and other host defense activities.

DTIC

*Ischemia; Peptides; Platelets*

**20070029701** Naval Medical Research Center, Silver Spring, MD USA

**Human Spotted Fever Rickettsial Infections**

Schoeler, George B; Moron, Cecilia; Richards, Allen; Blair, Patrick J; Olson, James G; Apr 2005; 4 pp.; In English

Report No.(s): AD-A468898; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468898>

Serum specimens from patients at 4 sites in Peru were tested for evidence of spotted fever group rickettsial infection. Results showed that 30 (18%) of 170 patients had spotted fever group rickettsial infections which likely caused their illnesses. These findings document laboratory-confirmed spotted fever from diverse areas of Peru.

DTIC

*Antibodies; Blood; Fever; Globulins; Infectious Diseases; Serums*

**20070029707** Navy Environmental and Preventive Medicine Unit No. 5, San Diego, CA USA

**Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis**

Andersen, Ellen M; Cruz-Saldarriaga, Maria; Llanos-Cuentas, Alejandro; Luz-Cjuno, Maria; Echevarria, Juan; Maranda-Verastegui, Cesar; Colina, Olga; Berman, Jonathan D; Jan 2005; 6 pp.; In English

Report No.(s): AD-A468919; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468919>

Pentamidine was compared with meglumine antimoniate (Glucantime) for 80 patients with cutaneous leishmaniasis due

to *Leishmania braziliensis* in Peru. Of the 40 patients administered Glucantime (20 mg of antimony [Sb]/kg/day intravenously for 20 days), 31 cured (78%), 6 failed (15%), of which 5 were due to relapse, and 3 were lost to follow-up (7%). Of the 40 patients administered pentamidine (2 mg/kg every other day for seven injections), 14 were cured (35%), 23 failed (58%), and 3 were lost to follow-up (7%). Five pentamidine failures were due to relapse, and 14 failures were due to the presence of parasites two weeks after therapy. Both regimens were well tolerated. Gastrointestinal, musculoskeletal, and total adverse events were not statistically different in either group. Elevations in levels of liver enzymes and pancreatic enzymes were statistically higher in the Glucantime group, but no patient terminated therapy prematurely. In this study, Glucantime was more effective than pentamidine for treatment of *L. braziliensis* cutaneous leishmaniasis in Peru based on parasitologic as well as clinical criteria.

DTIC

*Diseases; Gastrointestinal System; Musculoskeletal System; Parasites*

**20070029708** Naval Medical Research Inst. Detachment, Lima, Peru

**Cross-Serotype Neutralization of Dengue Virus in *Aotus nancymae* Monkeys**

Kochel, Tadeusz J; Watts, Douglas M; Gozalo, Alfonso S; Ewing, Daniel F; Porter, Kevin R; Russell, Kevin L; Jan 31, 2005; 6 pp.; In English

Report No.(s): AD-A468920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468920>

Previously, we observed that serum from humans immune to dengue serotype 1 (dengue-1) neutralized the American genotype of dengue serotype 2 (American-2) to a greater extent than it neutralized the Asian genotype of dengue serotype 2 (Asian-2). To determine if this activity is protective, *Aotus nancymae* monkeys were infected with dengue-1 followed by either American-2 or Asian-2. Dengue-1 infected animals produced antibody with neutralizing titers of 2656 antibodies against dengue-1, 409 against American-2, and 120 against Asian-2. Infection with American-2 did not produce detectable viremia in either dengue-1 immune or dengue-1 naive animals. These findings support the hypothesis that dengue-1 immunity might have prevented disease or altered the severity of disease in individuals sequentially infected with dengue-1 and American-2. Dengue viruses are single-stranded, positive-sense RNA viruses that belong to the Flavivirus genus in the Flaviviridae family. There are 4 serotypes of dengue virus (dengue 1-4), and each serotype consists of many closely related (genotypic) viruses. Dengue viruses are transmitted primarily by *Aedes aegypti* mosquitoes, and all 4 serotypes cause human disease. It is estimated that 100 million dengue infections occur annually worldwide [1], and these can either be subclinical or cause diseases ranging from a flulike syndrome dengue fever to severe disease characterized by capillary leakage and thrombocytopenia dengue hemorrhagic fever (DHF) to hypovolemic shock dengue shock syndrome.

DTIC

*Antigens; Infectious Diseases; Monkeys; Viruses*

**20070029709** Sutter Inst. for Medical Research, Sacramento, CA USA

**Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru**

Belmusto-Worn, Vivian E; Sanchez, Joel L; McCarthy, Karen; Nichols, Richard; Baustista, Christian T; Magill, Alan J; Pastor-Cauna, Giovanna; Echevarria, Carlos; Laguna-Torres, Victor A; Samame, Billey K; Aug 17, 2004; 10 pp.; In English  
Report No.(s): AD-A468921; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468921>

We conducted a randomized, double-blind, phase III yellow fever (YF) vaccine trial among 1,107 healthy children in Sullana in northern Peru. The safety and efficacy (by measurement of geometric mean neutralizing antibody titer responses) were determined for two YF vaccines, ARILVAX (exp Trademark)' (n 738) and YF-VAX (n 369). Seroconversion rates were higher (94.9%) in ARILVAX(EXP TRADEMARK)' than in YF-VAX (90.6%) recipients. The two-sided 95% confidence interval (YF-VAX ARILVAX(EXP TRADEMARK)') was (12.8% to 2.5%), indicating that the higher seroconversion rate for Arilvax' was significant. Post-vaccination (30-day) mean log<sub>10</sub> neutralization indices were found to be similar for both products: 1.32 for ARILVAX(EXP TRADEMARK)' and 1.26 for YF-VAX (P 0.1404, by analysis of variance). A similar number of subjects in each group reported at least one adverse event (AE); 441 (59.8%) for ARILVAX(EXP TRADEMARK)' versus 211 (59.9%) for YF-VAX. Most (591; 96.7%) of these were of a mild nature and resolved without treatment. There

were no treatment-related serious AEs. This is the first randomized, double-blind comparison of two YF vaccines in a pediatric population; both vaccines were shown to be highly immunogenic and well-tolerated.

DTIC

*Children; Clinical Medicine; Fever; Peru; Safety; Vaccines*

**20070029714** Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA  
**Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor kB Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling**  
Minsavage, Gary D; Dillman III, James F; Jan 2007; 12 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468940; USAMRICD-P05-036; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA468940>

Bifunctional alkylating agents (BFA) such as mechlorethamine (nitrogen mustard) and bis-(2-chloroethyl) sulfide (sulfur mustard; SM) covalently modify DNA and protein. The roles of nuclear factor kappa B (NF-kB) and p53, transcription factors involved in inflammatory and cell death signaling, were examined in normal human epidermal keratinocytes (NHEK) and immortalized HaCaT keratinocytes, a p53-mutated cell line, to delineate molecular mechanisms of action of BFA. NHEK and HaCaT cells exhibited classical NF-kB signaling as degradation of inhibitor protein of NF-kappa B alpha (I kappa B alpha) occurred within 5 min after exposure to tumor necrosis factor-alpha. However, exposure to BFA induced nonclassical NF-kB signaling as loss of I kappa B alpha was not observed until 2 or 6 h in NHEK or HaCaT cells, respectively. Exposure of an NF-kB reporter gene-expressing HaCaT cell line to 12.5, 50, or 100 micrometers SM activated the reporter gene within 9 h. Pretreatment with caffeic acid phenethyl ester (CAPE), a known inhibitor of NF-kB signaling, significantly decreased BFA-induced reporter gene activity. A 1.5-h pretreatment or 30-min postexposure treatment with CAPE prevented BFA-induced loss of membrane integrity by 24 h in HaCaT cells but not in NHEK. CAPE disrupted BFA-induced phosphorylation of p53 and p90 ribosomal S6 kinase (p90RSK) in both cell lines. CAPE also increased nuclear factor E2-related factor 2 and decreased aryl hydrocarbon receptor protein expression, both of which are involved in antioxidant/electrophilic response element (ARE/EpRE) signaling. Thus, disruption of p53/p90RSK-mediated NF-kB signaling and activation of ARE/EpRE pathways may be effective strategies to delineate mechanisms of action of BFA-induced inflammation and cell death signaling in immortalized versus normal skin systems.

DTIC

*Alkylation; Antioxidants; Death; Deoxyribonucleic Acid; Esters; Inhibitors*

**20070029719** Naval Medical Research Center, Silver Spring, MD USA  
**Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever**  
Chao, C C; Chen, H W; Li, X; Xu, W B; Hanson, B; Ching, W M; Jan 2005; 4 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468963; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA468963>

The clinical diagnosis of Q fever is difficult. Whole cell antigens are currently used in several serological methods, but antigens are limited due to the hazardous nature of *Coxiella burnetii* cultivation. In this report, we described the method of detecting immunodominant antigens of *C. burnetii* by using proteomic techniques with patient sera, and cloning and expressing the selected antigens using a novel vector known for its ease of expression, purification, and downstream application.

DTIC

*Antigens; Cloning (Biology); Electrophoresis; Fever; Liquid Chromatography; Markers; Mass Spectrometers; Proteins*

**20070029723** Wellcome Trust Sanger Inst. Genome Campus, Cambridge, UK  
**A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses**  
Hall, Neil; Karras, Marianna; Raine, J D; Carlton, Jane M; Kooij, Taco W; Berriman, Matthew; Florens, Laurence; Janssen, Christoph S; Pain, Arnab; Christophides, Georges K; Jan 7, 2005; 6 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468967; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA468967>

*Plasmodium berghei* and *Plasmodium chabaudi* are widely used model malaria species. Comparison of their genomes, integrated with proteomic and microarray data, with the genomes of *Plasmodium falciparum* and *Plasmodium yoelii* revealed a conserved core of 4500 *Plasmodium* genes in the central regions of the 14 chromosomes and highlighted genes evolving

rapidly because of stage-specific selective pressures. Four strategies for gene expression are apparent during the parasites life cycle: (i) housekeeping; (ii) host-related; (iii) strategy-specific related to invasion, asexual replication, and sexual development; and (iv) stage-specific. We observed post transcriptional gene silencing through translational repression of messenger RNA during sexual development, and a 47-base 3 untranslated region motif is implicated in this process.

DTIC

*Antigens; Genome; Immune Systems; Life (Durability); Parasites; Parasitic Diseases; Proteome; Protozoa; Ribonucleic Acids; Surveys*

**20070029724** Ministry of Health, Montevideo, Uruguay

**Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay**

Vinoles, Jose; Serra, Margarita; Russ, Jose C; Ruchansky, Dora; Sosa-Estani, Sergio; Montano, Silvia M; Carrion, Gladys; Eyzaguirre, Lindsay M; Carr, Jean K; Olson, James G; Jan 2005; 7 pp.; In English

Report No.(s): AD-A468969; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468969>

A cohort study involving 60 human immunodeficiency virus (HIV) negative male transvestite commercial sex workers (CSWs) was conducted in Montevideo, Uruguay in 1999-2001. Serum samples were tested for HIV by an enzyme-linked immunosorbent assay screening with immunoblot confirmation. Six participants seroconverted for an incidence-density rate of 6.03 (95% confidence interval 2.21-13.12) per 100 person-years. Inconsistent condom use during client sex (adjusted hazard ratio [AHR] 6.7), during oral sex (AHR 5.6), and at the last sexual encounter (AHR 7.8), and use of marijuana (AHR 5.4) were marginally associated with HIV seroconversion. Five samples were genotyped in the protease and reverse transcriptase regions; three were subtypes B and two were BF recombinants. Full genome analysis of four samples confirmed all three subtype B samples and one of the two BF recombinants. Male transvestite CSWs sustained a high rate of HIV infection. Larger prospective studies are required to better define subtypes and associated sexual and drug-related risk factors.

DTIC

*Blood; Human Immunodeficiency Virus; Infectious Diseases; Personnel; Risk; Serums; Sex; Uruguay; Viruses*

**20070029725** Food and Drug Administration, Rockville, MD USA

**Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain**

Mahajan, Babita; Jani, Dewal; Chattopadhyay, Rana; Nagarkatti, Rana; Zheng, Hong; Majam, Victoria; Weiss, Walter; Kumar, Sanjai; Rathore, Dharmendar; Apr 27, 2005; 9 pp.; In English

Report No.(s): AD-A468970; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468970>

Proteins present on the surface of malaria parasites that participate in the process of invasion and adhesion to host cells are considered attractive vaccine targets. Aided by the availability of the partially completed genome sequence of the simian malaria parasite *Plasmodium knowlesi*, we have identified a 786-bp DNA sequence that encodes a 262-amino-acid-long protein, containing an altered version of the thrombospondin type I repeat domain (SPATR). Thrombospondin type 1 repeat domains participate in biologically diverse functions, such as cell attachment, mobility, proliferation, and extracellular protease activities. The SPATR from *P. knowlesi* (PkSPATR) shares 61% and 58% sequence identity with its *Plasmodium falciparum* and *Plasmodium yoelii* orthologs, respectively. By immunofluorescence analysis, we determined that PkSPATR is a multistage antigen that is expressed on the surface of *P. knowlesi* sporozoite and erythrocytic stage parasites. Recombinant PkSPATR produced in *Escherichia coli* binds to a human hepatoma cell line, HepG2, suggesting that PkSPATR is a parasite ligand that could be involved in sporozoite invasion of liver cells. Furthermore, recombinant PkSPATR reacted with pooled sera from *P. knowlesi*-infected rhesus monkeys, indicating that native PkSPATR is immunogenic during infection. Further efficacy evaluation studies in the *P. knowlesi*-rhesus monkey sporozoite challenge model will help to decide whether the SPATR molecule should be developed as a vaccine against human malaria.

DTIC

*Cloning (Biology); Genes; Infectious Diseases; Proteins; Thrombosis; Vaccines*

**20070029727** Army War Coll., Carlisle Barracks, PA USA

**Can GWOT Primary Prevention Strategy More Effectively Impede Religious Extremism?**

Meyers, Michael A; Mar 23, 2007; 22 pp.; In English

Report No.(s): AD-A468975; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468975>

Primary prevention, as a medical term, involves taking action to prevent problems from occurring before the onset of symptoms. This concept, when related to the Global War on Terrorism (GWOT) in the Middle East, provides insights on the current strategy's effort and effectiveness in staying ahead of religious extremism expansion. Current U.S. focus and expenditure of resources in Iraq and Afghanistan are very expensive and largely a treatment of religious extremism symptoms. To realize cost effective and enduring effects, Middle East primary prevention strategy requires increased emphasis, updated strategic objectives, and implementation analysis. Existing regimes, with their stability, influence, and control over the vast pool of undecided moderate Muslims, are the critical point of strength and vulnerability for both sides. The strategic objective of cauterization, strengthening the states surrounding the country facing an insurgency, is the most valid approach to achieve the end state of isolated pockets of extremism. Diplomacy through principled negotiation, unilateral hegemonic restraint, and a multi-lateral focus of execution will provide the U.S. legitimacy and leverage to realize the efficacy of primary prevention.

DTIC

*Cost Effectiveness; Medical Science; Prevention; Signs and Symptoms; Terrorism; Warfare*

**20070029730** Georgetown Univ., Washington, DC USA

**Medical Vanguard Diabetes Management**

Mun, Seong K; Sep 2006; 86 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-2-0002

Report No.(s): AD-A468986; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468986>

The Medical Vanguard Diabetes Management Project was designed to deploy an Internet based diabetes management system, MyCare Team, into a number of existing diverse clinical environments and evaluate how such a stand-alone clinical information system can be integrated into diabetes management program. The diverse environments include the High-Risk Pregnancy Clinic at the National Naval Medical Center and Native American Communities throughout the USA. The GAO Report Executive Guide: Measuring Performance and Demonstrating Results of Information Technology Investments (GAO/AIMD-98-89) will be used as the basis for the evaluation of the technology implementations. Enrollment of patients is set to start in two Native Communities, and the IRB process almost complete in two others. The processes required to implement this technology into diverse communities will be studied. This project has two primary specific aims: clinical deployment and deployment evaluation.

DTIC

*Metabolic Diseases; Telemedicine*

**20070029734** New Mexico Univ., Albuquerque, NM USA

**Prognostic Significance of Telomere Attrition in Ductal Carcinoma in Situ of the Breast**

Griffith, Jeffrey K; Feb 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0226

Report No.(s): AD-A468993; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468993>

We are using an innovative quantitative assay for telomere DNA content (TC) developed and characterized by the PI to test the hypothesis that TC predicts the likelihood of disease recurrence in women with DCIS. In Year One we collaborated to determine whether TC measured in bulk DCIS tumor tissue is comparable to that measured in tumor epithelial cells purified by laser-capture microscopy. In 7/10 instances TC in microdissected specimens was 72-112% of that in the undissected control (mean 85%). These results suggest that it will not be necessary to microdissect or otherwise fractionate DCIS specimens prior to TC analysis. We are currently confirming and extending these results in our own laboratory. In Years One and Two we measured TC in 46 specimens of normal breast tissue 126 specimens of DCIS and 657 specimens of breast tumor tissues. In Year Two we used a Kaplan-Meier plot and log-rank test to show that low TC predicts a shorter survival interval. TC was not associated with ethnicity menopausal status or the expression of several other markers including estrogen receptor progesterone receptor p53 Ki67 and Her2. We are working with the New Mexico Tumor Registry to identify additional specimens of DCIS from women with longer follow-up to confirm and extend these results. In summary during Years One and

Two we have shown that (i) meaningful TC measurements can be obtained with bulk DCIS issues (ii) TC is associated with tumor stage and (iii) TC in DCIS is associated with breast cancer-free survival.

DTIC

*Breast; Cancer; Genome; Mammary Glands; Prognosis; Telomeres*

**20070029735** Michigan Univ., Ann Arbor, MI USA

**Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies**

LeCarpentier, Gerald L; Oct 2006; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0327

Report No.(s): AD-A468994; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468994>

Doppler ultrasound and other imaging modalities have been used to assess characteristics of vasculature associated with malignant breast masses. 3D contrast refill imaging should help visualize slow-flow in small neo-vasculature associated with these masses. The dual-transducer method investigated is expected to provide vascular mapping while minimizing acquisition time, the major limitation of techniques such as interval-imaging (I-I) and real-time (RT) imaging. Phantom tube-flow studies confirmed the method as viable in a simple sense. Further experiments with an in vitro fixed porcine kidney provided the bulk of the data post Y2. Image volumes reconstructed using the dual-transducer method displayed remarkable spatial detail. A parametric method of visualizing mean transit times (MTTs) throughout a volume was developed, and a secondary scheme for extending the technique into clinical trials was developed. Simple MTT estimates were extended into actual perfusion estimates, using large vessel reference signals within each image plane. These signals were characterized and quantified by way of a variety of means presented in this report. There was significant consistency among methods. Results over the course of the study have been promising, and clinical trials are expected in the near future.

DTIC

*Anomalies; Breast; Cancer; Cardiovascular System; Imaging Techniques; Mammary Glands; Ultrasonics*

**20070029736** Michigan Univ., Ann Arbor, MI USA

**Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies**

LeCarpentier, Gerald L; Oct 2005; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0327

Report No.(s): AD-A468996; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468996>

Doppler ultrasound and other imaging modalities have been used to assess characteristics of vasculature associated with malignant breast masses. 3D contrast refill imaging should help visualize slow-flow in small neo-vasculature associated with these masses. The dual-transducer method proposed should provide vascular mapping while minimizing acquisition time, the major limitation of techniques such as interval-imaging (I-I) and real-time (RT) imaging. Previous phantom tube-flow studies and fixed porcine kidney studies were further analyzed and formalized in two separate papers submitted to Ultrasound in Medicine and Biology. While results were promising, follow-up verification of the latter displayed some unexplainable anomalies. It has become clear that comparisons of mean transit time alone are insufficient. It is also apparent that input contrast signal levels vary in time in less than ideal ways (i.e. as opposed to our earlier assumption of exponential decay). We have begun to evaluate a method for estimating the signal level in 100% blood from characteristics of cumulative histograms of each acquired image. This should allow us a method to both monitor fluctuations of input contrast signal level and calculate a real value for fractional blood volume (and subsequently, combined with mean transit time estimates, an actual measure of perfusion).

DTIC

*Anomalies; Breast; Cancer; Cardiovascular System; Imaging Techniques; Mammary Glands; Ultrasonics*

**20070029737** California Univ., Irvine, CA USA

**Physiological Stress Reactivity and Breast Cancer**

Wadhwa, Pathik; Oct 2005; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9248

Report No.(s): AD-A468998; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468998>

The objective of the present program of research is to study physiological processes that may mediate the links between

psychological states and cancer. Specifically, the present study is designed to conduct an investigation of the cross-sectional associations between indices of stress reactivity and psychological coping styles in women with breast cancer and matched healthy controls. The aims of the project are: (1) To quantify parameters of biological reactivity to a behavioral stress paradigm in women with and without breast cancer; (2) To examine effects of menopause and familial risk on biological stress reactivity and emotional expression; and (3) To develop the methodology and obtain preliminary data which could justify subsequent, prospective research with high-risk populations. Data collection ended May 2005. Results of data analyses indicated significant differences in several cardiovascular indicators of stress-reactivity, as well as significant differences in changes in cortisol levels between the breast cancer and control group. While specific coping styles were shown to relate differently to cardiovascular stress responses and negative emotional responses among participants, coping styles were not associated with changes in cortisol levels. This suggests that the HPA-stress hormone link may not be mediated by perception of stress. Among reproductive and familial risk factors assessed, oral contraceptive use and length of use were associated with a dysregulated biological stress response profile (i.e., respond quicker and not recover as quickly).

DTIC

*Breast; Cancer; Mammary Glands; Physiology; Reactivity*

**20070029741** California Univ., Berkeley, CA USA

**A Rat Model for Human Ductal Carcinoma In Situ**

Nandi, Satyabrata; Sep 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0551

Report No.(s): AD-A469002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469002>

Our objective was to develop a rodent model for human OCIS and LCIS in which lesions of diverse phenotypes could be induced and characterized and their malignant potential studied in a linear manner. We tested the effect of the infusion of EGF FGF or IGF1 on the proliferation of mammary glands in ovariectomized rats. Infusion of EGF, FGF or IGF1 resulted in end bud formation and lobuloalveolar development within 72 hours. Intraductal proliferation resulted only in rats treated with IGF1. These results indicate that infusion of growth factors into the mammary glands induces proliferation of different kinds of structures including end buds lobuloalveolar structures and intraductal proliferations and that the growth factors in ovariectomized rats can support neoplastic mammary transformation. EGF or IGF-1 were infused in ovariectomized rats using Alzet pumps and treated with the chemical carcinogen N-methyl-N nitrosourea (MNU). The cancers were varied in their estrogen and progesterone receptor expression as determined by immunocytochemistry. The objectives of the project were not achieved due to the low incidence of mammary cancers induced following treatment with growth factors and MNU making it difficult to transplant lesions of different phenotypes and characterize the malignant potential.

DTIC

*Breast; Cancer; Mammary Glands; Rats*

**20070029744** National Inst. of Health, Bethesda, MD USA

**Sources of Variability in Determining Malaria Parasite Density by Microscopy**

O'Meara, Wendy P; McKenzie, F E; Magill, Alan J; Forney, J R; Permpanich, Barnyen; Lucas, Carmen; Gasser, Jr , Robert A; Wongsrichanalai, Chansuda; Jan 2005; 7 pp.; In English

Report No.(s): AD-A469015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469015>

Enumeration of parasites by microscopic examination of blood smears is the only method available for quantifying parasitemia in infected blood. However, the sources and scale of error inherent in this technique have not been systematically investigated. Here we use data collected in outpatient clinics in Peru and Thailand to elucidate important sources of variation in parasite density measurements. We show that discrepancies between readings from two independent microscopists and multiple readings from a single microscopist are inversely related to the density of the infection. We present an example of how differences in reader technique, specifically the number of white blood cells counted, can contribute to the differences between readings. We discuss the implications of this analysis for field studies and clinical trials.

DTIC

*Infectious Diseases; Microscopy; Parasites; Parasitic Diseases; Variability*

**20070029745** Kasetsart Univ., Bangkok, Thailand

**Behavioral Responses to DDT and Pyrethroids Between Anopheles Minimus Species A and C Malaria Vectors in Thailand**

Potikasikorn, Jinnapa; Chareonviriyaphap, Theeraphap; Bangs, Michael J; Prabaripai, Atchariya; Jan 2005; 8 pp.; In English Report No.(s): AD-A469018; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469018>

Behavioral responses of two field populations of *Anopheles minimus* complex species A and C for contact and non-contact actions of chemicals were compared during and after exposure to operational field concentrations of DDT (2 g/sq m), deltamethrin (0.02 g/sq m), and lambda-cyhalothrin (0.03 g/sq m) using an excito-repellency escape chamber. The two populations were collected from the Mae Sot District in Tak Province (species A) and the Tri Yok District in Kanchanaburi Province (species C) in western Thailand. Female mosquitoes of both populations rapidly escaped from chambers after direct contact with DDT, deltamethrin, and lambda-cyhalothrin. The non-contact repellency response to DDT and the two synthetic pyrethroids was pronounced with *An. minimus* species A; however, non-contact repellency was relatively weak with *An. minimus* species C, but remained significantly greater than the paired controls ( $P < 0.05$ ). We conclude that strong contact irritancy was present in both test populations, whereas non-contact repellency also played a significant role in the escape response of *An. minimus* species A.

DTIC

*DDT; Insects; Parasitic Diseases; Thailand*

**20070029750** Naval Medical Research Inst. Detachment, Lima, Peru

**Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America**

Montano, Silvia M; Sanchez, Jose L; Laguna-Torres, Alberto; Cuchi, Paloma; Avila, Maria M; Weissenbacher, Mercedes; Serra, Margarita; Russi, Jose Vinales; ose C; Aguayo, Nicolas; Feb 7, 2005; 8 pp.; In English

Report No.(s): AD-A469029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469029>

HIV cross-sectional studies were conducted among high-risk populations in 9 countries of South America. Enzyme-linked immunosorbent assay screening and Western blot confirmatory testing were performed, and env heteroduplex mobility assay genotyping and DNA sequencing were performed on a subset of HIV-positive subjects. HIV prevalences were highest among men who have sex with men (MSM; 2.0%-27.8%) and were found to be associated with multiple partners, noninjection drug use (non-IDU), and sexually transmitted infections (STIs). By comparison, much lower prevalences were noted among female commercial sex workers (FCSWs; 0%-6.3%) and were associated mainly with a prior IDU and STI history. Env subtype B predominated among MSM throughout the region (more than 90% of strains), whereas env subtype F predominated among FCSWs in Argentina and male commercial sex workers in Uruguay (more than 50% of strains). A renewed effort in controlling STIs, especially among MSM groups, could significantly lessen the impact of the HIV epidemic in South America.

DTIC

*Infectious Diseases; Risk; South America; Viruses*

**20070029752** Library of Congress, Washington, DC USA

**Mandatory Vaccinations: Precedent and Current Laws**

Welborn, Angie A; Jan 18, 2005; 6 pp.; In English

Report No.(s): AD-A469034; CRS-RS21414; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469034>

This report discusses the history legal precedent for mandatory vaccination laws and provides a brief overview of state laws that require certain individuals or populations to be vaccinated against various communicable diseases. State laws include those requiring children to be vaccinated before they enroll in a public or private school and laws providing for mandatory vaccinations during a public health emergency or outbreak of a communicable disease. In addition to the current laws, many states are considering or have considered the provisions set forth in the Model State Emergency Health Powers Act. The Model Act addresses a number of issues likely to arise during a public health emergency and offers guidelines for states with respect to what powers may be necessary during such an emergency. Under the Model Act, during a public health emergency the public health authority would be authorized to 'vaccinate persons as protection against infectious disease and to prevent the spread of contagious or possibly contagious disease.' Under the Public Health Service Act, the Secretary of Health and Human Services has the authority to make and enforce regulations necessary 'to prevent the introduction, transmission, or spread of communicable diseases from foreign countries into the States or possessions, or from one State or possession into any other State or possession.' Generally, federal regulations authorizing the apprehension, detention, examination, or conditional



release of individuals are applicable only to individuals coming into a State or possession from a foreign country or a possession. This limitation on federal jurisdiction acknowledges that states have the primary responsibility for protecting the public health, but under certain circumstances, federal intervention may be necessary. This report will be updated as warranted.  
DTIC

*Immunology; Infectious Diseases; Law (Jurisprudence); Laws; Public Health*

**20070029755** Georgetown Univ. Hospital, Washington, DC USA

**Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele**

Lazaro, A M; Steiner, N K; Moraes, M E; Moraes, J R; Ng, J; Hartzman, R J; Hurley, C K; May 31, 2006; 4 pp.; In English  
Contract(s)/Grant(s): N00014-90-1-0795; N00014-00-1-0898

Report No.(s): AD-A469041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469041>

Ten novel HLA-DRB1 and one DRB3 alleles are described. Eight of the variants are single-nucleotide substitutions, four resulting in an amino acid change (DRB1\*1145, \*1148, \*0828 and \*1514) and four with silent substitutions (DRB1\*040504, \*130103, \*160502 and DRB1\*1447 and \*1361) amino acid and one allele alters three nucleotides and two amino acids.

DTIC

*Amino Acids; Antigens; Nucleotides*

**20070029756** Naval Medical Research Unit No. 2, Jakarta, Indonesia

**Early Detection of Dengue Infections using Cluster Sampling Around Index Cases**

Beckett, Charmagne G; Kosasih, Herman; Faisal, Indra; Nurhayati,.; Tan, Ratna; Widjaja, Susana; Aningsih, Erlin L; Ma'Roef, Chairin; Wuryadi, Suharyono; Bangs, Michael J; Jan 2005; 7 pp.; In English

Report No.(s): AD-A469042; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469042>

A two-year study using a cluster investigation method was conducted in West Jakarta, Indonesia to demonstrate the detection of dengue cases prior to onset of clinical illness. The clusters consisted of family members and neighbors of 53 hospitalized dengue index cases. Among 785 adult and child volunteers enrolled, 17 (2.2%) post enrollment dengue (PED) infections were identified. Eight PED cases were asymptomatic and nine were symptomatic. Symptomatic cases included eight with dengue fever and one with dengue hemorrhagic fever (DHF) (grade II). Among the eight asymptomatic PED cases, viremia was detected in two. Eleven volunteers had acute dengue infections at the time of enrollment. Four of the 11 developed DHF, resulting in a total of five DHF cases detected during the investigation. This study design can serve as a benchmark for future investigations that seek to define early immunologic events following dengue infections that contribute to the development of DHF.

DTIC

*Clinical Medicine; Detection; Fever; Hemorrhages; Infectious Diseases; Sampling; Viral Diseases*

**20070029759** Naval Medical Research Center, Silver Spring, MD USA

**Intracellular Survival of Campylobacter jejuni in Human Monocytic Cells and Induction of Apoptotic Death by Cytolethal Distending Toxin**

Hickey, Thomas E; Majam, Gary; Guerry, Patricia; Mar 30, 2005; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469046>

Campylobacter jejuni 81-176 is capable of extensive replication within human monocytic cell vacuoles and induces apoptotic death via cytolethal distending toxin.

DTIC

*Apoptosis; Death; Monocytes; Survival; Toxins and Antitoxins*

**20070029760** Maryland Univ., Baltimore, MD USA

**Murine Macrophages Kill the Vegetative Form of Bacillus anthracis**

Kang, Tae J; Fenton, Matthew J; Weiner, Matthew A; Hibbs, Stephen; Basu, Subhendu; Baillie, Les; Cross, Alan S; Aug 18, 2005; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469048; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469048>

Anti-protective antigen antibody was reported to enhance macrophage killing of ingested Bacillus anthracis spores, but

it was unclear whether the antibody-mediated macrophage killing mechanism was directed against the spore itself or the vegetative form emerging from the ingested and germinating spore. To address this question, we compared the killing of germination-proficient (gp) and germination-deficient (DeltagerH) Sterne 34F2 strain spores by murine peritoneal macrophages. While macrophages similarly ingested both spores, only gp Sterne was killed at 5 h (0.37 log kill). Pretreatment of macrophages with gamma interferon (IFN-gamma) or opsonization with immunoglobulin G (IgG) isolated from a subject immunized with an anthrax vaccine enhanced the killing of Sterne to 0.49 and 0.73 log, respectively, but the combination of IFN-gamma and IgG was no better than either treatment alone. Under no condition was there killing of DeltagerH spores. To examine the ability of the exosporium to protect spores from macrophages, we compared the macrophage-mediated killing of nonsonicated (exosporium+) and sonicated (exosporium-) Sterne 34F2 spores. More sonicated spores than nonsonicated spores were killed at 5 h (0.98 versus 0.37 log kill, respectively). Pretreatment with IFN-gamma increased the sonicated spore killing to 1.39 log. However, the opsonization with IgG was no better than no treatment or pretreatment with IFN-gamma. We conclude that macrophages appear unable to kill the spore form of *B. anthracis* and that the exosporium may play a role in the protection of spores from macrophages.

DTIC

*Antibodies; Bacillus; Infectious Diseases; Macrophages; Rodents; Spores; Urine; Vegetation*

**20070029762** Naval Medical Research Center, Silver Spring, MD USA

**A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation**

Philbin, Nora; Rice, Jennifer; Gurney, Jennifer; McGwin, Gerald; Arnaud, Francoise; Dong, Feng; Johnson, Todd; Flourncy, W S; Ahlers, Stephen; Pearce, L B; McCarron, Richard; Freilich, Daniel; Mar 23, 2005; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469050>

Objective: To evaluate the efficacy of HBOC-201 for resuscitation of hemorrhagic shock in a swine model incorporating soft tissue injury and delayed evacuation. Methods: A muscle crush injury and 40% estimated blood volume controlled hemorrhage was completed in 24 Yucatan mini-pigs. Pigs were untreated or resuscitated with HBOC-201 or 6% hetastarch (HEX) at 20 min. Invasive hemodynamics and clinical variables were monitored for 4 h (pre-hospital phase) and subsequent fluid infusions were administered for severe hypotension or tachycardia. Animals were recovered from anesthesia and monitored non-invasively to 72 h (hospital phase). Results: 100% (8/8) of HBOC-201-, 88% (7/8) of HEX-, and 63% (5/8) of non-resuscitated pigs, survived to 72 h ( $p = 0.27$ ). Mean arterial pressure, mean pulmonary arterial pressure and systemic vascular resistance index were higher in HBOC-201 pigs. By 90 min, cardiac index was restored to baseline in the HBOC-201 group and was 1.4-fold greater than baseline in the HEX group. HBOC-201 pigs had lower fluid requirements than HEX pigs (18.8 1.8 and 29.9 1.1 ml/kg,  $p < 0.001$ ) in the pre-hospital phase and required fewer blood transfusions (1.3 1.3 and 9.4 0.6 ml/kg, respectively,  $p < 0.001$ ) in the hospital phase. Urine output and blood creatinine were comparable in HBOC-201 and HEX pigs. Tissue oxygenation levels were highest in the HBOC-201 group. Conclusions: As HBOC-201 restored hemodynamics and tissue oxygenation and decreased fluid requirements, in comparison with HEX, HBOC-201 was at least as efficacious and possibly a superior resuscitative fluid in a military-relevant delayed evacuation hemorrhagic shock swine model.

DTIC

*Blood Circulation; Delay; Hemoglobin; Injuries; Oxygen; Polymerization; Resuscitation; Shock (Physiology); Swine*

**20070029768** Naval Medical Research Center, Silver Spring, MD USA

**Proteomic Analysis of *Rickettsia prowazekii***

Chao, C C; Chelius, D; Zhang, T; Mutumanje, E; Ching, W M; Jan 2005; 4 pp.; In English

Report No.(s): AD-A469065; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469065>

*Rickettsia prowazekii* is an obligate intracellular gram-negative bacterium. Comparative proteomics study of a virulent strain (Breinl) versus an avirulent strain (Madrid E) was performed using an integrated liquid chromatography and mass spectrometer. About 30% of predicted proteins were detected and identified. Among the detected proteins, more than 30 proteins were of unknown function in both strains. Although several proteins were detected in only one strain, the overall distribution of detected proteins in different COGs (clusters of orthologs groups) was very similar between the two strains.

Functional analysis of differentially expressed proteins, either qualitatively or quantitatively, may lead to the discovery of pathogenesis-related factors.

DTIC

*Bacteria; Proteome; Virulence*

**20070029770** Naval Medical Research Unit No. 3, Cairo, Egypt

**Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan)**

Sanders, John W; Putnam, Shannon D; Frankart, Carla; Frenck, Robert W; Monteville, Marshall R; Riddle, Mark S; Rockabrand, David M; Sharp, Trueman W; Tribble, David R; May 25, 2005; 8 pp.; In English

Report No.(s): AD-A469067; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469067>

Historically, non-combatant injuries and illnesses have had a significant impact on military missions. We conducted an anonymous cross-sectional survey to assess the prevalence and impact of common ailments among U.S. military personnel deployed to Iraq or Afghanistan during 2003-2004. Among 15,459 persons surveyed, diarrhea (76.8% in Iraq and 54.4% in Afghanistan), respiratory illness (69.1%), non-combat injuries (34.7%) and leishmaniasis (2.1%) were commonly reported. For all causes 25.2% reported that they required intravenous fluids, 10.4% required hospitalization and 5.2% required medical evacuation. Among ground units 12.7% reported that they missed a patrol because of illness and among air units, 11.7% were grounded because of illness. The incidence of diarrhea and respiratory infections doubled from the pre-combat to combat phases, and the perceived adverse impact of these illnesses on the unit increased significantly during the combat phase. Despite technologic advances in warfare and preventive medicine illness and non-combat injuries have been common during operations in Iraq and Afghanistan, resulting in frequent transient decreases in operational efficiency.

DTIC

*Afghanistan; Combat; Injuries; Sicknesses*

**20070029771** Princeton Univ., NJ USA

**Measuring 'Impossible' Intermolecular Cross-Peaks to Improve Selectivity and Sensitivity in Breast MRI**

Warren, Warren S; Oct 2002; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-99-1-9357

Report No.(s): AD-A469069; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469069>

This proposal focuses on development of a radically new method for breast magnetic resonance imaging (MRI), which could improve detection of small tumors and reduce the unnecessary biopsies generated by false positives in conventional breast MRI and mammography. This method is based on my groups recent discovery of a significant omission in the decades old theoretical framework of nuclear magnetic resonance (NMR, the spectroscopic precursor to MRI). We have shown that it is possible to detect strong signals from intermolecular resonances for example, simultaneously flipping up a water spin at one location while flipping down another water spin 100 um away even though such intermolecular zero-quantum coherences (iZQCs) would be predicted to be completely impossible to observe in the conventional formulation of NMR or MRI. This fundamentally new physics provides the basis for a potentially extremely useful contrast enhancement technique geared towards early detection and tumor grading. Our preliminary results demonstrated iZQC breast imaging on one healthy volunteer, with and without fat suppression. Unfortunately, the human approval process took the entire grant year, during which time the existing human machine was decommissioned. During this time, work progressed on phantom imaging and sequence improvement.

DTIC

*Breast; Cancer; Imaging Techniques; Magnetic Resonance; Mammary Glands; Sensitivity*

**20070029772** Armed Forces Research Inst. of Medical Sciences, Bangkok, Thailand

**Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations**

Islam, Dilara; Lewis, Michael D; Srijan, Apichai; Bodhidatta, Ladaporn; Aksomboon, Ajchara; Gettayacamin, Montip; Baqar, Shahida; Scott, Daniel; Mason, Carl J; Jul 25, 2005; 11 pp.; In English

Report No.(s): AD-A469071; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469071>

disease Campylobacter jejuni is a common cause of enteritis worldwide. The mechanisms by which C. jejuni causes

disease are unclear. Challenge studies in humans are currently considered unethical due to the possibility of severe complications, such as Guillain Barr e syndrome. Campylobacter infection in non-human primates closely mimics the disease and immune response, seen in humans. In this study, we attempted to determine the minimal dose of a pathogenic *C. jejuni* 81-176 strain required for clinical signs and symptoms of disease (e80% attack rate) in *Macaca mulatta* monkeys using an escalating dosage (three doses for three monkey groups: 107, 109 and 1011 cfu). Eighty percent of the monkeys challenged with highest dose (1011 cfu) had mild disease, but the 80% attack rate (moderate diarrhea in 80% of the monkeys) was not achieved. However, 100% of monkeys showed IgA seroconversions (three-fold over pre-challenge titers). The elicited immune response was challenge dose-dependent. Campylobacter antigen specific fecal s-IgA responses were observed in all challenged groups but the response was not dose-dependent. Only IgM antibody secreting cells response was observed against Campylobacter antigens. The elicited immune response in three groups of rhesus monkeys was dose-dependent, indicating this monkey model can be used for pre-clinical evaluation of Campylobacter candidate vaccines, however these adult rhesus monkeys are less prone to Campylobacter infection.

DTIC

*Diseases; Immunity; Infectious Diseases; Monkeys; Primates; Vaccines*

**20070029773** Children's Hospital Medical Center, Cincinnati, OH USA

**National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report**

Filipovich, Alexandra H; Weisdorf, Daniel; Pavletic, Steven; Socie, Gerard; Wingard, John R; Lee, Stephanie J; Martin, Paul; Chien, Jason; Przepiorka, Donna; Couriel, Daniel; Sep 9, 2005; 13 pp.; In English

Report No.(s): AD-A469074; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469074>

This consensus document is intended to serve 3 functions. First, it standardizes the criteria for diagnosis of chronic graft-versus-host disease (GVHD). Second, it proposes a new clinical scoring system (0-3) that describes the extent and severity of chronic GVHD for each organ or site at any given time, taking functional impact into account. Third, it proposes new guidelines for global assessment of chronic GVHD severity that are based on the number of organs or sites involved and the degree of involvement in affected organs (mild, moderate, or severe). Diagnosis of chronic GVHD requires the presence of at least 1 diagnostic clinical sign of chronic GVHD (e.g., poikiloderma or esophageal web) or the presence of at least 1 distinctive manifestation (e.g., keratoconjunctivitis sicca) confirmed by pertinent biopsy or other relevant tests (e.g., Schirmer test) in the same or another organ. Furthermore, other possible diagnoses for clinical symptoms must be excluded. No time limit is set for the diagnosis of chronic GVHD. The Working Group recognized 2 main categories of GVHD, each with 2 subcategories. The acute GVHD category is defined in the absence of diagnostic or distinctive features of chronic GVHD and includes (1) classic acute GVHD occurring within 100 days after transplantation and (2) persistent, recurrent, or late acute GVHD (features of acute GVHD occurring beyond 100 days, often during withdrawal of immune suppression). The broad category of chronic GVHD includes (1) classic chronic GVHD (without features or characteristics of acute GVHD) and (2) an overlap syndrome in which diagnostic or distinctive features of chronic GVHD and acute GVHD appear together. It is currently recommended that systemic therapy be considered for patients who meet criteria for chronic GVHD of moderate to severe global severity.

DTIC

*Clinical Medicine; Diagnosis; Diseases; Health*

**20070029775** Naval Medical Research Center, Silver Spring, MD USA

**HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates**

Mattapallil, Joseph J; Weiss, Walter R; Roederer, Mario; Seder, Robert A; Wille-Reece, Ulrike; Flynn, Barbara J; Lor, Karin; Koup, Richard A; Kedl, Ross M; Jun 23, 2005; 7 pp.; In English

Report No.(s): AD-A469077; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469077>

Induction and maintenance of antibody and T cell responses will be critical for developing a successful vaccine against HIV. A rational approach for generating such responses is to design vaccines or adjuvants that have the capacity to activate specific antigenpresenting cells. In this regard, dendritic cells (DCs) are the most potent antigen-presenting cells for generating primary T cell responses. Here, we report that Toll-like receptor (TLR) agonists and ligands that activate DCs in vitro influence the magnitude and quality of the cellular immune response in nonhuman primates (NHPs) when administered with HIV Gag protein. NHPs immunized with HIV Gag protein and a TLR7 8 agonist or a TLR9 ligand [CpG oligodeoxynucleotides (CpG

ODN)] had significantly increased Gag-specific T helper 1 and antibody responses, compared with animals immunized with HIV Gag protein alone. Importantly, conjugating the HIV Gag protein to the TLR7/8 agonist (Gag-TLR7/8 conjugate) dramatically enhanced the magnitude and altered the quality of the T helper 1 response, compared with animals immunized with HIV Gag protein and the TLR7/8 agonist or CpG ODN. Furthermore, immunization with the Gag-TLR7/8 conjugate vaccine elicited Gag-specific CD8 T responses. Collectively, our results show that conjugating HIV Gag protein to a TLR7/8 agonist is an effective way to elicit broad-based adaptive immunity in NHPs. This type of vaccine formulation should have utility in preventive or therapeutic vaccines in which humoral and cellular immunity is required.

DTIC

*Conjugation; Health; Lymphocytes; Primates; Proteins; Vaccines; Viruses*

**20070029776** Naval Medical Research Center, Silver Spring, MD USA

**Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection**

Taye, A; Chen, H; Duncan, K; Zhang, Z; Hendrix, L; Gonzalez, J; Ching, W; Jan 2005; 7 pp.; In English

Report No.(s): AD-A469080; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469080>

Tropical bartonellosis is a highly fatal epidemic and endemic infectious disease that occurs throughout the communities of the Andes Mountains in South America. The disease is caused by the facultative intracellular bacteria, Bartonella bacilliformis. The emergence of bartonellosis in new geographic areas and an increase in the number of reported cases suggest the need for a rapid test for epidemiologic study and investigation of the disease burden. The objective of this research is to develop a rapid serologic diagnostic test using recombinant antigens to overcome the limitations of the current standard IFA technique for laboratory diagnosis. Western blot analysis with patient sera of whole cell lysate separated on a 2D gel identified Pap31 as a dominant antigen. PCR primers were designed according to the sequence of ATCC strain 35685 to amplify the gene coding for Pap31 from a local isolate (HOSP 800-09, Peru). The amplicon was subsequently cloned into pET24a, adding the T7 tag, and expressed in E. coli. Patient sera with different IFA titers confirmed the diagnostic band of 31 kDa on a Western blot of SDS-PAGE. The performance of affinity-purified recombinant Pap31 (rPap31) was also evaluated in an ELISA format with 137 patient sera of known IFA titers. The range of ELISA reading from positive sera did not overlap with the range of those from negative sera, suggesting the potential application of rPap31 in both ELISA for high throughput regional hospital settings and in the construction of handheld rapid tests for rural clinical sites.

DTIC

*Bacteria; Diagnosis; Epidemiology; Infectious Diseases; Microorganisms; Parasites; Proteins*

**20070029777** Library of Congress, Washington, DC USA

**Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation**

Swendiman, Kathleen S; Jones, Nancy L; Jun 5, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469081; CRS-RS22672; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469081>

The recent international saga of a traveler with XDR-TB, a drug-resistant form of tuberculosis, has placed a spotlight on existing mechanisms to contain contagious disease threats and raised numerous legal and public-health issues. This report will briefly address the existing law relating to quarantine and isolation, with an emphasis on the interaction of state and federal laws and international agreements. It will not be updated.

DTIC

*Agreements; Contamination; Drugs; Infectious Diseases; Isolation; Law (Jurisprudence); Planetary Quarantine; Tuberculosis*

**20070029780** Army War Coll., Carlisle Barracks, PA USA

**Observation on the Joint Service Military Medical Facility What Does the Future Hold**

O'Connell, Cynthia A; Mar 30, 2007; 31 pp.; In English

Report No.(s): AD-A469087; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469087>

There has been much discussion regarding the Unified Medical Command (MEDCOM), but not much written about what 'right might look like' for the Service medical organizations. Our Service Medical Centers (MEDCENs) are a strategic asset in the healthcare mission and will continue to be as they move into the realm of joint MEDCENs. To extend some recent speculation about joint MEDCENs, this paper describes the prototype organization of the joint MEDCEN model that has been

in joint operation for the past ten years: Landstuhl Regional Medical Center (LRMC) in Landstuhl, Germany. It further describes the historical transformation of LRMC into the joint organization that it is today, its evolution during peacetime, its integration of joint staffing during Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF), its progress to achieve jointness, and efforts to make it part of the organizational culture. The paper concludes with recommendations on what still needs to be done to create a fully joint environment of a tertiary care MEDCEN.

DTIC

*Medical Services; Military Operations*

**20070029781** Naval Medical Research Center, Silver Spring, MD USA

**Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene**

May 27, 2005; 7 pp.; In English

Report No.(s): AD-A469095; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469095>

The 56-kD outer membrane protein of *Orientia tsutsugamushi* has previously been shown to be the immunodominant antigen in scrub typhus infections. Its gene was cloned into the DNA vaccine vector pVR1012 as a vaccine candidate (pKarp56). The in vitro expression of this 56-kD antigen by pKarp56 was confirmed in tissue culture by an indirect fluorescence assay and Western blot analysis. The initial antibody responses of mice immunized with varied doses of the pKarp56 were barely detected, but increases were observed after each of three subsequent booster immunizations. Although no protection was observed with a single immunization of pKarp56, after four immunizations, 60% of the mice survived a 1,000 50% lethal dose (LD50) challenge. These results specifically confirm the importance of the 56-kD protein antigen in protective immunity against *O. tsutsugamushi* and demonstrate the feasibility of DNA vaccines for the prevention of scrub typhus.

DTIC

*Antibodies; Antigens; Coding; Genes; Infectious Diseases; Membranes; Plasmids; Protection; Proteins; Typhus; Vaccines*

**20070029783** Naval Medical Research Center, Silver Spring, MD USA

**Cloning and Sequence Analysis of the 22-kDa Antigen Genes of *Orientia tsutsugamushi* Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119**

Ge, Hong; Tong, Min; Li, Andrew; Mehta, Rajan; Ching, Wei-Mei; Jan 2005; 9 pp.; In English

Report No.(s): AD-A469100; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469100>

The 22-kDa protein antigen is one of several antigens recognized by sera from scrub typhus patients infected with *Orientia tsutsugamushi*. The 22-kDa protein genes from six *O. tsutsugamushi* strains (Kato, TA763, AFSC 7, 18-032460, TH1814, MAK119) were cloned and their sequences were determined and compared to each other and to the Karp strain sequence listed in GenBank. The sequence alignment revealed that the promoter regions of these seven strains were highly conserved. However, the ORFs exhibited some variation. The phylogenetic analysis of the DNA sequences indicated that among the seven strains assessed, Kato and TA763 were the most closely related, while Karp and TH1814 were the most distantly related. The information gained from this analysis will facilitate our selection of *O. tsutsugamushi* strains from which antigens should be derived to be included in a multivalent vaccine candidate for scrub typhus.

DTIC

*Antigens; Cloning (Biology); Deoxyribonucleic Acid; Genes; Typhus; Vaccines*

**20070029784** Naval Medical Research Center, Silver Spring, MD USA

**Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp**

Xu, Guang; Chattopadhyay, Schismita; Jiang, Ju; Chan, Teik-Chye; Chao, Chien-Chung; Ching, Wei-Mei; Richards, Allen L; Jan 2005; 5 pp.; In English

Report No.(s): AD-A469102; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469102>

*Orientia tsutsugamushi* is an obligate intracellular bacterium that is the causative agent of scrub typhus. To develop an effective vaccine to prevent or ameliorate scrub typhus, knowledge of the protective immune response to *O. tsutsugamushi* needs to be ascertained. Our laboratory has demonstrated that the DNA vaccine vector pVR1012 carrying the *O. tsutsugamushi*

Karp strain 47-kDa protein gene (p47Kp) consistently provides outbred mice protection against homologous challenge.  
DTIC

*Bacteria; Deoxyribonucleic Acid; Immunity; Mice; Physiological Responses; Typhus; Vaccines*

**20070029785** Army War Coll., Carlisle Barracks, PA USA

**Federally Sponsored Health Care Research Gulf War Illnesses and Beyond**

Forster, Ellen E; Mar 22, 2007; 21 pp.; In English

Report No.(s): AD-A469103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469103>

The USA Congress has poured vast amounts of money into Gulf War illnesses research projects. From 1994 through 2005, the Department of Veterans Affairs, the Department of Defense, and the Department of Health and Human Services collectively spent \$284 million on Gulf War illnesses research. Some question whether there is sufficient oversight and collaboration directed at ensuring that the most appropriate and strategic priorities aimed to improve the health status of deployed soldiers and veterans are being addressed. Who is conducting what research where? Is this research resulting in America's sons and daughters getting the care they need and deserve? Gulf War illnesses are defined and the evolution of the interagency committees that coordinated and conducted federal Gulf War illnesses research from its inception are highlighted. Congressionally directed funding trends, where the funds are spent, and significant impacts and improvements resulting from research findings are explored. Regardless of partisan or political views, there is great interest in the federal response to health concerns of Gulf War and Global War on Terrorism veterans as well as a significant interest in aid provided to our service men and women who endure great sacrifice to protect our freedom.

DTIC

*Deployment; Gulfs; Health; Military Personnel; Persian Gulf; Sicknesses; Warfare*

**20070029786** Maryland Univ., Baltimore, MD USA

**HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls**

Lyke, Kirsten E; Burges, Robin B; Cissoko, Yacouba; Sangare, Lansana; Kone, Abdoulaye; Dao, Modibo; Diarra, Issa; Fernandez-Vina, Marcelo A; Plowe, Christopher V; Doumbo, Ogobara K; Sztein, Marcelo B; Apr 25, 2005; 11 pp.; In English  
Report No.(s): AD-A469105; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469105>

Understanding HLA-restricted adaptive host immunity to defined epitopes of malarial antigens may be required for the development of successful malaria vaccines. Fourteen epitopes of preerythrocytic malarial antigens known to mediate cytotoxic T-lymphocyte responses against target cells expressing HLA-A2-restricted epitopes were synthesized and pooled based on antigen: thrombospondin-related anonymous protein (TRAP), circumsporozoite protein (CSP), and export protein 1 (Exp-1) peptides. HLA-A2 supertype (\*0201, \*0202, \*0205, \*6802) peripheral blood mononuclear cells collected from 774 Malian children, aged 3 months to 14 years, with severe Plasmodium falciparum malaria matched to uncomplicated malaria or healthy controls were stimulated with the HLA-A2-restricted peptide pools. Significant gamma interferon production, determined by enzyme-linked immunospot assay to at least one of the three peptide pools, was observed in 24/58 (41%) of the severe malaria cases, 24/57 (42%) of the uncomplicated malaria cases, and 34/51 (67%) of the healthy controls. Significant lymphoproliferation to these peptides was observed in 12/44 (27%) of the severe malaria cases, 13/55 (24%) of the uncomplicated malaria cases, and 18/50 (36%) of the healthy controls. Responses to individual peptide pools were limited. These studies confirm the presence of adaptive cell-mediated immunity to preerythrocytic malaria antigens in volunteers from Mali and demonstrate that suballeles of the HLA-A2 supertype can effectively present antigenic epitopes. However, whether these immune responses to TRAP, CSP, and Exp-1 malarial proteins play a substantial role in protection remains a matter of controversy.

DTIC

*Antigens; Blood Cells; Children; Immune Systems; Immunity; Lymphocytes; Parasitic Diseases; Vaccines*

**20070029789** National Inst. of Health, Bethesda, MD USA

**White Blood Cell Counts and Malaria**

McKenzie, F E; Prudhomme, Wendy A; Magill, Alan J; Forney, J R; Permpnich, Barnyen; Lucas, Carmen; Gasser, Jr, Robert A; Wongsrichanalai, Chansuda; Jun 9, 2005; 9 pp.; In English

Report No.(s): AD-A469110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469110>

White blood cells (WBCs) were counted in 4697 individuals who presented to outpatient malaria clinics in Maesod, Tak

Province, Thailand, and Iquitos, Peru, between 28 May and 28 August 1998 and between 17 May and 9 July 1999. At each site and in each year, WBC counts in the *Plasmodium falciparum* infected patients were lower than those in the *Plasmodium vivax* infected patients, which, in turn, were lower than those in the uninfected patients. In Thailand, one-sixth of the *P. falciparum* infected patients had WBC counts of  $<4000$  cells/mL. Leukopenia may confound population studies that estimate parasite densities on the basis of an assumed WBC count of 8000 cells/mL. For instance, in the present study, use of this conventional approach would have overestimated average asexual parasite densities in the *P. falciparum* infected patients in Thailand by nearly one-third.

DTIC

*Antigens; Biometrics; Blood; Counting; Immune Systems; Leukocytes; Parasitic Diseases*

**20070029790** Hawaii Univ., Honolulu, HI USA

**Semi-Synthesis and In-vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism**

Hemscheidt, Thomas K; Sep 2004; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0282

Report No.(s): AD-A469112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469112>

Taccalonolides are plant-derived steroids which act as microtubule poisons on mammalian cells with a taxol-like mechanism. This makes them potentially useful lead compounds for the development of anti-cancer agents specifically breast cancer. Natural taccalonolide A was modified through selective chemical reactions at various sites in the molecule in preparation for biological tests that will compare the biological effects and potency of the derivatives with that of the starting material. These studies will allow the identification of those parts of the structure of taccalonolide A that are important for its biological activity. Work towards this goal is subject of this report.

DTIC

*Breast; Cancer; Derivation; In Vitro Methods and Tests; Mammary Glands; Poisons*

**20070029791** Scripps Research Inst., La Jolla, CA USA

**The *Plasmodium falciparum* Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification**

Young, Jason A; Fivelman, Quinton L; Blair, Peter L; de la Vega, Patricia; Le Roch, Karine G; Zhou, Yingyao; Carucci, Daniel J; Baker, David A; Winzeler, Elizabeth A; Jun 17, 2005; 14 pp.; In English

Report No.(s): AD-A469116; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469116>

The sexual stages of malarial parasites are essential for the mosquito transmission of the disease and therefore are the focus of transmission blocking drug and vaccine development. In order to better understand genes important to the sexual development process, the transcriptomes of high-purity stage I V *Plasmodium falciparum* gametocytes were comprehensively profiled using a full-genome high-density oligonucleotide microarray. The interpretation of this transcriptional data was aided by applying a novel knowledge-based data-mining algorithm termed ontology-based pattern identification (OPI) using current information regarding known sexual stage genes as a guide. This analysis resulted in the identification of a sexual development cluster containing 246 genes, of which  $<75\%$  were hypothetical, exhibiting highly-correlated, gametocyte-specific expression patterns. Inspection of the upstream promoter regions of these 246 genes revealed putative cis-regulatory elements for sexual development transcriptional control mechanisms. Furthermore, OPI analysis was extended using current annotations provided by the Gene Ontology Consortium to identify 380 statistically significant clusters containing genes with expression patterns characteristic of various biological processes, cellular components, and molecular functions. Collectively, these results, available as part of a web-accessible OPI database (<http://carrier.gnf.org/publications/Gametocyte>), shed light on the components of molecular mechanisms underlying parasite sexual development and other areas of malarial parasite biology.

DTIC

*Antigens; Immune Systems; Infectious Diseases; Parasites; Parasitic Diseases*

**20070029792** Guelph Univ., Ontario Canada

**Cell-surface Alpha-glucan in *Campylobacter jejuni* 81-176**

Papp-Szabo, Erzsebet; Kanipes, Margaret I; Guerry, Patricia; Monteiro, Mario A; Jun 14, 2005; 5 pp.; In English

Report No.(s): AD-A469117; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469117>

*Campylobacter jejuni* infection is a main source of severe gastroenteritis-related illnesses in humans and there is also



evidence that it may be linked to neurological disorders. C. jejuni 81-176 is a virulent strain that has become the global model in the study of mechanisms and pathogenesis of C. jejuni infection. For this reason, we were engaged in studying the ne structures of cell-surface carbohydrate antigens of C. jejuni 81-176, namely, the capsule polysaccharide (CPS) and lipooligosaccharide (LOS). Serologically, C. jejuni 81-176 has been classified as belonging to serogroups HS23 and HS36, and indeed previous studies have shown that the LOS and CPS structures possess components similar to those expressed by serostrains HS23 and HS36. Here, we describe that in addition to the LOS and CPS, this strain also produced an independent cell-surface (1!4)-a-glucan capsule.

DTIC

*Bacteria; Diseases; Gastrointestinal System; Infectious Diseases; Intestines; Neurology; Sicknesses*

**20070029793** Army Medical Research and Materiel Command, Fort Detrick, MD USA

**The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*)**

Gamble, Christopher S; Jacobsen, Kenneth O; Leffel, Elizabeth K; Pitt, M L; Nov 28, 2006; 4 pp.; In English  
Report No.(s): AD-A469118; USAMRMC-TR-06-037; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469118>

Normal hematological values for African green monkeys have been reported, but these results are confounded by the effect of chemical restraint (ketamine), physical restraint, and capture stress. The dual-lumen central venous catheter, jacket, and tether combination described allows intravenous fluid administration and repeated blood sampling without using restraint or anesthesia. The use of a low-concentration heparin solution for catheter maintenance resulted in a significant increase in mean patency time compared to a saline-only catheter flush solution. Adding a low-concentration heparin solution creates a suitable system for long-term, serial blood collection in the African green monkey.

DTIC

*Africa; Catheterization; Heparins; Low Concentrations; Medical Equipment; Monkeys; Veterinary Medicine*

**20070029797** Army War Coll., Carlisle Barracks, PA USA

**Dental Considerations in a Unified Medical Command**

Tempel, Jr , Thomas R; Mar 23, 2007; 24 pp.; In English  
Report No.(s): AD-A469128; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469128>

Volumes have been written touting the benefits of a Unified Medical Command, but none have discussed the Army, Navy, and Air Force Dental Corps' role in this command. The pace of military medicine's transformation is increasing, and in order to ensure eligible beneficiaries continue to get world class dental care, a study of dentistry's potential role must be conducted. Whether a Unified Medical Command is established or not, there are several joint dental initiatives that should be undertaken to achieve unity of effort between the services in both peacetime and war. To meaningfully contribute to a Joint Medical structure, the Dental Corps must start now to ensure young officers receive joint exposure to understand each service's dental capabilities and how to employ them.

DTIC

*Dentistry; Medical Services; Military Operations*

**20070029798** Naval Medical Research Center, Silver Spring, MD USA

**Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites**

Wang, Ruobing; Richie, Thomas L; Baraceros, Maria F; Rahardjo, Nancy; Gay, Tanya; Banania, Jo-Glenna; Charoenvit, Yupin; Epstein, Judith E; Luke, Thomas; Freilich, Daniel A; Norman, Jon; Hoffman, Stephen L; Dec 11, 2004; 11 pp.; In English

Report No.(s): AD-A469138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469138>

A mixture of DNA plasmids expressing five Plasmodium falciparum pre-erythrocyte-stage antigens was administered with or without a DNA plasmid encoding human granulocyte-macrophage colony-stimulating factor (hGM-CSF) as an immune enhancer. After DNA immunization, antigen-specific gamma interferon (IFN-gamma) responses were detected by ELISPOT in 15/31 volunteers to multiple class I- and/or class II-restricted T-cell epitopes derived from all five antigens. Responses to multiple epitopes (less than or equal 7) were detected simultaneously in some volunteers. By 4 weeks after

challenge with *P. falciparum* parasites, 23/31 volunteers had positive IFN- responses and the magnitude of responses was increased from 2- to 143-fold. Nonetheless, none was protected against malaria. Volunteers who received hGM-CSF had a reduced frequency of IFN-gamma responses to class I peptides compared to those who only received plasmids expressing *P. falciparum* proteins before challenge (3/23 versus 3/8; P=0.15) or after parasite challenge (4/23 versus 5/8; P=0.015) but not to class II peptides before or after challenge. The responses to one antigen (*P. falciparum* circumsporozoite protein [PfCSP]) were similar among volunteers who received the five-gene mixture compared to volunteers who only received the PfCSP DNA plasmid in a previous study. In summary, DNA-primed IFN-gamma responses were boosted in humans by exposure to native antigen on parasites, coadministration of a plasmid expressing hGM-CSF had a negative effect on boosting of class I-restricted IFN-gamma responses, and there was no evidence that immunization with PfCSP DNA in the mixture reduced T-cell responses to PfCSP compared to when it was administered alone.

DTIC

*Deoxyribonucleic Acid; Exposure; Interferon; Parasites; Parasitic Diseases; Vaccines*

**20070029799** Food and Drug Administration, College Park, MD USA

**Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis**

Sharma, Shashi K; Eblen, Brian S; Bull, Robert L; Burr, Donald H; Whiting, Richard C; Feb 8, 2005; 8 pp.; In English  
Report No.(s): AD-A469140; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469140>

The suitability and sensitivity of two in vitro lateral-flow assays for detecting Clostridium botulinum neurotoxins (BoNTs) in an assortment of foods were evaluated. Toxin extraction and preparation methods for various liquid, solid, and high-fat-content foods were developed. The lateral-flow assays, one developed by the Naval Medical Research Center (Silver Spring, MD) and the other by Alexeter Technologies (Gaithersburg, MD), are based on the immunodetection of BoNT types A, B, and E. The assays were found to be rapid and easy to perform with minimum requirements for laboratory equipment or skills. They can readily detect 10 ng/ml of BoNT types A and B and 20 ng/ml of BoNT type E. Compared to other in vitro detection methods, these assays are less sensitive, and the assessment of a result is strictly qualitative. However, the assay was found to be simple to use and to require minimal training. The assays successfully detected BoNT types A, B, and E in a wide variety of foods, suggesting their potential usefulness as a preliminary screening system for triaging food samples with elevated BoNT levels in the event of a *C. botulinum* contamination event.

DTIC

*Clostridium Botulinum; Detection; Food; In Vitro Methods and Tests; Kits; Medical Science; Medical Services; Toxins and Antitoxins*

**20070029800** Courter Products, Boyne City, MI USA

**Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru**

Laguna-Torres, V A; Perez-Bao, J; Chauca, G; Sovero, M; Blichtein, D; Chunga, A; Flores, W; Retamal, A; Mendoza, S; Cruz, M; Jan 2005; 9 pp.; In English

Contract(s)/Grant(s): NMRC-2002-0018

Report No.(s): AD-A469142; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469142>

Transfusion-transmitted infections (TTIs) constitute a major health problem worldwide where routine screening of blood or blood products is temperately done, and where non-medical injecting medications and/or drug use are prevalent. Prevalence and risk factors vary by geographic location and by the specific TTI (including HIV-1, HBV, HCV and HTLV-I). Objective To determine the prevalence and risk factors associated with TTIs among a sample of multi-transfused adult patients in Peru. Study design: A cross-sectional multi-center study was conducted across seven major hospitals in Peru from February 2003 to September 2004. Self-reported behavior information (medical procedures, number of sexual partners, and drug use history) was analyzed, along with a review of exposure history from hospital medical records. Prevalences were calculated by TTI the different exposures, along with unadjusted and adjusted odds ratios for infection risk. Results: Overall, 192 (54.7%) of 351 multi-transfused patients were found infected with one or more TTIs. Number of transfusion units, years of transfusion history (6 or more), and number of treatment facilities (2 or more) were associated with HCV infection. Hemodialysis history was a common risk factor associated with HBV, HCV and HTLV-I infection. HIV infection was associated only with total number of transfusion units received. Conclusions: High prevalences of HBV and HCV infection were found among Peruvian multi-transfused patients and were associated with a past history and number of blood transfusions, as well as with past hemodialysis procedures. TTIs continue to represent a significant public health problem in Peru. Continued vigilant attention

to blood safety procedures, including universal screening and health care provider education, is recommended  
DTIC

*Blood; Epidemiology; Hepatitis; Hospitals; Infectious Diseases; Medical Services; Patients; Peru; Safety; Transfusion; Viruses*

**20070029801** Walter Reed Army Inst. of Research, Silver Spring, MD USA

**The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites**

Steers, Nick; Schwenk, Robert; Bacon, David J; Berenzon, Dmitri; Williams, Jackie; Krzych, Urszula; May 18, 2005; 13 pp.; In English

Contract(s)/Grant(s): NIH-AI-46438

Report No.(s): AD-A469143; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469143>

Multi-factorial immune mechanisms underlie protection induced with radiation-attenuated Plasmodia sporozoites (gamma-spz). Spz pass through Kupffer cells (KC) before invading hepatocytes but the involvement of KC in protection is poorly understood. In this study we investigated whether gamma-spz-immune KC respond to infectious spz in a manner that is distinct from the response of naive KC to infectious spz. KC were isolated from (1) naive, (2) spz-infected, (3) gamma-spz-immune, and (4) gamma-spz-immune-challenged C57BL/6 mice and examined for the expression of MHC class I and II, CD40 and CD80/CD86, IL-10 and IL-12 responses and antigen-presenting cell (APC) function. KC from gamma-spz-immune- challenged mice up-regulated class I and costimulatory molecules and produced elevated IL-12p40, relative to naive KC. In contrast, KC from naive mice exposed to infectious spz down-modulated class I and IL-12p40 was undetectable. Accordingly, KC from spz-infected mice had reduced APC function, while KC from gamma-spz-immune-challenged mice exhibited augmented APC activity. The nearly opposite responses are consistent with the fact that spz challenge of gamma-spz-immune mice results in long-lasting sterile protection, while infection of naive mice always results in malaria.

DTIC

*Immunity; Infectious Diseases; Protozoa*

**20070029802** Maryland Univ., Baltimore, MD USA

**Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression**

Sacci, Jr , John B; Ribeiro, Jose M; Huang, Fengying; Alama, Uzma; Russell, Joshua A; Blair, Peter L; Witney, Adam; Carucci, Daniel J; Azada, Abdu F; Aguiar, Joao C; Apr 26, 2005; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469146>

The transcriptional repertoire of the in vivo liver stage of Plasmodium has remained largely unidentified and seemingly not amenable to traditional molecular analysis because of the small number of parasites and large number of uninfected hepatocytes. We have overcome this obstruction by utilizing laser capture microdissection to provide a high quality source of parasite mRNA for the construction of a liver stage cDNA library. Sequencing and annotation of this library demonstrated expression of 623 different Plasmodium yoelii genes during development in the hepatocyte. Of these genes, 25% appear to be unique to the liver stage. This is the first comprehensive analysis of in vivo gene expression undertaken for the liver stage of P. yoelii, and provides insights into the differential expression of P. yoelii genes during this critical stage of development.

DTIC

*Gene Expression; Genes; In Vivo Methods and Tests; Liver; Parasites*

**20070029804** Naval Medical Research Center, Silver Spring, MD USA

**Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru**

Jiang, Ju; Blair, Patrick J; Felices, Vidal; Moron, Cecilia; Cespedes, Manuel; Anaya, Elizabeth; Schoeler, George B; Sumner, John W; Olson, James G; Richards, Allen L; Jan 2005; 7 pp.; In English

Report No.(s): AD-A469149; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469149>

Phylogenetic analysis of five rickettsial genes (17-kDa gene, gltA, ompB, ompA, and sca4) from two molecular isolates of Candidatus Rickettsia andeanae from two ticks (Amblyomma maculatum and Ixodes boliviensis) collected from two domestic horses living in two separate locations in northern Peru (Coletas and Naranjo) was conducted to more clearly

characterize this recently reported novel spotted fever group (SFG) rickettsia. Following nested polymerase chain reaction (PCR) amplification of the 17-kDa gene, *gltA*, *ompB*, *ompA*, and *sca4*, amplicons were purified, sequenced, and compared to those downloaded from GenBank. Phylogenetic analyses of the Candidatus *Rickettsia andeanae* sequences generated from 17-kDa gene (483 bp), *gltA* (1185 bp), *ompA* (1598 bp), *ompB* (4839 bp), and *sca4* (2634 bp) demonstrated that they aligned strongly with those of SFG rickettsiae. Moreover, the sequences of these five genes most closely aligned with the following rickettsiae: *ompA*: *Rickettsia* sp RpA4 (98.03%), *R. sp* DnS28 (97.90%), and *R. rhipicephali* and *R. massiliae* (97.11%); *ompB*: *R. aeschlimannii* (97.22%), *R. rhipicephali* (97.20%), and *R. sp* Bar 29 (97.10%); and *sca4*: *R. massiliae* (97.8%), *R. rhipicephali*, and *R. slovacica* (97.7%). These results from the additional phylogenetic analyses of Candidatus *Rickettsia andeanae* confirm its inclusion within, and distance and uniqueness from, other known SFG rickettsiae.

DTIC

*Blood; Fever; Nucleic Acids; Peru*

**20070029805** Louisiana State Univ., Baton Rouge, LA USA

**Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens**

Cunningham, Albert R; Aug 2006; 120 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0376

Report No.(s): AD-A469150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469150>

This project investigated the potential that environmental chemicals may be involved in the etiology of breast cancer. We hypothesized that specific features of chemicals can be identified that are significantly associated with female and breast carcinogens and that these features are related to mechanisms of chemical carcinogenesis. Our overall scientific objective was to investigate the hypothesized relationship between environmental chemicals, xenoestrogens, and the development of breast cancer. With the success of the project, we published several papers, have one accepted pending revision but temporarily withdrawn specific to our rat mammary carcinogen model, and we will be preparing others for later publication. We also developed a novel SAR approach that allowed us to address the question of 'why do some carcinogens cause cancer in the breast?' which is a very different question than that posed in older SAR studies of 'why do some chemicals cause cancer?' Two graduate students have been awarded MS degrees based (supported) on this project. We have also used this project to obtain an appointment at the University of Louisville's Brown Cancer Center, significant funding for an associated project in conjunction with its NIH-funded Molecular Targets Program, and another BCRP IDEA award studying a novel approach to discover highly specific breast cancer drugs.

DTIC

*Analysis (Mathematics); Breast; Cancer; Carcinogens; Females; Mammary Glands; Rodents*

**20070029808** New Mexico Univ., Albuquerque, NM USA

**Evaluation of Genomic Instability in the Abnormal Prostate**

Haaland-Pullus, Christina; Griffith, Jeffrey K; Dec 2006; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0120

Report No.(s): AD-A469155; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469155>

The aim of this study is to investigate the field effect in prostate cancer, the relationship between tumor and nearby histologically normal tissues compared to truly disease free prostate tissue. Identification of changes within tumor adjacent tissues has two possible clinical implications: prognosis and diagnosis. Several tools are being used to investigate this effect, specifically the assessment of telomere length, allelic imbalance, and methylation status, all markers of genomic instability. Microarray studies will be used to aid in the identification of additional gene expression changes occurring between tumor and histologically normal tissues compared to truly disease free tissue. While telomere length and allelic imbalance have been shown to correlate with outcome, it is expected that, when compared with truly normal tissue from disease-free prostates, several progressive changes will be seen, as has been found in prostate cancer cell lines. The proposed study will allow for interaction with other scientists, exposure to new technologies, teaching and continued patient interaction, all of which are important to the physician scientist.

DTIC

*Abnormalities; Cancer; Genome; Prostate Gland*

**20070029810** John Wayne Inst. for Cancer Treatment and Research, Santa Monica, CA USA  
**A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect**  
Cabot, Myles C; Feb 2007; 9 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): W81XWH-05-1-0528  
Report No.(s): AD-A469157; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA469157>

The development of drug resistance represents a formidable barrier to the successful treatment of breast cancer. Although some cancers such as melanoma can be intrinsically resistant, many cancers acquire resistance through selection pressure in the face of adversity, e.g., chemotherapy. One of the most consistent features of drug resistance is overexpression of P-glycoprotein (P-gp). This protein functions as a pump to reduce the intracellular concentration of anticancer drugs. Clinical use of P-gp antagonists to inhibit drug efflux has been disappointing. Here we propose silencing the multidrug resistance (MDR1) phenotype by retarding glycolipid metabolism via inhibition of glucosylceramide synthase (GCS), a lipogenic enzyme associated with MDR1. We will determine whether inhibitors of GCS affect MDR1/P-gp expression and chemotherapy sensitivity in drug-resistant breast cancer cells and determine whether GCS inhibitors forestall acquired resistance to chemotherapy in wild-type breast cancer cells. This is the first study to attack drug resistance in breast cancer by manipulating GCS and glycolipids, and as such, it represents a major shift in the research paradigm for drug resistance. This is also the first study to propose an approach that might have prophylactic as well as therapeutic value.

DTIC

*Breast; Cancer; Chemotherapy; Drugs; Lipids; Mammary Glands; Prophylaxis; Therapy*

**20070029813** Wayne State Univ., Detroit, MI USA  
**Molecular Effects of 13C/DIM in Prostate Cancer**  
Sarkar, Fazlul H; Apr 2007; 156 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): DAMD17-03-1-0042  
Report No.(s): AD-A469160; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA469160>

To discover the mechanisms of 13C/DIM action on prostate cancer cells, we have investigated the molecular effects of 13C/DIM on Akt and NF- $\kappa$ B pathways and their downstream genes which play critical roles in the control of cell survival. We have found that 13C/DIM significantly inhibited the activation of Akt in PC-3 and LNCaP prostate cancer cells. Moreover, we found that 13C/DIM also significantly inhibited the activity of NF- $\kappa$ B. However, we did not observe such inhibitory effects of 13C/DIM on non-tumorigenic CRL-2221 prostate epithelial cells. Most importantly, we found that 13C/DIM could inhibit NF- $\kappa$ B activation and AR transactivation in prostate cancer cells transfected with activated Akt. These results demonstrate that there is a crosstalk between Akt, NF- $\kappa$ B, and AR signaling pathways and 13C/DIM could interrupt the crosstalk, leading to the induction of apoptosis. From transfection experiments, we found that 13C/DIM inhibited the expression of IKK $\beta$ , the subsequent phosphorylation of I $\kappa$ B $\alpha$ , and the nuclear localization and activation of NF- $\kappa$ B. By microarray analysis, we found that 13C/DIM could regulate the expression of genes which control cell cycle, apoptosis, and signal transduction. 13C/DIM also inhibited angiogenesis and invasion. These results suggest that 13C and DIM may be potent agents for the prevention and/or treatment of prostate cancers.

DTIC

*Cancer; Prostate Gland*

**20070029818** Virginia Univ., Charlottesville, VA USA  
**BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response**  
Sun, Jianlong; Li, Rong; Mar 2007; 10 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): W81XWH-06-1-0302  
Report No.(s): AD-A469165; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA469165>

During the first year of current funding period, we have focused our study on the identification of BRCA1 regulated genes in human breast cancer cells. By combining the genome-wide microarray study and gene-specific approaches, we have discovered a group of genes that were significantly repressed or stimulated by BRCA1, and several genes in this group, such as TIMP-1, S100P, and GABBR1 have been implicated in the development of breast cancer. We have also found that transcriptional regulation by BRCA1 required gene-specific involvement of its cofactor, COBRA1. These findings will serve as the basis for us to explore the role of BRCA1 in transcriptional regulation in the presence of DNA damage. It also provides

targets for investigating the dynamic association of BRCA1, the transcriptional machinery, and DNA damage checkpoint protein complex with chromatin templates under the stress conditions.

DTIC

*Breast; Cancer; Coordination; Damage; Deoxyribonucleic Acid; Genes; Mammary Glands*

**20070029820** Armed Forces Research Inst. of Medical Sciences, Bangkok, Thailand

**Mosaic Structure of a Multiple-Drug-Resistant, Conjugative Plasmid from *Campylobacter jejuni***

Nirdnoy, Warawadee; Mason, Carl J; Guerry, Patricia; Jan 30, 2005; 7 pp.; In English

Report No.(s): AD-A469168; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469168>

Partial sequence analysis of a tet(O) plasmid from a multiple-drug-resistant clinical isolate of *Campylobacter jejuni* revealed 10 genes or pseudogenes encoding different aminoglycoside inactivating enzymes, transposaselike genes, and multiple unknown genes from a variety of pathogenic and commensal bacteria. The plasmid could be mobilized by a P incompatibility group plasmid into *Escherichia coli*, where it apparently integrated into the chromosome and expressed high-level resistance to multiple aminoglycoside antibiotics. This work provides new information about both the nature of drug resistance in *C. jejuni* and the ability of *C. jejuni* to exchange genes with other bacterial species.

DTIC

*Drugs; Intestines; Mosaics; Plasmids*

**20070029824** Naval Postgraduate School, Monterey, CA USA

**Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006**

Rago, Thomas A; Michisaki, Reiko; Marinovic, Baldo; Blum, Marguerite; Whitaker, Katherine; Jun 2007; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469172; NPS-OC-07-002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469172>

The results of analyses of hydrographic, nutrient, and biological data collected in coastal ocean waters off Central California in October 2006 aboard the R/V *Wecoma* (Hoke cruise) and R/V *Point Sur* (PaCOOS cruise) are presented in both tabular and graphical form. Along with all the data from the PaCOOS cruise, included in this report are also hydrographic data sampled over the last two days of the Hoke cruise at CalCOFI stations between Moss Landing, California, and Point Reyes, California, and along CalCOFI line 60. The PaCOOS cruise departed from Moss Landing and proceeded to Point Reyes following CalCOFI line 67 to station 90, thence to CalCOFI line 60/station 90, and finally along CalCOFI line 60. The cruise then returned to Moss Landing via the course from CalCOFI line 61.75/station 52.5 to CalCOFI Line 65.25/station 52.5, and thence to site H3. The Hoke cruise finished in Redwood City, California, after following a route from Moss Landing via the aforementioned H3/CalCOFI stations 52.5 and the inshore CalCOFI Line 60 stations from station 60. ADCP observations collected during both cruises, and marine mammal and biological observations taken during the PaCOOS cruise, are also included.

DTIC

*Coastal Water; Dimensional Measurement; Hydrography; Mammals; Marine Biology; Oceanography*

**20070029825** Michigan Univ., Ann Arbor, MI USA

**Characterization of Neurofibromas of the Skin and Spinal Roots in a Mouse Model**

Zhu, Yuan; Feb 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0293

Report No.(s): AD-A469173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469173>

Benign neurofibromas and malignant peripheral nerve sheath tumors (MPNSTs) contribute to the majority of morbidity and mortality associated with NF1. The proposed studies will provide significant insight into one of the fundamental questions in neurofibroma biology: whether bi-allelic NF1 inactivation is necessary for neurofibroma formation. The objectives of this proposal are to use a newly established mouse model to (1) identify and characterize neurofibromas that are exclusively or predominantly comprised of NF1+/- cells (designated NF1+/- neurofibromas hereafter) in the skin and spinal roots; and (2) determine whether in this model, neurofibromas in the skin are similar to human dermal neurofibromas and thus are fundamentally different from the plexiform neurofibromas found in spinal roots. Previous studies of human tumors suggest that dermal and plexiform neurofibromas have fundamental differences in their dependence on the NF1 heterozygous

environment and have different malignant transformation potentials. We have made substantial progress in the first year of the award. For Task 1, we have generated most of the mutant mice proposed for the study. Phenotypic analysis of these mutant mice will be undertaken in the second year as proposed. For Task 2, we have completed most of the proposed experiments. We are writing a manuscript and trying to publish these results this year. For Task 3, we have generated the half of the mutant mice proposed for the study. The preliminary data suggest that the NF1 heterozygous environment is not essential for malignant transformation. This year, we will finish characterizing tumor phenotypes of these mutant mice and generate more mutants for analysis.

DTIC

*Cells (Biology); Mice; Neoplasms; Spinal Cord; Spine*

**20070030003** Naval Medical Research Inst., San Diego, CA USA

**History of U.S. Military Contributions to the Study of Diarrheal Diseases**

Lim, Matthew L; Apr 2005; 10 pp.; In English

Report No.(s): AD-A468897; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468897>

Diarrhea, a scourge upon humanity since preliterate times, has been the particular nemesis of military forces. The Armed Forces of the USA have been in the forefront in the diagnosis, treatment, and prevention of diarrheal illness. U.S. military scientists and physicians implemented the first mandatory typhoid inoculation program, contributed to advances in water chlorination, and pioneered the use of antibiotics for typhoid fever. U.S. Navy physicians refined the intravenous treatment of cholera, reducing the death rate from 20% to less than 1%. Their studies of electrolyte and fluid balance in cholera, and the subsequent development of oral rehydration therapy for cholera and other diarrheal illness, have saved millions of lives worldwide. U.S. Army researchers refuted the desquamation theory of cholera pathogenesis, isolated the cholera exotoxin, and developed improved cholera vaccines. U.S. Army and Navy researchers pioneered the use of antibiotics for the treatment of typhoid fever, made major contributions to the treatment of dysentery, developed algorithms for the treatment of traveler's diarrhea, and continue active development of traveler's diarrhea and dysentery vaccines. U.S. military diarrheal research has directly contributed to the welfare of hundreds of millions of people.

DTIC

*Diseases; Sicknesses; Military Technology*

## 52

### AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

**20070026564** Army Research Lab., Aberdeen Proving Ground, MD USA

**Workload, Stress, and Situation Awareness of Soldiers Who are Controlling Unmanned Vehicles in Future Urban Operations**

Sterling, Bruce S; Perala, Chuck H; Apr 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-7MB25R

Report No.(s): AD-A466480; ARL-TR-4071; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466480>

This research describes the workload, stress, and situation awareness of operators of robotic reconnaissance platforms who are conducting future full spectrum operations in an urban setting. The participants controlled unmanned aerial vehicles, unmanned ground vehicles, and unmanned ground sensors in a virtual reality simulation as part of a combined arms battalion using Future Combat Systems. Results suggested that robotic controllers supporting infantry units had higher workloads and stress than controllers supporting non-line-of-sight cannon units, mounted combat system units, or reconnaissance units, perhaps because infantry units are more vulnerable and require closer surveillance. Also, individuals controlling all three sensor types had higher workloads and stress than those controlling other combinations of assets. Human factors recommendations for the interface included an ability to automatically track a target, switch to teleoperation to make slight adjustments, an auto-scan function on the sensor, and the ability for the platform to automatically plot a route to a grid location. Some potential limitations of this study include the fact that the workload may have been affected by other factors such as

experience or training; the robotic platforms may have been operated simultaneously or sequentially; and the interface used in this study may or may not mirror the (to be determined) future interfaces.

DTIC

*Military Personnel; Situational Awareness; Stress (Physiology); Stress (Psychology); Workloads (Psychophysiology)*

**20070026602** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Hypothermia Induction and Recovery in Free-Ranging Rats**

DuBose, D A; Leon, L R; Morehouse, D H; Rufolo, D M; Blaha, M D; Gordon, C J; Jan 2007; 11 pp.; In English  
Report No.(s): AD-A466547; USARIEM-M06-32; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA466547>

1. To avoid anesthesia confounders, free-ranging rats were exposed to cool water, warm water, or temperate air to induce hypothermia, or control for water or novel environment stress, respectively. 2. While WW and TA core temperature and the brown adipose tissue subdermal skin temperature relationship remained similar, CW hypothermia induction was variable and associated with tachycardia or TA with CW TBAT elevated CW TSDS. 3. Without anesthesia to blunt thermoregulatory countermeasures to hypothermia, variable resistance to Tc depression, tachycardia rather than bradycardia and BAT thermogenic responses were demonstrated.

DTIC

*Hypothermia; Rangefinding; Rats*

**20070026687** Air Force Research Lab., Brooks AFB, TX USA

**Communication and Decision Making in C4ISR Sustained Operations: An Experimental Approach**

Barnes, Christopher; Jun 2003; 19 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466715; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA466715>

Presentation on Air Force research on Warfighter fatigue from sustained usage of C4ISR systems and means to counter fatigue effects.

DTIC

*Decision Making; Military Technology; Research and Development*

**20070027484** Allen Inst. for Brain Science, Seattle, WA USA

**High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain**

Lein, Ed; Dec 2006; 33 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): W81XWH-06-1-0131  
Report No.(s): AD-A467705; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sleep deprivation in mice causes changes in gene expression in discrete brain regions associated with sleep/wake control as well as higher cognitive functions. Laser capture microdissection was used to isolate a set of relevant brain regions, and these samples were amplified to allow genome-wide genetic profiling on DNA microarrays to search for altered gene expression correlated with sleeping, waking, sleep deprivation and recovery sleep following sleep deprivation. Candidate genes from this microarray approach have been comprehensively analyzed using a highthroughput in situ hybridization platform. The resulting data indicate that there is dynamic gene expression correlated with circadian time of day, sleeping vs. waking states, and sleep deprivation specifically. This dynamic gene expression is also highly brain region and cell type-specific within a given region. These genes help to provide an anatomical and genetic framework for understanding the consequences of sleep deprivation and potential new means for pharmacological intervention. A web-based viewer interface has been developed to provide access to this data for the entire sleep community.

DTIC

*Brain; Circadian Rhythms; Gene Expression; Genes; Mice; Sleep; Sleep Deprivation*

**20070027740** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water**

O'Brien, Catherine; Tharion, Ingrid V Sils, and John W Castellani, William J; Jun 2007; 7 pp.; In English  
Report No.(s): AD-A468440; USARIEM/TMMD-MO6-46; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study evaluated performance after lowering core temperature at different rates while local tissues were either cooled



(lower body) or not cooled (upper body). Methods: There were 10 men who volunteered to perform up to 8 cold water immersions (CWI) at combinations of 2 water temperatures (10 deg C and 15 deg C), 2 depths [waist (W), chest (C)], and 2 walking speeds (0.44 or 0.88 m/s<sup>-1</sup>) until their core temperature fell to 35.5 deg C, stabilized above that temperature, or they requested to stop. They also completed a control trial (120 min rest in 19 deg C air). Immediately following each CWI and control, cognitive and physical performance tests were performed in cold air (10 deg C; CAE). Results: Overall, the CWI protocol lowered rectal temperature by 0.3-1.0 deg C. Mean skin temperature was ~26 deg C and finger temperature was ~15 deg C during CAE. No statistical differences were observed across trials for any cognitive test. On the physical performance tests, step test performance was degraded ~12% on CWI trials compared with control, but there were no differences in manual dexterity, hand grip strength, marksmanship, or pull-ups. Conclusions: These results indicate that cognitive performance can be maintained despite mild hypothermia, and that physical performance is related to local tissue temperature, not a moderately reduced core temperature.

DTIC

*Cold Tolerance; Cold Water; Cooling; Mental Performance; Physical Exercise; Psychomotor Performance*

**20070027748** Army Research Lab., Aberdeen Proving Ground, MD USA

**Galvanic Skin Response as a Measure of Soldier Stress**

Perala, Chuck H; Sterling, Bruce S; May 2007; 37 pp.; In English

Report No.(s): AD-A468462; ARL-TR-4114; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the ever-increasing realm of 'high-tech' Soldier systems, one factor remains fairly constant: the human factor. The use of multiple high-tech and increasingly complex systems is intended to add capabilities to Soldiers and to reduce stress and workload. However, these systems may add increased levels of stress and workload onto Soldiers who are already at heightened levels of each because of the environments in which the systems are employed. To gauge what levels of stress and workload are being impinged upon these Soldiers, researchers have used a small number of tools at their disposal. The two primary tools used are self-report surveys and salivary amylase. Surveys are quick and cheap but subjective, while salivary amylase tests are objective but time-consuming, intrusive, and expensive. As requirements increase to incorporate larger numbers of high-tech and more complex systems with Soldier-in-the-loop (SIL) systems, researchers will need a method to gather stress data in an accurate, timely, and less intrusive manner. This report discusses the use of a third method to measure Soldier stress: galvanic skin response (GSR). The first step of this process compared the survey method with the GSR method to determine if GSR data are similar to survey stress data in terms of statistics and trends. The ultimate goal of the research (this phase and ensuing research) is to determine if the GSR method is a suitable 'middle ground' between the survey method and the salivary amylase method. GSR has the potential to provide researchers with a tool for objectively measuring Soldier stress that is quick, effective, and unobtrusive during research, training, and operational conditions. Stress levels were tested with soldiers using a head-tracked sensor suite (HTSS), aided target recognition technology, and a crew-aiding behavior interface. Results of the survey-GSR comparison and recommendations for ensuing research are presented.

DTIC

*Galvanic Skin Response; Measurement; Military Personnel; Physiological Effects; Saliva; Surveys*

**20070027760** Children's Hospital of Pittsburgh, Pittsburgh, PA USA

**Pharmacological and Nonpharmacological Methods of Treatment for Fragile**

Perlmutter, David H; Feb 2007; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0057

Report No.(s): AD-A468498; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Fragile X (FX) syndrome causes behavioral disturbances such as labile mood, anxiety, hyperactivity, and aberrant behavioral responses to stress. Affected males may suffer from learning disabilities, attention deficit disorders, mental retardation, or autism spectrum disorders. We seek to address the most effective methods of treatment (pharmacological and behavioral) for the symptoms and behavioral problems associated with FX syndrome. During the past year, we have established a comprehensive FX syndrome clinic and we continue to refine our treatment protocol. Collaborative relationships have been established with genetics, speech/language, psychiatry, ophthalmology and dental so that families can obtain these services from specific professionals with an interest in FX syndrome. School liaison services for school aged youth with FX syndrome have been established. Community education programs, in the form of a website, a parent advisory group, and announcements have been established. We continue to refine our database to track the frequency of the disease and specific symptoms with the goal of guiding future treatment through evidence based medicine.

DTIC

*Abnormalities; Mental Performance; Pharmacology; Signs and Symptoms*

**20070028434** Air Force Research Lab., San Antonio, TX USA

**Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts)**

Barnes, Christopher; Miller, James C.; Elliott, Linda; Coovert, Michael; Jun 2003; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467397; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467397>

This briefing discusses methodology and preliminary findings focused on the application of multi-level modeling techniques to distinguish effects of sleep loss and task demands on individual and team C4ISR decision making, coordination, and performance over time. We focus our efforts on measurement and modeling. First, we describe aspects of C4ISR scenario development, to ensure (a) psychological fidelity and operational relevance, (b) elicitation and assessment of performance constructs of interest, and (b) equivalence in scenario task demands and difficulty. Sustained operations research is challenged by the need for repeated-measures assessment, while minimizing effects of practice or experience. Second, we describe aspects of cognitive performance based on a standard cognitive test battery. Third, we describe other assessments (e.g. NEO PI personality assessment, mood-state inventory, Stanford Sleepiness Scale, physiological indices) that will be included in an overall approach to modeling fatigue effects, using multi-level hierarchical modeling analyses.

DTIC

*Charts; Command and Control; Decision Making; Performance Prediction*

**20070028552** NASA Johnson Space Center, Houston, TX, USA

**Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions?**

Davis-Street, Janis; Paloski, William H.; June 23, 2005; 14 pp.; In English; Bone Loss During Space Flight, 23-24 Jun. 2005, Cleveland, OH, USA; Copyright; Avail.: CASI: **A03**, Hardcopy

Prolonged microgravity exposure disrupts bone, muscle, and cardiovascular homeostasis, sensory-motor coordination, immune function, and behavioral performance. Bone loss, in particular, remains a serious impediment to the success of exploration-class missions by increasing the risks of bone fracture and renal stone formation for crew members. Current countermeasures, consisting primarily of resistive and aerobic exercise, have not yet proven fully successful for preventing bone loss during long-duration spaceflight. While other bone-specific countermeasures, such as pharmacological therapy and dietary modifications, are under consideration, countermeasure approaches that simultaneously address multiple physiologic systems may be more desirable for exploration-class missions, particularly if they can provide effective protection at reduced mission resource requirements (up-mass, power, crew time, etc). The most robust of the multi-system approaches under consideration, artificial gravity (AG), could prevent all of the microgravity-related physiological changes from occurring. The potential methods for realizing an artificial gravity countermeasure are reviewed, as well as selected animal and human studies evaluating the effects of artificial gravity on bone function. Future plans for the study of the multi-system effects of artificial gravity include a joint, cooperative international effort that will systematically seek an optimal prescription for intermittent AG to preserve bone, muscle, and cardiovascular function in human subjects deconditioned by 6 degree head-down-tilt-bed rest. It is concluded that AG has great promise as a multi-system countermeasure, but that further research is required to determine the appropriate parameters for implementation of such a countermeasure for exploration-class missions.

Derived from text

*Aerospace Medicine; Artificial Gravity; Bone Demineralization; Bones; Countermeasures; Gravitational Effects; Osteoporosis; Long Duration Space Flight*

**20070028553** NASA Johnson Space Center, Houston, TX, USA

**Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor**

Patel, Mamta J.; Liu, Wenbin; Sykes, Michelle C.; Ward, Nancy E.; Risin, Semyon A.; Risin, Diana; Hanjoong, Jo; [2007]; 29 pp.; In English; Copyright; Avail.: CASI: **A03**, Hardcopy

Microgravity of spaceflight induces bone loss due in part to decreased bone formation by osteoblasts. We have previously examined the microgravity-induced changes in gene expression profiles in 2T3 preosteoblasts using the Random Positioning Machine (RPM) to simulate microgravity conditions. Here, we hypothesized that exposure of preosteoblasts to an independent microgravity simulator, the Rotating Wall Vessel (RWV), induces similar changes in differentiation and gene transcript profiles, resulting in a more confined list of gravi-sensitive genes that may play a role in bone formation. In comparison to static 1g controls, exposure of 2T3 cells to RWV for 3 days inhibited alkaline phosphatase activity, a marker of differentiation, and downregulated 61 genes and upregulated 45 genes by more than two-fold as shown by microarray analysis. The microarray results were confirmed with real time PCR for downregulated genes osteomodulin, bone morphogenic protein 4

(BMP4), runx2, and parathyroid hormone receptor 1. Western blot analysis validated the expression of three downregulated genes, BMP4, peroxiredoxin IV, and osteoglycin, and one upregulated gene peroxiredoxin I. Comparison of the microarrays from the RPM and the RWV studies identified 14 gravi-sensitive genes that changed in the same direction in both systems. Further comparison of our results to a published database showing gene transcript profiles of mechanically loaded mouse tibiae revealed 16 genes upregulated by the loading that were shown to be downregulated by RWV and RPM. These mechanosensitive genes identified by the comparative studies may provide novel insights into understanding the mechanisms regulating bone formation and potential targets of countermeasure against decreased bone formation both in astronauts and in general patients with musculoskeletal disorders.

Author

*Bioreactors; Bone Demineralization; Bones; Clinostats; Osteoblasts; Rotating Environments; Clinorotation; Gravitational Physiology*

**20070028555** NASA Johnson Space Center, Houston, TX, USA

#### **Integrated Crew Health Care System for Space Flight**

Davis, Jeffrey R.; October 10, 2007; 1 pp.; In English; Digital Health Conference: Integrated Health Care, 10-11 Oct. 2006, Baltimore, MD, USA; No Copyright; Avail.: Other Sources; Abstract Only

Dr. Davis' presentation includes a brief overview of space flight and the lessons learned for health care in microgravity. He will describe the development of policy for health care for international crews. He will conclude his remarks with a discussion of an integrated health care system.

Author

*Aerospace Medicine; International Cooperation; Spacecrews; Bioastronautics; Space Flight*

**20070028811** Civil Aerospace Medical Inst., Oklahoma City, OK, USA; NASA Ames Research Center, Moffett Field, CA, USA

#### **Flight Attendant Fatigue**

Nesthus, T.; Schroeder, D.; Connors, M.; Rentmeister-Bryant, H.; DeRoshina, C.; July 2007; 67 pp.; In English; Original contains black and white illustrations

Report No.(s): DOT/FAA/AM-07/21; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028811>

The Departments of Transportation and Treasury and Independent Agencies Appropriations Bill (House Rpt. 108-671) included a directive to the Federal Aviation Administration to conduct a study of flight attendant fatigue. The NASA Ames Research Center Fatigue Countermeasures Group (FCG) was contracted by CAM1 to conduct the study. To meet the goals of the study, this report contains a literature review on fatigue as potentially experienced by flight attendants, an evaluation of currently used (actual vs. scheduled) flight attendant duty schedules, and a comparison of these schedules to the current CFRs. The report additionally reviews fatigue related incident/accident information from the Aviation Safety Reporting System (ASRS) and the NTSB database. One report section describes the application of three different performance and fatigue models to assess how flight attendant duty schedules contribute to increased levels of fatigue and predicted changes in performance. The report concludes with 6 recommendations concerning issues that require further evaluation, including (1) Survey of Field Operations. To assess the frequency with which fatigue is experienced, the situations in which it appears, and the consequences that follow; (2) Focused Study of Incident Reports. To better understand details of the incidents; (3) Field Research on the Effects of Fatigue. To explore physiological and neuropsychological effects of fatigue, sleepiness, circadian factors, and rest schedules on flight attendants; (4) Validation of Models for Assessing FA Fatigue. An important step to understanding whether and how models could be used in conjunction with field operations; (5) International Carrier Policies and Practices Review. To learn how other countries address these issues and with what results; and (6) Training. FAs could benefit from information on fatigue, its causes and consequences, its interaction with circadian disruption, and how and when to employ countermeasures (e.g., scheduled naps, physical activity, social activity and caffeine

Author

*Countermeasures; Flight Fatigue; Performance Prediction; Physiological Effects; Flight Crews; Aerospace Medicine; Flight Stress (Biology)*

**20070028831** NASA Johnson Space Center, Houston, TX, USA

#### **Fundamentals of Aerospace Medicine: Cosmic Radiation**

Bagshaw, Michael; Cucionotta, Francis A.; [2007]; 35 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Cosmic rays were discovered in 1911 by the Austrian physicist, Victor Hess. The planet earth is continuously bathed in

high-energy galactic cosmic ionizing radiation (GCR), emanating from outside the solar system, and sporadically exposed to bursts of energetic particles from the sun referred to as solar particle events (SPEs). The main source of GCR is believed to be supernovae (exploding stars), while occasionally a disturbance in the sun's atmosphere (solar flare or coronal mass ejection) leads to a surge of radiation particles with sufficient energy to penetrate the earth's magnetic field and enter the atmosphere. The inhabitants of planet earth gain protection from the effects of cosmic radiation from the earth's magnetic field and the atmosphere, as well as from the sun's magnetic field and solar wind. These protective effects extend to the occupants of aircraft flying within the earth's atmosphere, although the effects can be complex for aircraft flying at high altitudes and high latitudes. Travellers in space do not have the benefit of this protection and are exposed to an ionizing radiation field very different in magnitude and quality from the exposure of individuals flying in commercial airliners. The higher amounts and distinct types of radiation qualities in space lead to a large need for understanding the biological effects of space radiation. It is recognized that although there are many overlaps between the aviation and the space environments, there are large differences in radiation dosimetry, risks and protection for airline crew members, passengers and astronauts. These differences impact the application of radiation protection principles of risk justification, limitation, and the principle of as low as reasonably achievable (ALARA). This chapter accordingly is divided into three major sections, the first dealing with the basic physics and health risks, the second with the commercial airline experience, and the third with the aspects of cosmic radiation appertaining to space travel including future considerations.

Author

*Aerospace Medicine; Solar System; Nuclear Radiation; Civil Aviation; Cosmic Rays*

**20070028896** NASA Johnson Space Center, Houston, TX, USA

#### **Translational Research in Space Exploration**

Iyengar, M. Sriram; Johnson-Throop, Kathy A.; Bernstam, Elmer; Meric-Bernstam, Funda; August 20, 2007; 6 pp.; In English; MEDINFO, 20-24 Aug. 2007, Brisbane, Australia; Copyright; Avail.: CASI: [A02](#), Hardcopy

This viewgraph presentation reviews NASA's role in medical translational research, and the importance in research for space exploration. The application of medical research for space exploration translates to health care in space medicine, and on earth.

CASI

*Aerospace Medicine; Space Exploration; Biomedical Data*

**20070029230** NASA Johnson Space Center, Houston, TX, USA

#### **Johnson Space Center Flight Medicine Clinic Experience**

Landry, Trela; [2006]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Being a member of the Flight Medicine Clinic (FMC) Staff is a great experience. I joined the FMC staff 2 years ago when I became part of the Kelsey-Seybold team. The FMC staff consists of Flight Surgeons, Family Clinic Physician, Nursing staff, Wellness Coordinator and Support staff. We serve as the Primary Care Physicians for the astronauts and their families and provide annual physicals for the retired astronauts. We have approximately 800 patients in the FMC. As the Family Clinic Physician, I care for the astronaut spouses and children and provide annual physicals for the retired astronauts. Since we have a small patient population, we have the opportunity to spend increased personal time with our patients, which I enjoy. We have a pretty healthy patient population, who are very interested in their overall health and preventive care. In preparation for a shuttle launch, our nursing staff assists the flight surgeons with the astronaut physical exams, which occur 10 days prior to launch and again 3 days after their return. We also provide Primary Contact physicals for the families and guests, who will be in close contact with shuttle crew members. During these physicals, we provide education, emphasizing the importance of preventing the spread of communicable diseases to shuttle crew members. Being a part of the Space Medicine Program is an honor. To know that you contribute in some way to our nation's Space Program is very special. (This article was prepared by Dr. Trela Landry, M.D. for inclusion in a Kelsey-Seybold newsletter on 25 OCT 2006.)

Author

*Aerospace Medicine; NASA Programs; Astronauts; Flight Surgeons; Clinical Medicine*

**20070029235** NASA Johnson Space Center, Houston, TX, USA

#### **The Effect of Increasing Mass on Locomotion**

DeWitt, John; Hagan, R. Donald; August 2007; 50 pp.; In English; Original contains color and black and white illustrations Report No.(s): NASA/TP-2007-214757; S-1007; Copyright; Avail.: CASI: [A03](#), Hardcopy

The purpose of this investigation was to determine if increasing body mass while maintaining bodyweight would affect

ground reaction forces and joint kinetics during walking and running. It was hypothesized that performing gait with increased mass while maintaining body weight would result in greater ground reaction forces, and would affect the net joint torques and work at the ankle, knee and hip when compared to gait with normal mass and bodyweight. Vertical ground reaction force was measured for ten subjects (5M/5F) during walking and running on a treadmill. Subjects completed one minute of locomotion at normal mass and bodyweight and at four added mass conditions (10%, 20%, 30% and 40% of body mass) in random order. Three-dimensional joint position data were collected via videography. The addition of mass resulted in several effects. Peak impact forces and loading rates increased during walking, but decreased during running. Peak propulsive forces decreased during walking and did not change during running. Stride time increased and hip extensor angular impulse and positive work increased as mass was added for both styles of locomotion. Work increased at a greater rate during running than walking. The adaptations to additional mass that occur during walking are different than during running. Increasing mass during exercise in microgravity may be beneficial to increasing ground reaction forces during walking and strengthening hip musculature during both walking and running.

Author

*Locomotion; Body Weight; Reaction Kinetics; Impact Loads; Physical Exercise*

**20070029237** NASA Johnson Space Center, Houston, TX, USA

### **A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment**

Ott, C. M.; John, J.; Castro, V. A.; Cruz, P.; Buttner, L. M.; Pierson, D. L.; February 12, 2007; 1 pp.; In English; NASA HRP Investigators' Workshop, 12-14 Feb. 2007, Houston, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

The determination of risk from infectious disease during long-duration missions is composed of several factors including (1) the host's susceptibility, (2) the host's exposure to the infectious disease agent, and (3) the concentration of the infectious agent, and (4) the characteristics of the infectious agent. While stringent steps are taken to minimize the transfer of potential pathogens to spacecraft, several medically significant organisms have been isolated from both the Mir and International Space Station (ISS). Historically, the method for isolation and identification of microorganisms from spacecraft environmental samples depended upon their growth on culture media. Unfortunately, only a fraction of the organisms may grow on a culture medium, potentially omitting those microorganisms whose nutritional and physical requirements for growth are not met. Thus, several pathogens may not have been detected, such as *Legionella pneumophila*, the etiological agent of Legionnaire's disease. We hypothesize that environmental analysis using non-culture-based technologies will reveal microorganisms, allergens, and microbial toxins not previously reported in spacecraft, allowing for a more complete health assessment. The development of techniques for this flight experiment, operationally named SWAB, has already provided advances in NASA laboratory processes and beneficial information toward human health risk assessment. The first accomplishment of the SWAB experiment was the incorporation of 16S ribosomal DNA sequencing for the identification of bacteria. The use of this molecular technique has increased bacterial speciation of environmental isolates from previous flights three fold compared to conventional methodology. This increased efficiency in bacterial speciation provides a better understanding of the microbial ecology and the potential risk to the crew. Additional SWAB studies focused on the use of molecular-based DNA fingerprinting using repetitive sequence-based polymerase chain reaction (rep-PCR). This technology has allowed contamination tracking of microorganisms between crewmembers and their environment. This study not only demonstrated that ISS has a greater diversity of organisms than originally expected, but also provided insight into possible routes of infection to the crew. Additional ground-based studies used rep-PCR and protein based assays to determine the potential of methicillin resistant *Staphylococcus aureus* (MRSA) aboard ISS. MRSA has become increasingly common on Earth and pose a treatment problem for infections during flight. While no MRSA have been isolated from ISS to date, the *mecA* gene product that is responsible for methicillin resistance was isolated in other *Staphylococcus* species aboard ISS suggesting a potential of MRSA through gene transfer. Using improved sample collection technologies, flight sampling for SWAB was initiated in August 2006 and should continue through spring of 2007. The focus of these flight samples is the collection of DNA for evaluation by Denaturing Gradient Gel Electrophoresis (DGGE). Unlike other techniques, DGGE does not depend on any microbial growth on culture media allowing a more comprehensive assessment of the spacecraft interior. This study should provide insight into the true microbial ecology that is experienced by the crew during flight. This information will lead toward an accurate microbial risk assessment to help set flight requirements to protect the safety, health, and performance of the crew.

Author

*Bacteria; Infectious Diseases; Microbiology; Microorganisms; Spacecraft Environments; Bioastronautics; Aerospace Medicine*

**20070029268** NASA Johnson Space Center, Houston, TX, USA

**An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island**

Scheuring, R. A.; Jones, J. A.; Lee, P.; Comtois, J. M.; Chappell, S.; Rafiq, A.; Braham, S.; Hodgson, E.; Sullivan, P.; Wilkinson, N.; Bach, D.; Torney, S.; May 20, 2007; 2 pp.; In English; Humans in Space: 2007, 20-24 May 2007, Beijing, China; Copyright; Avail.: Other Sources; Abstract Only

The lunar architecture for future sortie and outpost missions will require humans to serve on the lunar surface considerably longer than the Apollo moon missions. Although the Apollo crewmembers sustained few injuries during their brief lunar surface activity, injuries did occur and are a concern for the longer lunar stays. Interestingly, lunar medical contingency plans were not developed during Apollo. In order to develop an evidence-base for handling a medical contingency on the lunar surface, a simulation using the moon-Mars analog environment at Devon Island, Nunavut, high Canadian Arctic was conducted. Objectives of this study included developing an effective management strategy for dealing with an incapacitated crewmember on the lunar surface, establishing audio/visual and biomedical data connectivity to multiple centers, testing rescue/extraction hardware and procedures, and evaluating in suit increased oxygen consumption. Methods: A review of the Apollo lunar surface activities and personal communications with Apollo lunar crewmembers provided the knowledge base of plausible scenarios that could potentially injure an astronaut during a lunar extravehicular activity (EVA). Objectives were established to demonstrate stabilization and transfer of an injured crewmember and communication with ground controllers at multiple mission control centers. Results: The project objectives were successfully achieved during the simulation. Among these objectives were extraction from a sloped terrain by a two-member crew in a 1 g analog environment, establishing real-time communication to multiple centers, providing biomedical data to flight controllers and crewmembers, and establishing a medical diagnosis and treatment plan from a remote site. Discussion: The simulation provided evidence for the types of equipment and methods for performing extraction of an injured crewmember from a sloped terrain. Additionally, the necessary communications infrastructure to connect multiple centers worldwide was established from a remote site. The surface crewmembers were confronted with a number of unexpected scenarios including environmental, communications, EVA suit, and navigation challenges during the course of the simulation which provided insight into the challenges of carrying out a medical contingency in an austere environment. The knowledge gained from completing the objectives will be incorporated into the exploration medical requirements involving an incapacitated astronaut on the lunar surface.

Author

*Aerospace Medicine; Biomedical Data; Lunar Surface; Bioastronautics; Analogies*

**20070029269** NASA Johnson Space Center, Houston, TX, USA

**Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment**

Hurst, Victor; Doerr, Harold K.; Polk, J. D.; Schmid, Josef; Parazyński, Scott; Kelly, Scott; May 13, 2007; 14 pp.; In English; ASMA, 13-17 May 2007, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029269>

This viewgraph presentation reviews the use of telemedicine in a simulated microgravity environment using a patient simulator. For decades, telemedicine techniques have been used in terrestrial environments by many cohorts with varied clinical experience. The success of these techniques has been recently expanded to include microgravity environments aboard the International Space Station (ISS). In order to investigate how an astronaut crew medical officer will execute medical tasks in a microgravity environment, while being remotely guided by a flight surgeon, the Medical Operation Support Team (MOST) used the simulated microgravity environment provided aboard DC-9 aircraft teams of crew medical officers, and remote flight surgeons performed several tasks on a patient simulator.

CASI

*Flight Surgeons; Medical Personnel; Microgravity; Simulators; Telemedicine; Aerospace Medicine; Medical Services*

**20070029270** NASA Johnson Space Center, Houston, TX, USA

**Space Medicine Issues and Healthcare Systems for Space Exploration Medicine**

Scheuring, Richard A.; Jones, Jeff; June 2007; 70 pp.; In English; Korean Aerospace Medical Association Annual Meeting, 3 Jun. 2007 - 27 May 2007, Seoul, Korea, Republic of; Original contains color illustrations; No Copyright; Avail.: CASI:

A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029270>

This viewgraph presentation reviews issues of health care in space. Some of the issues reviewed are: (1) Physiological

adaptation to microgravity, partial gravity, (2) Medical events during spaceflight, (3) Space Vehicle and Environmental and Surface Health Risks, (4) Medical Concept of Operations (CONOPS), (4a) Current CONOPS & Medical Hardware for Shuttle (STS) and ISS, (4b) Planned Exploration Medical CONOPS & Hardware needs, (5) Exploration Plans for Lunar Return Mission & Mars, and (6) Developing Medical Support Systems.

CASI

*Aerospace Medicine; Health; Bioastronautics; Gravitational Physiology; Spacecraft Environments; Physiological Responses; Physiological Effects; Weightlessness; Space Psychology*

**20070029279** NASA Johnson Space Center, Houston, TX, USA

#### **MDS MIC Catalog Inputs**

Johnson-Throop, Kathy A.; Vowell, C. W.; Smith, Byron; Darcy, Jeannette; October 23, 2006; 19 pp.; In English; Medical Informatics and Technology Working Group, 23-27 Oct. 2006, Cologne, Germany; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation reviews the inputs to the MDS Medical Information Communique (MIC) catalog. The purpose of the group is to provide input for updating the MDS MIC Catalog and to request that MMOP assign Action Item to other working groups and FSs to support the MITWG Process for developing MIC-DDs.

CASI

*Catalogs (Publications); Medical Personnel; Medicine; Medical Science; Data Bases*

**20070029282** NASA Johnson Space Center, Houston, TX, USA

#### **Translational Research from an Informatics Perspective**

Bernstam, Elmer; Meric-Bernstam, Funda; Johnson-Throop, Kathy A.; Turley, James P.; Smith, Jack W.; August 20, 2007; 3 pp.; In English; MEDINFO 2007, 20-24 Aug. 2007, Brisbane, Australia; Copyright; Avail.: CASI: [A01](#), Hardcopy

Clinical and translational research (CTR) is an essential part of a sustainable global health system. Informatics is now recognized as an important en-abler of CTR and informaticians are increasingly called upon to help CTR efforts. The US National Institutes of Health mandated biomedical informatics activity as part of its new national CTR grant initiative, the Clinical and Translational Science Award (CTSA). Traditionally, translational re-search was defined as the translation of laboratory discoveries to patient care (bench to bedside). We argue, however, that there are many other kinds of translational research. Indeed, translational re-search requires the translation of knowledge discovered in one domain to another domain and is therefore an information-based activity. In this panel, we will expand upon this view of translational research and present three different examples of translation to illustrate the point: 1) bench to bedside, 2) Earth to space and 3) academia to community. We will conclude with a discussion of our local translational research efforts that draw on each of the three examples.

Author

*Information; Clinical Medicine; Health; Translating*

**20070029284** NASA Johnson Space Center, Houston, TX, USA

#### **Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice**

Risin, Semyon A.; Dasgupta, Amitava; Ramesh, Govindarajan T.; Risin, Diana; [2007]; 2 pp.; In English; 79th Annual Scientific Meeting of the Aerospace Medical Association, 11-15 May 2008, Boston, MA, USA; Copyright; Avail.: Other Sources; Abstract Only

The pharmacokinetics (PK) of medications administered to astronauts could be altered by the conditions in space. It is prudent to expect that low gravity and free floating (and associated hemodynamic changes) could affect the absorption, distribution, metabolism and excretion of the drugs. Knowledge of these alterations is essential for adjusting the dosage and the regimen of drug administration. Among the medications of special interest are the cardiovascular drugs, especially the antiarrhythmic agents. In this study we used hind limb unloaded (HLU) mice as a model to investigate possible changes in the PK of a common antiarrhythmic drug procainamide (PA). Prior to drug administration the experimental animals were tail suspended for 24 hours and the control animals were kept free. PA (150-250 mg per kg) was given orally by a gavage procedure. After that the experimental mice were kept suspended for additional 1, 2, 3 and 6 hours. At these time points the serum concentration of PA and N-acetyl-procainamide (NAPA), an active metabolite which is formed by N-acetyltransferase in the liver, were measured by the fluorescence polarization immunoassay (FPIA) on the AxSYM autoanalyzer (Abbott Laboratories, Abbott Park, IL). The serum level of PA in HLU mice at 1 hour after administration was almost 40% lower than in controls. At 2-3 hours the difference still maintained, however, it was not statistically significant; at 6 hours no difference

was detected. The level of NAPA in HLU mice was slightly lower at 1 and 2 hours but the difference did not reach statistical significance. The estimated PA half-life time in HLU mice was almost 55% longer than in control animals. These results confirm that hind limb unloading and related hemodynamic changes significantly alter the PK of PA. The effects are most likely primarily associated with a decrease in the drug absorption, especially within the first two hours after administration. At the same time prolongation of the PA half-life time in the HLU mice points towards slower drug elimination from the circulation.

Author

*Dosage; Drugs; Microgravity; Pharmacology; Bioprocessing; Bioavailability; Gravitational Physiology; Weightlessness; Physiological Effects; Aerospace Medicine*

**20070029285** NASA Johnson Space Center, Houston, TX, USA

#### **Behavioral Health Program Element**

Leveton, Lauren B.; February 27, 2006; 1 pp.; In English; NSBRI Investigator's Workshop, 27 Feb. 2006 - 1 Mar. 2006, Houston, TX, USA; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029285>

The project goal is to develop behavioral health prevention and maintenance system for continued crew health, safety, and performance for exploration missions. The basic scope includes a) Operationally-relevant research related to clinical cognitive and behavioral health of crewmembers; b) Ground-based studies using analog environments (Antarctic, NEEMO, simulations, and other testbeds); c) ISS studies (ISSMP) focusing on operational issues related to behavioral health outcomes and standards; d) Technology development activities for monitoring and diagnostic tools; and e) Cross-disciplinary research (e.g., human factors and habitability research, skeletal muscle, radiation).

Derived from text

*Aerospace Medicine; Human Factors Engineering; Spacecrews; Health; Musculoskeletal System*

**20070029339** NASA Johnson Space Center, Houston, TX, USA

#### **Exploration Medical Capability (ExMC) Program**

Kalla, Elizabeth; February 27, 2006; 1 pp.; In English; NSBRI Investigator's Workshop, 27 Feb. 2006 - 1 Mar. 2006, Houston, TX, USA; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029339>

This document reviews NASA's Exploration Medical Capability (ExMC) program. The new space exploration program, outlined by the President will present new challenges to the crew's health. The project goals are to develop and validate requirements for reliable, efficient, and robust medical systems and treatments for space exploration to maximize crew performance for mission objectives.

CASI

*Health; Space Exploration; Spacecrews; Aerospace Medicine; Aerospace Environments*

**20070029340** NASA Johnson Space Center, Houston, TX, USA

#### **Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells**

Currie, Stephen; Hammond, Dianne; Jeevarajan, Anthony; July 24, 2007; 1 pp.; In English; Summer Institute for Students, 24 Jul 2007, USA; No Copyright; Avail.: Other Sources; Abstract Only

In order to develop appropriate countermeasures for NASA's return mission to the moon, the potential toxicity of lunar dust needs to be examined. Due to its abrasiveness, reactivity, composition and small size, lunar dust may pose a serious health risk to astronauts who inhale it. This project focuses on the toxicity of lunar dust simulant (JSC-1A-vf) using WI-38 human embryonic lung cells. Past results show that the simulant has toxic effects on small animals using intratracheal instillation. Earlier studies in this lab suggest that the dust remaining in media after low speed centrifugation is toxic. In order to better assess its toxicity, the simulant has been diluted in media, filtered with a 5 micron filter before combining it with media. This filtered dust is compared with dust centrifuged in media. Whole dust toxicity is also tested. Toxicity is estimated using a 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) toxicity test which measures the activity of reducing enzymes in the mitochondria of viable cells. Preliminary results suggest that simulant which is diluted in media at different concentrations is slightly toxic. Interestingly, the cells appear to sweep up and collect the simulant. Whether this contributes to its toxicity is unclear. This project provides possible toxicity testing protocols for lunar dust and contributes to the knowledge of nanosize particle toxicity.

Author

*Lunar Dust; Lungs; Reactivity; Toxicity; Health; Astronauts*



**20070029341** NASA Johnson Space Center, Houston, TX, USA

**Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines**

Burgoyne, Madeline; Holtorf, Heidi; Huff, Janice; Moore, Valerie; Jeevarajan, Antony; July 24, 2007; 1 pp.; In English; USRA CASS Summer Student Presentation, 24 Jul. 2007, Houston, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

The DF-1 compound, a sixty carbon fullerene derivative, has been shown to have antioxidant effects and is thought to possibly help mediate the effects of radiation on cells. While this is potentially useful, it is important to first understand the effect that the DF-1 has on the cells and the growth rate of the cells to determine if the material itself has any innate toxicity. A growth curve was established for both HF-19 cells, human fibroblasts, and HepG2 cells, liver tissue cells in the presence of two different concentrations of DF-1 and for untreated controls. The cells were plated in triplicate in 60mm dishes and were lifted and counted with a hemocytometer daily for one week. The growth curve data for the HF-19 cells show that while the low concentration of DF-1 had no apparent effect on the growth rate, the high concentration of DF-1 appeared to severely inhibit the growth of the HF-19 cells. The growth curve data for the HepG2 cells shows that the DF-1 compound had no significant effect on the rate at which the cells grew. A second growth curve study was performed plain carbon nanotubes, but with only 24 hour exposure to a high and low concentration of material. The carbon nanotubes are another carbon compound similar to DF-1, but in the shape of a tube, rather than a ball. We hypothesize that nanotubes may also mediate the effect of radiation on cells. This time, nanotubes did not show any significant effect on the growth rate HF-19 or HepG2 cells. A third growth curve study is underway to further determine the effect of DF-1, nanotubes, and a derivatized nanotube (BHT-nanotubes). This derivatized nanotube has been modified with a compound that is known to be very effective at neutralizing free radicals. We expect that the high concentration of DF-1 and possibly the nanotubes and BHT-nanotubes may inhibit the growth of the HF-19 cells while the low concentration will resemble the growth of the control. We also hypothesize that there will be no significant effect on the growth of the HepG2 cells by the nanotubes, and BHT-nanotubes. In order to examine the usefulness of the DF-1, nanotubes, and BHT-nanotubes in mediating the effects of radiation a clonogenic assay is being performed. The HF-19 cells were plated in different concentrations of the various compounds and exposed to varying amounts of radiation. The cells are being allowed to grow in a small enough concentration so that the ability of each cell to divide can be seen by the development of cell clusters. By comparing the irradiated control to the un-irradiated control the effects of radiation alone can be seen. By comparing the compound treated irradiated cells to the irradiated control the usefulness of each compound can be seen. It is thought that Amifostine, the positive control, will have more regularly dividing cells than the irradiated control, as will DF-1 and hopefully both nanotube materials as well.

Author

*Toxicity; Radiation Effects; Radiation Protection; Deuterium Fluorides; Carbon Compounds; Carbon Nanotubes; Fullerenes; Lungs; Liver*

**20070029421** NASA Johnson Space Center, Houston, TX, USA

**Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest**

Paloski, William H.; September 13, 2007; 1 pp.; In English; Medicine and Mobility 2007, 13-16 Sept. 2007, Cologne, Germany; No Copyright; Avail.: Other Sources; Abstract Only

We have begun to explore the utility of intermittent artificial gravity (AG) as a multi-system countermeasure to the untoward health and performance effects of adaptation to decreased gravity during prolonged space flight. The first study in this exploration was jointly designed by an international, multi-disciplinary team of scientists interested in standardizing an approach so that comparable data could be obtained from follow-on studies performed in multiple international locations. Fifteen rigorously screened male volunteers participated in the study after providing written informed consent. All were subjected to 21 days of 6deg head-down-tilt (HDT) bed rest. Eight were treated with daily 1hr AG exposures (2.5g at the feet decreasing to 1.0g at the heart) aboard a short radius (3m) centrifuge, while the other seven served as controls. Multiple observations were made of dependent measures in the bone, muscle, cardiovascular, sensory-motor, immune, and behavioral systems during a 10 day acclimatization period prior to HDT bed rest and again during an 8 day recovery period after the bed rest period. Comparisons between the treatment and control subjects demonstrated salutary effects of the AG exposure on aspects of the muscle and cardiovascular systems, with no untoward effects on the vestibular system, the immune system, or cognitive function. Bone deconditioning was similar between the treatment and control groups, suggesting that the loading provided by this specific AG paradigm was insufficient to protect that system from deconditioning. Future work will be devoted to varying the loading duty cycle and/or coupling the AG loading with exercise to provide maximum physiological

protection across all systems. Testing will also be extended to female subjects. The results of this study suggest that intermittent AG could be an effective multi-system countermeasure.

Author

*Artificial Gravity; Exposure; Head Down Tilt; Aerospace Medicine; Cardiovascular System; Deconditioning; Long Duration Space Flight; Physiology; Gravitational Effects; Bed Rest*

**20070029988** Civil Aerospace Medical Inst., Oklahoma City, OK, USA; Gulhane Military Medical Academy, Eskishehir, Turkey

**Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots**

Sen, Ahmet; Akin, Ahmet; Canfield, D. V.; Chaturvedi, A. K.; July 2007; 11 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): AM-B-07-TOX-202

Report No.(s): DOT/FAA/AM-07/19; Copyright; Avail.: CASI: [A03](#), Hardcopy

Selective serotonin reuptake inhibitors (SSRIs) are popularly prescribed for treating depression, but these antidepressants are not currently approved for use by U.S. civilian aviators. In a 2003 study, 4 SSRIs--citalopram, fluoxetine, paroxetine, and sertraline--were found in 61 pilot fatalities of civil aviation accidents that occurred during 1990-2001. However, it was not known whether these pilots had had disqualifying psychological conditions, including depression, and had properly reported the use of the antidepressants. The aeromedical history of the pilots was retrieved from the Federal Aviation Administration's (FAA's) Medical Certification Database; additional pilot medical information and the cause/factor of the accidents were obtained from the National Transportation Safety Board's (NTSB's) Aviation Accident Database. Fifty-nine pilots had medical records in the FAA's Certification Database. The database did not contain medical records of 2 pilots--1 had never received a medical certificate and another had a Canadian pilot and medical certificate. Although driving under the influence was self-reported by 22 of the 59 pilots during their past aeromedical examinations, disqualifying psychological conditions were self-reported in the past examinations of only 7 (12%) of the 59 pilots, and the use of an SSRI was reported by 3 of the 7 pilots. In later examinations, 6 of the 7 indicated that they were free from the conditions and not taking SSRIs; thus, they were reissued medical certificates. Such conditions and/or drug use were not self-reported in the aeromedical records of the 52 (88%) pilots. Nevertheless, the NTSB investigations revealed that 12 (20%) of the 61 pilots had a history of a psychological condition and/or an SSRI use, as suggested by their personal medical records. Psychological conditions and/or the use of drugs were determined to be the cause or a factor in 19 (31%) of the 61 accidents. These findings reconfirm that SSRIs were used by the aviators but were not reported in their last aeromedical examinations.

Author

*Aerospace Medicine; Aircraft Pilots; Civil Aviation; Psychotropic Drugs; Psychopharmacology*

**20070029992** NASA Johnson Space Center, Houston, TX, USA

**An Introduction to the History of Aerospace Medicine**

Tarver, William J.; July 16, 2007; 71 pp.; In English; Aerospace Medicine Short Course, 16 Jul. - 10 Aug. 2007, Galveston, TX, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029992>

This viewgraph presentation reviews the history of aviation and space travel from the precursors of aviation to the lighter than air aviation to the heavier than air to the space travel. The improvement of heavier than air travel, in all dimensions from length of time traveled, to altitude and speed of travel between the first to World War I is reviewed. An understanding of the medical problems associated with air travel was begun. The beginning of the position of flight surgeons is reviewed. The advancement of flight from air to space flight is shown using photos.

CASI

*Aerospace Medicine; Air Transportation*

**20070029993** NASA Johnson Space Center, Houston, TX, USA

**The Need for an Aerospace Pharmacy Residency**

Bayuse, T.; Schuyler, C.; Bayuse, Tina M.; May 13, 2007; 12 pp.; In English; ASMA Annual Conference, 13-17 May 2007, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS9-02078; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph poster presentation reviews the rationale for a call for a new program in residency for aerospace pharmacy. Aerospace medicine provides a unique twist on traditional medicine, and a specialty has evolved to meet the

training for physicians, and it is becoming important to develop such a program for training in pharmacy designed for aerospace. The reasons for this specialist training are outlined and the challenges of developing a program are reviewed.

CASI

*Aerospace Medicine; Education; Pharmacology*

**20070029994** NASA Johnson Space Center, Houston, TX, USA

#### **Utility of DF-1 for Radioprotection in Lymphocytes**

Reynolds, Julia; Casey, Rachael; Wu, Honglu; Huff, Janice; Emami, Kamal; Moore, Valerie; Jeevarajan, Antony; July 24, 2007; 1 pp.; In English; USRA CASS, 24 Jul. 2007, Houston, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

The development of degenerative changes in the vasculature, such as atherosclerosis, is a known consequence of exposure to ionizing radiation, and is thus a concern for astronaut health following long duration space flight. Cellular damage caused by radiation is due to free radical generation and DNA damage. The goal of this project was to assess the ability of a C60-derivative, DF-1, to mitigate cellular damage resulting from radiation exposure in primary human lymphocytes. DF-1 is a water-soluble C60 fullerene encapsulated in dendrimeric functional groups that is proposed to exhibit antioxidant properties. Human lymphocytes are radiosensitive and travel throughout the body potentially causing bystander effects in any tissues they contact. These cells were subjected to varying doses of gamma radiation in the presence or absence of DF-1. Cells were collected at 48 hours post-irradiation for chromosomal aberration studies and at 72 hours post-irradiation for micronuclei studies. These studies showed that the irradiated cells contained more chromosomal aberrations and micronuclei than the control cells. Addition of the DF-1 reduced the amount of observed DNA damage in the irradiated cells. Growth curves were measured for the lymphocytes exposed to 0 and 4 Gray gamma irradiations, and we observed less growth in the cells irradiated at 4 Gy. 2,7-dichlorofluorescein diacetate was used to detect reactive oxygen species production, and increased production of ROS was observed in the irradiated lymphocytes. Human lymphocytes were subjected to varying doses of gamma or photon radiation in the presence and absence of DF-1 and a known radioprotectant, amifostine. After irradiation, the production of reactive oxygen species, growth curves and cell viability were measured. These cells were also collected to quantify chromosomal aberrations and micronuclei formation. We predict that irradiated cells will show the most damage and that DF-1 will provide protective effects similar to those of amifostine, an established radioprotectant.

Author

*Cells (Biology); Radiation Protection; Radiation Effects; Gamma Rays; Fullerenes; Deuterium Fluorides; Chromosome Aberrations; Reactivity; Health*

**20070030001** NASA Johnson Space Center, Houston, TX, USA

#### **Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq**

Wilson, J. W.; Ott, C. M.; zuBentrup, K. Honer; Ramamurthy R.; Quick, L.; Porwollik, S.; Cheng, P.; McClellan, M.; Tsaprailis, G.; Radabaugh, T.; Hunt, A.; Fernandez, D.; Richter, E.; Shah, M.; Kilcoyne, M.; Joshi, L.; Nelman-Gonzalez, M.; Hing, S.; Parra, M.; Dumaras, P.; Norwood, K.; Nickerson, C. A.; Bober, R.; Devich, J.; Ruggles, A.; [2007]; 37 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

A comprehensive analysis of both the molecular genetic and phenotypic responses of any organism to the spaceflight environment has never been accomplished due to significant technological and logistical hurdles. Moreover, the effects of spaceflight on microbial pathogenicity and associated infectious disease risks have not been studied. The bacterial pathogen *Salmonella typhimurium* was grown aboard Space Shuttle mission STS-115 and compared to identical ground control cultures. Global microarray and proteomic analyses revealed 167 transcripts and 73 proteins changed expression with the conserved RNA-binding protein Hfq identified as a likely global regulator involved in the response to this environment. Hfq involvement was confirmed with a ground based microgravity culture model. Spaceflight samples exhibited enhanced virulence in a murine infection model and extracellular matrix accumulation consistent with a biofilm. Strategies to target Hfq and related regulators could potentially decrease infectious disease risks during spaceflight missions and provide novel therapeutic options on Earth.

Author

*Infectious Diseases; Spacecraft Environments; Proteins; Pathogens; Microorganisms; Microgravity; Space Shuttle Missions; Gene Expression; Bacteria*

**MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT**

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

**20070026396** Naval Postgraduate School, Monterey, CA USA

**A Process Model of Situated Cognition in Military Command and Control**

Miller, Nita L; Shattuck, Lawrence G; Jun 2004; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466093; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466093>

Complex cognitive systems couple humans with machines for the purpose of accomplishing a specific goal. It is often the case that human factors practitioners focus their attention on the humans while designers tend to focus on the technological aspects of the system. The point of intersection between humans and technology has become a boundary with respect to evaluation. In addition, human factors practitioners have often studied the result of cognitive activity (e.g., a decision) rather than the processes that lead to the outcome. In this paper, the authors present a general model that combines the technological aspects of a system with the perceptual and cognitive processes of the humans embedded in the system. The model emphasizes that such systems are both process oriented and dynamic. The authors describe a process tracing methodology that can be used to investigate the flow of data and information through both the technological and human components of the system. The attack on the USS Stark is used as a case study to illustrate the model and the process tracing methodology. The results of the process tracing analysis have implications for the design of complex systems and the training received by those who operate such systems.

DTIC

*Cognition; Command and Control*

**20070026650** Space and Naval Warfare Systems Command, San Diego, CA USA

**Human Systems Integration Assessment of Network Centric Command and Control**

Quashnock, Dee; Kelly, Richard T; Dunaway, John; Smillie, Robert J; Sep 2004; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466644; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466644>

Trident Warrior 2003 (TW03) was a Navy initiative to demonstrate an initial baseline of potential FORCENet capabilities. FORCENet is the operational construct and architectural framework for Naval Network Centric Warfare in the information age that integrates warriors, sensors, networks, command and control, platforms, and weapons into a distributed combat force. TW03 provided an integrated prototype capability for fleet evaluation and refinement of a supportable incremental delivery of FORCENet capability. The Chat system was limited by the synchronous nature of the system that required constant attention to monitor communications, by the number of participants that could be accommodated and recognized, and by the time required for users to authorize, compose, and type messages. The connections between the fire control systems allowed users to share common situation awareness on tracks, targets, and fire schedules but were mediated by the GCCS-M position information, which could lag up to 15 minutes behind real-time. The utility of the links between the fire support systems were limited by the inability of one system to accommodate the same target designations from another system and by the lack of connection between systems. Situation awareness is a continuing process and the limitation of reliance on chat as a status indicator was highlighted when one shooter was not aware that he was supposed to be in position to provide fire support to shore. Chat technology was used extensively to transfer information among distributed teams. Confusions and missed messages were noted occasionally and were typically due to user interface design problems, ambiguous operating procedures, or technical incompatibilities between chat systems. Display configurations and workspace layouts were problematic and led to inefficiencies in the way that information was transferred within and between command centers. Consideration of the proper location of operator workstations, legibility of

DTIC

*Command and Control; Human Factors Engineering; Network Control; Systems Analysis; Systems Integration; Warfare*

**20070026805** BAE Systems, UK

**Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics**

McGuinness, Barry; Ebbage, Louise; May 2002; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467497; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467497>

The effects of digitized command and control on commanders workload and situational awareness (SA) were experimentally investigated in a simulated battle group scenario. Military participants acted in pairs to lead the planning and execution of a land reconnaissance operation, controlling the deployment of various units and sensor assets to find and fix an enemy. The subjects performed two versions of the exercise: one in which all communications between the HQ and its battlefield units occurred using the standard voice radio net, and a second version in which most of the interactions were either augmented or replaced with digital technology such as data-link, text messaging and automatic location reporting. During the execution phase, the command teams responded to various measures of workload and SA, described in the paper. These data, backed up with subject debriefings, provided several key insights into the impact of digitization. For example, it appears that the automatic presentation of enemy positional data reduced the depth to which commanders mentally processed incoming sighting information, thus reducing their sense of confidence in understanding the enemy picture. The pros and cons of the measures used are discussed, along with lessons learned.

DTIC

*Command and Control; Human Factors Engineering; Organizations; Situational Awareness; Telecommunication; Voice Communication; Workloads (Psychophysiology)*

**20070027383** Naval Postgraduate School, Monterey, CA USA

**Testing and Evaluation of Dynasig Biometric Pen in Support of Tactical Military and Law Enforcement Missions**

Odgers, Kenton M; Mar 2007; 91 pp.; In English

Report No.(s): AD-A467350; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Existing access control methods depend on mechanisms that can either be copied or stolen. From passwords to identification cards, these forms of authentication and verification are unique only while they remain in possession of the owner. Signature-based authentication and verification however, while not implying the two-dimensional ink on paper, but rather the method with which a signature is made, is extremely unique and provides a method that cannot feasibly be duplicated or stolen. Thereby, this form of access control can be more beneficial to security issues and to the increasing awareness of identity management. The objective of this thesis is to test and evaluate the Bio-Pen(trademark) and its associated WebClient software leveraging the Cooperative Operations and Applied Science and Technology Studies (COASTS) field experimentation program as a vessel for equipment and idea testing, requirements and standards definition. This thesis will examine a new biometric technology in terms of access control as well as its associated software. The primary objective of this research is to develop a fundamental understanding of the doctrinal, technological, and operational considerations of how the Bio-Pen can be utilized within the Department of Defense and Homeland Defense. To accomplish this objective, the Bio-Pen(trademark) and WebClient software will be tested and evaluated for use in the field to determine feasibility for future applications.

DTIC

*Biometrics; Law (Jurisprudence); Military Operations*

**20070027399** ICF Kaiser Engineers, Inc., Edgewood, MD USA

**Fort Holabird Defense Investigative Service (DIS), Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II**

Longe, Timothy; Chuang, R; Johnston, D; Brand, C; McKown, Gary; Dec 1998; 105 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA31-94-D-0064

Report No.(s): AD-A467428; ESP506-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II, summarizes the current status of the Fort Holabird DIS environmental restoration and associated environmental compliance programs, and presents a comprehensive strategy for implementing response actions necessary to protect human health and the environment. Fort Holabird DIS was situated on 7.92 acres within the corporate limits of Baltimore City and performed clearances for the Department of Defense and other federal government agencies. Fort Holabird DIS was approved for closure under the Base Closure and Realignment Act of 1995. The official closure date was October 1, 1998. Fort Holabird DIS relocated all operations to a new site in Linthicum, MD in July 1996. In addition to laying out the response action approach at the installation in support of base

closure, this BCP defines the status of efforts to resolve technical issues so that continued progress and implementation of scheduled activities can occur. This BCP, originally prepared as Version 1, Draft Document, in September 1996, has been updated regularly to incorporate newly obtained information. This Version II BCP was prepared with information available as of December 10, 1998.

DTIC

*Cleaning; Environmental Engineering*

**20070027725** Army Research Lab., Aberdeen Proving Ground, MD USA

**The Tactile Modality: A Review of Tactile Sensitivity and Human Tactile Interfaces**

Myles, Kimberly; Binseel, Mary S; May 2007; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468389; ARL-TR-4115; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Even though vision is only one modality humans use to interact with their environment, most people consider it to be the most important. Hearing also is viewed as necessary for interpreting environmental stimuli. In contrast, touch, smell, and taste are largely ignored as being essential to humans' interaction with the environment. The brain seldom processes environmental information sequentially using successive sensory modalities; rather, it simultaneously processes stimuli from several or all of the sensory modalities. Because humans have a limited capacity to receive, hold in working memory, and cognitively process information taken from the environment, the use of one sensory modality to convey information within a system can overload that modality. Multimodal systems can help to alleviate overload for any one modality, and such systems have been favorable in showing that the touch or tactile modality can be used as an independent input modality to convey information to the user, or as a redundant modality to increase information prominence of the visual and auditory modalities. The purpose of this review, which reflects work that occurred before mid-2006, is to discuss the tactile modality, specifically measures of tactile sensitivity for the human body, capabilities and limitations of the tactile modality, and applications of human tactile interfaces. Compared to other areas of the body, tactile research for the head and interfaces for the head is sparse. Therefore, a secondary concern of this review is to highlight this gap in the tactile literature.

DTIC

*Display Devices; Sensitivity; Touch*

**20070027729** Army Research Lab., Aberdeen Proving Ground, MD USA

**Human Factors Evaluation of the XM30 Guided Multiple Launch Rocket System (GMLRS) in the Combined High Mobility Artillery Rocket System (HIMARS)-GMLRS Initial Operational Test**

Hernandez, Charles L; May 2007; 30 pp.; In English

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A468402; ARL-TR-4113; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary purpose of this effort by the U.S. Army Research Laboratory (ARL) was to record Soldier-participant comments, impressions, and any recommendations for improving the guided multiple launch rocket system (GMLRS) in areas related to the design of the rocket itself and the training required to handle, maintain, and employ it with the use of the high mobility artillery rocket system (HIMARS) launcher and its associated support vehicles. The GMLRS was tested along with the HIMARS in a combined initial operational test (IOT) administered by the U.S. Army Test and Evaluation Command (ATEC). Three of the four multi-faceted questionnaires developed for the combined HIMARS-GMLRS IOT provided Soldiers with the opportunity to address GMLRS-related issues. These instruments were the military occupational specialties (MOS) 13M (MLRS crewman), 13P (Fire Direction Specialist), and 27M (MLRS Repairman). Results from this evaluation were used by ATEC (for the GMLRS system evaluation report) and ARL's Human Research and Engineering Directorate (for the human factors evaluation), in support of the Milestone C decision for full-rate production that occurred in June 2005.

DTIC

*Artillery; Human Factors Engineering; Launching; Mobility; Rocket Launchers*

**20070027768** Army Research Lab., Aberdeen Proving Ground, MD USA

**Human Factors Evaluation of the High Mobility Artillery Rocket System (HIMARS) in the Combined HIMARS-Guided Multiple Launch Rocket System (GMLRS) Initial Operational Test**

Hernandez, Charles L; May 2007; 73 pp.; In English

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A468506; ARL-TR-4112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary purpose of this effort by the U.S. Army Research Laboratory (ARL) was to collect data that could be used

to assess human factors issues related to mission performance, training, and safety. Using questionnaires specifically designed for this initial operational test (IOT), Soldier participant comments, we recorded impressions and recommendations for improving the HIMARS launcher and its associated support vehicles. Four multi-faceted questionnaires were developed to support the applicable measures of performance listed in the HIMARS test and evaluation master plan. The questionnaires were administered to military occupational specialties 13M (MLRS Crewman), 27M (MLRS Repairman), 13P (Fire Direction Specialist), and 63 series (Vehicle Maintenance) personnel. Selected leaders (i.e., support platoon leader and fire direction officer) were also given the opportunity to answer any of the questionnaires they felt qualified to answer, based on their having received HIMARS IOT training or having been closely involved in multiple aspects of the tactical IOT events or both. Results from this evaluation were used by the U.S. Army Test and Evaluation Command (for the HIMARS system evaluation report) and ARL (for the human factors evaluation) in support of the Milestone C decision for full-rate production that occurred in June 2005.

DTIC

*Artillery; Human Factors Engineering; Launching; Mobility*

**20070028500** Space and Naval Warfare Systems Center, San Diego, CA USA

**Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel**

Osga, Glenn; Galdorisi, George; Jun 2003; 56 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467381; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467381>

Transformation of the USA military requires new ways of defining both design and mission processes to improve warfighting performance and reduce system costs. New technologies engendered through the discipline of human-factors engineering enable warfighters to make more effective decisions in a timelier manner with fewer personnel. While the tradeoffs between new technologies and numbers of operators needed are complex, strong anecdotal evidence suggests that these manpower savings can be significant and have the potential to accelerate military transformation. The human factors engineering community has documented and quantified the enhanced mission effectiveness of fewer warfighters operating enhanced combat systems. What is less well quantified due to a number of institutional factors - is the true life cycle cost of military operators. This paper discusses design factors that support reduced crew workload and factors that influence crew cost estimation and size. The conclusion is that although we have identified good candidate designs to support reduced crew workload, we cannot adequately trade off their cost with personnel costs until we can more accurately quantify personnel costs.

DTIC

*Cost Analysis; Costs; Human Factors Engineering; Manpower; Personnel; Workloads (Psychophysiology)*

**20070028744** NASA Johnson Space Center, Houston, TX, USA

**Anthropometric Accommodation in Space Suit Design**

Rajulu, Sudhakar; Thaxton, Sherry; March 12, 2007; 1 pp.; In English; 10 Annual Applied Ergonomics Conference, 12-15 Mar. 2007, Dallas, TX, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

Design requirements for next generation hardware are in process at NASA. Anthropometry requirements are given in terms of minimum and maximum sizes for critical dimensions that hardware must accommodate. These dimensions drive vehicle design and suit design, and implicitly have an effect on crew selection and participation. At this stage in the process, stakeholders such as cockpit and suit designers were asked to provide lists of dimensions that will be critical for their design. In addition, they were asked to provide technically feasible minimum and maximum ranges for these dimensions. Using an adjusted 1988 Anthropometric Survey of U.S. Army (ANSUR) database to represent a future astronaut population, the accommodation ranges provided by the suit critical dimensions were calculated. This project involved participation from the Anthropometry and Biomechanics facility (ABF) as well as suit designers, with suit designers providing expertise about feasible hardware dimensions and the ABF providing accommodation analysis. The initial analysis provided the suit design team with the accommodation levels associated with the critical dimensions provided early in the study. Additional outcomes will include a comparison of principal components analysis as an alternate method for anthropometric analysis.

Author

*Anthropometry; Space Suits; Design Optimization; Human Factors Engineering; Body Size (Biology)*

**20070028902** NASA Johnson Space Center, Houston, TX, USA

**Revitalization of Space-Related Human Factors, Environmental and Habitability Data**

Russo, Dane; Pickett, Lynn K.; Tillman, Barry; Foley, Tico; February 12, 2007; 1 pp.; In English; NASA Human Research Program Investigators Workshop, 12-14 Feb. 2007, League City, TX, USA

Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: Other Sources; Abstract Only

The NASA Chief Health and Medical Officer (CHMO) recently directed that the agency establish crew health standards to aid in the development of requirements for future vehicles and habitats. Response to this direction includes development of a new NASA habitability and human factors standard and an accompanying design handbook. The new standard contains high-level, over-arching principles to assure its applicability and usability across all NASA development programs. The handbook will provide detailed design requirements and suggestions that will meet the standards. The information contained in NASA-STD-3000 will be updated and included in the new design handbook. In this approach, each new program will derive detailed program-specific requirements from the new standard using the handbook as a design guide and resource. With the completion of the standard, the focus of this year's effort is the development of the new handbook: Human Integration Design Handbook (HIDH). This is an opportunity for the space flight human factors and habitability community to consolidate up-to-date data for use by NASA programs and designers as well as outside researchers and policy makers looking for the next research focus. The goal of the handbook is to help NASA design and build human space flight systems which accommodate the capabilities and limitations of the crew so as to provide an environment where the crew can live and work effectively, safely, and comfortably. Handbook contents will address that primary goal, addressing unique aspects of space flight and habitation, including reduced gravity conditions, time lags, EVA systems and day/night cycles, not addressed in other standards or handbooks. The handbook will be divided into topics similar to NASA-STD-3000 (anthropometrics, architecture, workstations, etc.) and each topic area will contain elements for designers, human factors practitioners, program managers, operators, and researchers. The handbook will include the following elements: (1) Design considerations include a clear and concise summary of what is important to designers in space vehicle / habitat design, design information to translate Earth-base knowledge to the space environment, space issues and the data necessary to address those issues, and a consistent set of terminology. (2) Updates to Lessons Learned and example solutions from Shuttle and Station program experience will provide historical examples to help prevent repeating mistakes or reinvention of the wheel. (3) Requirements will aid in the translation of standards into program specific requirements. The scope of included requirements will define the pool that each program needs to consider and tailor for their specific program. (4) Requirements rationale will help understanding of the importance of these considerations. The HIDH development team at JSC is finalizing the format of the new handbook, prioritizing topic areas for expansion and update, and contacting subject matter experts within the scientific community to assist with this effort. Plans are also being made to continue handbook expansion and maintenance to assure it remains a valuable resource for human factors and human space flight programs.

Author

*Aerospace Medicine; Habitability; Handbooks; Human Factors Engineering; Spacecrews; Environmental Engineering; Spacecraft Environments*

**20070029313** Oak Ridge Inst. for Science and Education, TN USA

**Extended Research on Detection of Deception Using Volatile Organic Compound (VOC) Emissions. Final Report**

Jan. 1, 2006; 74 pp.; In English

Report No.(s): DE2007-901096; ORISE-06-1690; No Copyright; Avail.: National Technical Information Service (NTIS)

A system that captures and analyzes volatile organic compound (VOC) emissions from skin surfaces may offer a viable alternative method to the polygraph instrument currently in use for detecting deception in U.S. government settings. Like the involuntary autonomic central nervous system response data gathered during polygraph testing, VOC emissions from the skin may provide data that can be used to detect stress caused by deception. Detecting VOCs, then, may present a noninvasive, non-intrusive method for observing, recording, and quantifying evidence of stress or emotional change.

NTIS

*Deception; Volatile Organic Compounds*

**20070029720** General Accounting Office, Washington, DC USA

**Defense Logistics: Army and Marine Corps' Body Armor Requirements, Controls, and Other Issues**

Solis, William M; Jun 6, 2007; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468964; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468964>

In recent years, a number of reports and newspaper articles have cited concerns regarding the level of protection and the



available amounts of body armor to protect deployed service members. As part of GAO's efforts to monitor the Department of Defense's (DoD) and the services' action to protect ground forces, GAO reviewed the Army and Marine Corps' actions to address these concerns. On April 26, 2007, GAO issued a report regarding the Army and the Marine Corps' individual body armor systems. Today's testimony summarizes the report's findings regarding the extent to which the Army and Marine Corps have done the following: (1) have met the theater requirements for body armor, (2) have the controls in place to assure that the manufacturing and fielding of body armor meet requirements, and (3) have shared information regarding their efforts on body armor ballistic requirements and testing. The report also included additional information concerning whether contractors or non-DoD civilians obtain body armor in the same way as U.S. forces and DoD civilians given the number of contractors and non-DoD civilians in CENTCOM's area of operation. GAO did not make recommendations in the report. DoD officials did not provide written comments on the report but technical comments were incorporated as appropriate.

DTIC

*Armor; Evaluation; Personnel; Requirements; System Effectiveness*

**20070029721** Army War Coll., Carlisle Barracks, PA USA

**Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems**

Francis, Paul; Graveline, William R; Ahearn, Marie P; Breen, Beverly; Davis, Tana; Jenkins, Letisha; Patton, Kenneth E; Swierczek, Robert; Jun 2007; 33 pp.; In English

Report No.(s): AD-A468965; GAO-07-759; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468965>

Active Protection Systems (APS) protect vehicles from attack by detecting and intercepting missiles or munitions. In 2005, the lead systems integrator for the Army's Future Combat Systems (FCS) program sought proposals for an APS developer and design and to deliver APS prototypes on vehicles by fiscal year 2009. Raytheon was chosen the APS developer. At the same time, the Department of Defense's (DoD) Office of Force Transformation (OFT) evaluated near-term APS for potential use in Iraq. GAO was asked to review the Army's actions on APS/FCS: (1) the process for selecting the subcontractor to develop an APS for FCS and if potential conflicts of interest were avoided; (2) the timing of the trade study and if it followed a consistent methodology to evaluate alternatives, and the results; (3) the role the Army and Boeing played in selecting the developer; and (4) the process followed to provide a near-term APS solution for current forces. GAO recommends that the Secretary of Defense support additional testing and demonstration of APS systems to help develop tactics, techniques, procedures, and concepts of operations for active protection systems and provide useful data on the use of APS. DoD did not agree to support such testing.

DTIC

*Contractors; Decision Making; Government Procurement; Protection*

**20070029743** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Can a Self-Diagnostic Digitally Controlled Pacemaker/Defibrillator Device be Used for Alerting Military Personnel When a Soldier Health Condition Becomes Compromised Out in the Field**

Nedd, Steven; Jan 26, 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469014; TARDEC-16774; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469014>

The Self-Diagnostic Digitally Controlled Pacemaker/Defibrillator Device (SDDCPDD) has several features that I think may be very useful to the Armed Services. Even though this device is designed as a pacemaker/defibrillator device; its applications can be used as a sensory data retrieval device for Soldiers that have been captured in the field or in combat missions. This research investigates the use of Unified Modeling Language (UML) Diagrams, Object-Oriented Analysis and Design, and Structured Query Language (SQL) to develop the high level architecture of a system to store and retrieve digital/wireless communication information from a pacemaker/defibrillator, or other device to determine the whereabouts, and alert military personnel of the status of the Soldier. It presents the requirements and architectural design of the Self-Diagnostics Digitally Controlled Pacemaker/Defibrillator Device.

DTIC

*Data Transmission; Digital Systems; Health; Military Personnel; Pulse Communication*

**20070029828** Army Research Lab., Aberdeen Proving Ground, MD USA

**Stochastic Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile**

Chen, Michael M; Jun 2007; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-622618.H80

Report No.(s): AD-A469177; ARL-TR-4140; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469177>

Gun propulsion modeling has been undergoing development for many decades. Because of the great strides in recent development, one has been able to estimate in-bore pressure-time history at a fairly accurate level. However, some underlying assumptions among the models exhibit certain level of uncertainties, such as the time-varying friction between the obturator and bore surface, the granular shape variations of propelling charges, the packaging deviations of each propellant load, etc. These factors explain the fact that the recorded pressure levels differ from one gun shot to another with the same gun and projectile system in many experimental tests. Thus, this report considered the variations of the factors as a whole and investigated in-bore responses of the Extended Area Protection and Survivability projectile, subject to the inherent randomness of propulsion forces. The results provide a better understanding of the projectile behavior during proposed circumstances.

DTIC

*Projectiles; Protection; Stochastic Processes*

**20070029937** Air Univ., Maxwell AFB, AL USA

**Bio-Defense Now: 56 Suggestions for Immediate Improvements**

Pravecek, Tasha L; Davis, Jim A; May 2005; 161 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468978; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468978>

The 85% Biological Defense Project identifies those ideas that can significantly improve the defensive capabilities and facilitate military forces survival, operation, and sustainment in a biologically contaminated environment. The 100% biological warfare (BW) defense solution is difficult, if not impossible, to obtain. The purpose of the 85% Biological Defense Project, hereafter referred to as the 85% Project, is to determine if there are quick-to-implement ideas using available technologies or capabilities that have not yet been adequately addressed to enhance our military forces protection against biological weapons. While this project was focused on the military services as a whole (Army, Navy, Marines, and Air Force), several ongoing initiatives within the USA Air Force (USAF) are used as examples of the different services' initiatives to counter the biological warfare threat. Likewise, the 85% Project identifies areas being worked by other USAF programs under the USAF Counter- Chemical, Biological, Radiological, Nuclear, and high yield Explosives (CCBRNE) Council that require further attention and refinement. The ultimate goal is to reduce the biological weapons threat to U.S. and allied forces at fixed bases. This publication is the product of the authors' research, the 'Needed Now: The '85% Quick Fix' in Bio-Defense' publication (Appendix A), and a workshop held to address shortfalls in biological weapons defense. This report has been prepared by U.S. Air Force Counterproliferation Center (USAF CPC) senior researchers for the Defense Threat Reduction Agency/ Chemical and Biological Division (DTRA/CB). The report is targeted to be read by decision-makers, commanders, staff officers, and planners in all functional areas at the DoD, major command, and installation levels.

DTIC

*Countermeasures; Warfare*

**20070029967** Foster-Miller Associates, Inc., Waltham, MA, USA

**Human Error Investigation Software Tool (HEIST)**

Reinach, S.; Viale, A.; Green, D.; May 2007; 41 pp.; In English

Contract(s)/Grant(s): DTFR53-01-D-00029

Report No.(s): PB2007-110306; DFRA-060053; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Human factors are a leading cause of train accidents and incidents in the USA. Human factors go beyond the crewmembers who operate the on-track equipment. They include management support and oversight, operating practices and procedures, technologies and facilities, and the work culture in short, the socio-technical environment in which railroad employees work. The purpose of this project was to develop a software tool to help Federal Railroad Administration personnel, and the railroad industry in general, systematically consider human factors issues at all levels of the socio-technical environment (or system) when investigating the causes or contributing factors of train accidents, incidents, and close calls. This report describes the development and features of the Human Error Investigation Software Tool (HEIST). HEIST is a portable Tablet and Windows-based application that can be used in the field, a hotel room, or an office to support accident/incident investigations. HEIST data collection tools include a checklist of things to consider; operator, front-line

supervisor, and manager interview guides; a human factors taxonomy and definitions; an interactive data collection aid; and an online accident/incident/close call summary form. Data classification tools include an interactive aid and practice module. A HEIST user manual was also produced under separate cover. The report concludes with some recommendations for future enhancements to HEIST, including implementation of a centralized accident, incident, and close call database, and preparation of a field test.

NTIS

*Errors; Human Factors Engineering; Human Performance; Rail Transportation; Safety; Transportation*

## 59

### MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

**20070028567** Government Accountability Office, Washington, DC, USA

#### **Hospital Quality Data: HHS Should Specify Steps and Time Frame for Using Information Technology to Collect and Submit Data**

Apr. 2007; 59 pp.; In English

Report No.(s): PB2007-108778; GAO-07-320; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Hospitals submit data in electronic form on a series of quality measures to the Centers for Medicare & Medicaid Services (CMS) and receive scores on their performance. Increasingly, the clinical information from which hospitals derive the quality data for CMS is stored in information technology (IT) systems. GAO was asked to examine (1) hospital processes to collect and submit quality data, (2) the extent to which IT facilitates hospitals' collection and submission of quality data, and (3) whether CMS has taken steps to promote the use of IT systems to facilitate the collection and submission of hospital quality data. GAO addressed these issues by conducting case studies of eight hospitals with varying levels of IT development and interviewing relevant officials at CMS and the Department of Health and Human Services (HHS).

NTIS

*Data Acquisition; Hospitals; Information Systems; Medical Services*

**20070028569** Texas A&M Univ., College Station, TX USA

#### **Testing for Compliance to NTCIP Standards**

De Roche, R.; Apr. 2007; 494 pp.; In English

Report No.(s): PB2007-108773; REPT-0-5003-2; No Copyright; Avail.: CASI: [A21](#), Hardcopy

The objectives of this two-year project are to define a framework for testing conformance to National Transportation Communications for ITS Protocol (NTCIP) standards, identify an approach to describe the extent to which testing is needed, and recommend the appropriate documentation for such testing activities. To meet the objectives, the first years report included a summary of past and current efforts by various groups and organizations, a description of available testing tools, and the results of a survey undertaken to understand Texas Department of Transportations (TxDOTs) testing process and needs. These topics were followed by discussions of the steps involved in conformance testing, how NTCIP requirements are specified, current TxDOT testing processes, reporting results, and the mapping of requirements to tests. The first years report concluded with an enumerated list of recommendations to establish a testing framework. This second year report looks at the details of testing documentation, provides estimates for developing test procedures for the various NTCIP-conformant field devices, discusses how to apply the procedures to the TxDOT testing processes, and presents an outline for training classes. The main portion of the report concludes with some additional recommendations to establish a testing framework. Appendices address modifications to TxDOT Closed Circuit Television (CCTV) specifications, a template for a TxDOT specification listing CCTV NTCIP requirements, a set of CCTV test procedures, test results reporting, miscellaneous communications test procedures, and a preliminary set of traffic signal controller procedures.

NTIS

*Protocol (Computers); Transportation*

**20070028581** Utica Coll., NY, USA; WetStone Technologies, Inc., Cortland, NY, USA

#### **Assessing Technology, Methods, and Information for Committing and Combating Cyber Crime**

Gordon, G. R.; Hosmer, C. D.; Siedsma, C.; Rebovich, D.; Jan. 2003; 114 pp.; In English

Contract(s)/Grant(s): NCJRS-2000-LT-BX-K002

Report No.(s): PB2007-109014; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The goal of this report is to provide key insights to the law enforcement community on how to upgrade basic abilities to

effectively investigate computer crimes. This report is designed to reduce the skill distance between what computer criminals have learned to successfully commit their crimes and what law enforcers need to know to successfully bring these offenders to justice. By presenting this information in a clear, structured form, we believe great inroads can be made to gain a competitive edge over those who would misuse technology for criminal gain. The information contained in this report serves as a valuable guide to computer crime investigators. Properly implemented, the information should prove instrumental in controlling and preventing the highly damaging crimes committed against large portions of the general public and business community, crimes that, not long ago, would have been impossible to achieve with the ease with which it they can be achieved today.

NTIS

*Computer Information Security; Law (Jurisprudence)*

**20070028583** Cybergenetics, Pittsburgh, PA, USA

**Automated STR Analysis for DNA Databases**

Perlin, M. W.; Jan. 2003; 21 pp.; In English

Contract(s)/Grant(s): NCJRS-2000-IJ-CX-K005

Report No.(s): PB2007-109011; Copyright; Avail.: National Technical Information Service (NTIS)

STR technology has enabled the rapid generation of highly informative DNA data for use in human identification. However, these data must be carefully analyzed. With database samples, there is now an acute shortage of skilled data reviewers. With casework samples (including mixtures), much information is not extracted from the data, despite considerable examiner effort. We are rapidly developing novel computational, mathematical and statistical methods that help overcome these limitations. This report focuses on the collaborative validation of these methods as applied to DNA databases. Convicted offender DNA databases must be accurate. To minimize error, the original STR data are carefully reviewed by two or more people. Moreover, in a troubleshooting capacity, this review helps to continuously maintain high quality lab data. But there are not enough skilled personnel for this arduous, repetitive task. To alleviate this critical labor shortage, we developed the TrueAllele expert system. The computer program automates virtually every human review function, and provides consistent quality assessment and allele designation. The TrueAllele validation began with the original data from 50,000 CODIS genotypes. System parameters were adapted to the instruments (ABV310, ABV3700; HitachVFMbio) and panels (ProfilerPlus, Cofiler, PowerPlex 1.2) used to generate the data. Computer processing was then done, with automated scoring of the high quality data, followed by limited human review. The computed expert system results were compared against manually scored results. We report here on the relative accuracy and efficiency of the automated approach. Our report describes novel computer-based methods for assuring data quality and automating DNA database review. We present here the objective results of our validation study, and demonstrate the feasibility of practical automated analysis. Our primary objective is the rapid introduction of validated intelligent data analysis systems for eliminating tedious human STR analysis. This contribution may help free up valuable DNA examiner time for serving justice through forensic science.

NTIS

*Data Bases; Deoxyribonucleic Acid; Automatic Control; Technologies*

**20070028585** Ada County Sheriff's Office, Boise, ID, USA

**Ada County Sheriff's Office Internet Site**

Jun. 03, 2002; 116 pp.; In English

Contract(s)/Grant(s): NCJRS-96-IJ-CX-0085

Report No.(s): PB2007-109003; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The purpose of this report is to document the development and current status of the Ada County Sheriff's office Internet site. On January 1, 1997, Boise State University and the Ada County Sheriff's Office entered into a partnership whose purpose was to advance community policing initiatives at the Sheriff's Office. The goals of the partnership were: Form a research-practitioner partnership to contribute to policy-relevant research and evaluation on behalf of the Ada County Sheriff's Office. Use the partnership to develop a pool of research ideas fruitful to the Sheriff's department. Solicit information on citizens perceptions of current police practices, community-based initiatives within the Sheriff's Office, and ways in which the Sheriff's Office can more effectively communicate information about its activities.

NTIS

*Ada (Programming Language); Internets*

**20070028604** Moser, Patterson, Sheridan, LLP, Shrewsbury, NJ, USA  
**Method and Apparatus for Providing an Asymmetric Watermark Carrier**  
Blom, J. A., Inventor; Nafziger, J. C., Inventor; 5 Apr 05; 20 pp.; In English  
Contract(s)/Grant(s): NIST-70NANB1H3036  
Patent Info.: Filed 5 Apr 05; US-Patent-Appl-SN-11-098-954  
Report No.(s): PB2007-104586; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A low-frequency, temporally asymmetric watermark carrier decreases in luminance in a substantially monotonic manner at a different rate than it increases in luminance in a substantially monotonic manner. This allows the carrier to be embedded, e.g., in a video work, in a manner that renders the resultant watermark virtually invisible to the human eye. Moreover, the resultant watermark is substantially resistant to common pirating techniques in which high-frequency visual content (e.g., including watermark data) tends to be filtered out by piracy processing.

NTIS

*Asymmetry; Image Processing; Cryptography*

**20070028675** Transportoekonomisk Inst., Oslo, Norway  
**Appraising Policies to Reduce Freight Transport Time and Its Variability-A New Method**

Minken, H.; Samstad, H.; January 2006; 109 pp.; In Norwegian  
Report No.(s): PB2007-109949; TOI-825/2006; Copyright; Avail.: National Technical Information Service (NTIS)

Analytical formulas for freight values of time and the value of reliability have been developed, along with a toolbox to assess the impact of policies on the expectation and variance of delays. Some of the data required by the formulas are not available at present. Data for appraisal may be obtained from a survey. To assess impacts, more systematic registers on incidents causing delays are needed.

NTIS

*Cargo; Policies; Variability*

**20070028737** Honeywell Federal Mfg. and Technologies, Kansas City, MO, USA  
**Defect Prevention and Detection in Software for Automated Test Equipment**

Bean, E.; Nov. 30, 2006; 39 pp.; In English  
Report No.(s): DE2007-895743; DE-AC04-01AL66850; No Copyright; Avail.: Department of Energy Information Bridge

Software for automated test equipment can be tedious and monotonous making it just as error-prone as other software. Active defect prevention and detection are also important for test applications. Incomplete or unclear requirements, a cryptic syntax used for some test applications, especially script-based test sets, variability in syntax or structure, and changing requirements are among the problems encountered in one tester. Such problems are common to all software but can be particularly problematic in test equipment software intended to test another product. Each of these issues increases the probability of error injection during test application development. This report describes a test application development tool designed to address these issues and others for a particular piece of test equipment. By addressing these problems in the development environment, the tool has powerful built-in defect prevention and detection capabilities. Regular expressions are widely used in the development tool as a means of formally defining test equipment requirements for the test application and verifying conformance to those requirements. A novel means of using regular expressions to perform range checking was developed. A reduction in rework and increased productivity are the results. These capabilities are described along with lessons learned and their applicability to other test equipment software. The test application development tool, or application builder, is known as the PT3800 AM Creation, Revision and Archiving Tool (PACRAT).

NTIS

*Defects; Detection; Prevention; Equipment Specifications*

**20070028864** NASA Langley Research Center, Hampton, VA, USA  
**Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids**

Gnoffo, Peter A.; June 25, 2007; 19 pp.; In English; 18th AIAA Computational Fluid Dynamics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.07.05  
Report No.(s): AIAA Paper 2007-3960; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20070028864>

Hypersonic flow simulations using the node based, unstructured grid code FUN3D are presented. Applications include

simple (cylinder) and complex (towed ballute) configurations. Emphasis throughout is on computation of stagnation region heating in hypersonic flow on tetrahedral grids. Hypersonic flow over a cylinder provides a simple test problem for exposing any flaws in a simulation algorithm with regard to its ability to compute accurate heating on such grids. Such flaws predominantly derive from the quality of the captured shock. The importance of pure tetrahedral formulations are discussed. Algorithm adjustments for the baseline Roe / Symmetric, Total-Variation-Diminishing (STVD) formulation to deal with simulation accuracy are presented. Formulations of surface normal gradients to compute heating and diffusion to the surface as needed for a radiative equilibrium wall boundary condition and finite catalytic wall boundary in the node-based unstructured environment are developed. A satisfactory resolution of the heating problem on tetrahedral grids is not realized here; however, a definition of a test problem, and discussion of observed algorithm behaviors to date are presented in order to promote further research on this important problem.

Author

*Tetrahedrons; Hypersonic Flow; Stagnation Point; Unstructured Grids (Mathematics); Boundary Conditions; Surface Diffusion; Heating; Simulation*

**20070028886** Pacific Northwest National Lab., Richland, WA, USA; Nuclear Regulatory Commission, Washington, DC, USA

**Concepts Associated with Transferring Temporal and Spatial Boundary Conditions Between Modules in the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES)**

Whelan, G.; Castleton, K. J.; Pelton, M. A.; Oct. 2006; 31 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2007-901190; PNNL-16145; No Copyright; Avail.: National Technical Information Service (NTIS)

The Framework for Risk Assessments in Multimedia Environmental Systems (FRAMES) is a Windows-based software platform that provides an interactive user interface and, more importantly, specifications to allow a variety of Disk Operating System (DOS) and Windows-based codes to be integrated within a single framework. The major components of FRAMES include modules (module user interface, analysis code, and potentially pre- and/or post-processors), the Framework User Interface (FUI), a sensitivity/uncertainty module, and data visualization tools. Modules can accept data from the user or other modules and can calculate some portion of the risk assessment. The FUI allows the user to interact with the system. The sensitivity/uncertainty module allows the user to conduct a Monte Carlo analysis, and the visualization tools allow the user to review results from a particular stage in the process. FRAMES represents middleware for linking models so information can seamlessly pass between these components. A seamless linkage is best confirmed when the design is not parochial or inflexible but sets a standard through which communication can occur. Developing a standard is complicated when different models operate under different time and space constraints, or when dynamic feedback is desired.

NTIS

*Boundary Conditions; Multimedia; Risk*

**20070028906** Lawrence Livermore National Lab., Livermore, CA USA

**HPC-Colony: Services and Interfaces to Support Systems with Very Large Numbers of Processors. (2006 Annual Report, January-December 2006)**

Jones, T.; Kale, L.; Moreira, J.; January 2006; 10 pp.; In English

Report No.(s): DE2007-902273; UCRL-TR-227723; No Copyright; Avail.: National Technical Information Service (NTIS)

The primary objective of the Colony Project is to develop technologies that enable application scientists to easily scale applications to computing platforms comprised of tens of thousands to hundreds of thousands of compute cores. This will be accomplished by addressing several problem areas that are known to be key factors when scaling applications to tens of thousands of processors. First, by providing a smart runtime system to quickly and dynamically make cpu and memory and interconnect resource management adjustments, we remove the burden of achieving applications that are highly tuned and load-balanced for a particular execution instance (i.e. a particular input datasets and machine platform combination). Second, by providing a full complement of system services including the entire Linux system call set, we ease the challenge of developing portable applications since lightweight kernels frequently incorporate only a small subset of the POSIX calls prevalent in typical large scientific applications. Third, by providing fundamental changes to the Linux kernel that reduce variability in context switch times and provide for parallel-aware scheduling across the entire machine, we remove the negative impact of synchronizing collectives on bulk-synchronous applications. Fourth, by providing fault tolerance mechanisms that utilize our unique migration abilities in conjunction with in-memory techniques for minimal overhead, we

eliminate the necessity for costly frequent application-driven check-points. Our research utilizes full implementations of these technologies on systems consisting of tens of thousands of processors.

NTIS

*Parallel Processing (Computers); Support Systems; Interfaces*

**20070029247** Lawrence Livermore National Lab., Livermore, CA USA

**Visual Spreadsheets in VisIt**

Whitlock, B.; Childs, H.; Feb. 07, 2007; 7 pp.; In English

Report No.(s): DE2007-900855; UCRL-TR-227825; No Copyright; Avail.: National Technical Information Service (NTIS)

The VACET team would like to add visual spreadsheeting capability to the visualization tool VisIt, to make it be a viable tool for current users of AMRVis and ChomboVis. This document describes AMRVis' and ChomboVis' approaches to visual spreadsheets and describes a proposed visual spreadsheet mechanism for VisIt.

NTIS

*Computer Programs; Distributed Processing; Spreadsheets*

**20070029274** King and Schickli, PLLC, Lexinton, NY, USA

**Methods and Computer-Readable Medium for Navigating between a Plurality of Discrete Images**

Mostert, P. S., Inventor; 1 Mar 05; 22 pp.; In English

Contract(s)/Grant(s): DMI-0091510

Patent Info.: Filed Filed 1 Mar 05; US-Patent-Appl-SN-11-069 811

Report No.(s): PB2007-104660; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In a computer system, methods and computer-readable medium are disclosed for tracking motion of a subject in an activity captured by camera. The camera supplies pluralities of discrete images of the subject to a computing system environment. An event window has at least two cells for receiving a user input pertaining to an action of the subject in the activity. In a first cell, the user indicates a specific image number corresponding to one of the plurality of discrete images and an estimate of a fractional percent thereof. In the second cell, the user indicates another specific image number and estimate of a fractional percentage thereof. Software calculates deltas between the cells. Pushbuttons are provided to aid users in navigating between pluralities of the discrete images. Example subjects include horses in horse race activities while actions include horse stride length.

NTIS

*Computers; Navigation; Images*

**20070029275** GTE Service Corp., USA

**Intrusion and Misuse Deterrence System Employing a Virtual Network**

Roesch, M. F., Inventor; Gula, R. J., Inventor; 1 Nov 04; 15 pp.; In English

Contract(s)/Grant(s): DCA100-96-D-0048

Patent Info.: Filed Filed 1 Nov 04; US-Patent-Appl-SN-10-978 765

Report No.(s): PB2007-104659; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and apparatus is disclosed for increasing the security of computer networks through the use of an Intrusion and Misuse Deterrence System (IMDS) operating on the network. The IMDS is a system that creates a synthetic network complete with synthetic hosts and routers. It is comprised of a network server with associated application software that appears to be a legitimate portion of a real network to a network intruder. The IMDS consequently invites inquiry and entices the intruder away from the real network. Simulated services are configured to appear to be running on virtual clients with globally unique, class 'C' IP addresses. Since there are no legitimate users of the virtual network simulated by the IMDS, all such activity must be inappropriate and can be treated as such. Consequently, the entire set of transactions by an intruder can be collected and identified rather than just those transactions that meet a predefined attack profile. Also, new exploits and attacks are handled just as effectively as known attacks, resulting in better identification of attack methodologies as well as the identification and analysis of new attack types. Since the IMDS only has to be concerned with the traffic going to its simulated hosts it additionally eliminates the bandwidth limitation that plagues a traditional intrusion detection system (IDS).

NTIS

*Computer Information Security; Computer Networks; Intrusion Detection (Computers)*

**20070029301** Lawrence Livermore National Lab., Livermore, CA USA

**Towards Multi Level Optimization. Space Mapping and Manifold Mapping**

Echeverria, D.; Tong, C.; Aug. 01, 2006; 16 pp.; In English

Report No.(s): DE2007-900107; UCRL-TR-223288; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report we study space-mapping and manifold-mapping, two multi-level optimization techniques that aim at accelerating expensive optimization procedures with the aid of simple auxiliary models. Manifold-mapping improves in accuracy the solution given by space-mapping. In this report, the two mentioned techniques are basically described and then applied in the solving of two minimization problems. Several coarse models are tried, both from a two and a three level perspective. The results with these simple tests confirm the speed-up expected for the multi-level approach.

NTIS

*Optimization; Manifolds (Mathematics); Fixed Points (Mathematics)*

**20070029308** Lawrence Livermore National Lab., Livermore, CA USA

**Purple Computational Environment with Mappings to Ace Requirements for the General Availability User Environment Capabilities. Version 2.0**

Barney, B.; Shuler, J.; Dec. 05, 2006; 67 pp.; In English

Report No.(s): DE2007-900098; UCRL-TR-223888; No Copyright; Avail.: National Technical Information Service (NTIS)

Purple is an Advanced Simulation and Computing (ASC) funded massively parallel supercomputer located at Lawrence Livermore National Laboratory (LLNL). The Purple Computational Environment documents the capabilities and the environment provided for the FY06 LLNL Level 1 General Availability Milestone. This document describes specific capabilities, tools, and procedures to support both local and remote users. The model is focused on the needs of the ASC user working in the secure computing environments at Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and Sandia National Laboratories, but also documents needs of the LLNL and Alliance users working in the unclassified environment. Additionally, the Purple Computational Environment maps the provided capabilities to the Trilab ASC Computing Environment (ACE) Version 8.0 requirements. The ACE requirements reflect the high performance computing requirements for the General Availability user environment capabilities of the ASC community. Appendix A lists these requirements and includes a description of ACE requirements met and those requirements that are not met for each section of this document. The Purple Computing Environment, along with the ACE mappings, has been issued and reviewed throughout the Tri-lab community.

NTIS

*Massively Parallel Processors; Parallel Processing (Computers); Simulation; Supercomputers*

**20070029321** Lawrence Livermore National Lab., Livermore, CA USA

**Report to the Institutional Computing Executive Group (ICEG) August 14, 2006**

Carnes, B.; Sep. 08, 2006; 27 pp.; In English

Report No.(s): DE2007-900083; UCRL-TR-224276; No Copyright; Avail.: National Technical Information Service (NTIS)

We have delayed this report from its normal distribution schedule for two reasons. First, due to the coverage provided in the White Paper on Institutional Capability Computing Requirements distributed in August 2005, we felt a separate 2005 ICEG report would not be value added. Second, we wished to provide some specific information about the Peloton procurement and we have just now reached a point in the process where we can make some definitive statements. The Peloton procurement will result in an almost complete replacement of current M&IC systems. We have plans to retire MCR, iLX, and GPS. We will replace them with new parallel and serial capacity systems based on the same node architecture in the new Peloton capability system named ATLAS. We are currently adding the first users to the Green Data Oasis, a large file system on the open network that will provide the institution with external collaboration data sharing. Only Thunder will remain from the current M&IC system list and it will be converted from Capability to Capacity. We are confident that we are entering a challenging yet rewarding new phase for the M&IC program.

NTIS

*Parallel Processing (Computers); Computer Systems Programs; Procurement*

**20070029324** Lawrence Livermore National Lab., Livermore, CA USA

**Implicit Solvers for Large Scale Nonlinear Problems**

Keyes, D. E.; Reynolds, D.; Woodward, C. S.; Jul. 14, 2006; 12 pp.; In English

Report No.(s): DE2007-900076; UCRL-CONF-222859; No Copyright; Avail.: National Technical Information Service (NTIS)

Computational scientists are grappling with increasingly complex, multi-rate applications that couple such physical



phenomena as DGuid dynamics, electromagnetics, radiation transport, chemical and nuclear reactions, and wave and material propagation in inhomogeneous media. Parallel computers with large storage capacities are paving the way for high-resolution simulations of coupled problems; however, hardware improvements alone will not prove enough to enable simulations based on brute-force algorithmic approaches. To accurately capture nonlinear couplings between dynamically relevant phenomena, often while stepping over rapid adjustments to quasi-equilibria, simulation scientists are increasingly turning to implicit formulations that require a discrete nonlinear system to be solved for each time step or steady state solution. Recent advances in iterative methods have made fully implicit formulations a viable option for solution of these large-scale problems. In this paper, we overview one of the most effective iterative methods, Newton-Krylov, for nonlinear systems and point to software packages with its implementation. We illustrate the method with an example from magnetically coned plasma fusion and briefly survey other areas in which implicit methods have bestowed important advantages, such as allowing high-order temporal integration and providing a pathway to sensitivity analyses and optimization. Lastly, we overview algorithm extensions under development motivated by current SciDAC applications.

NTIS

*Nonlinearity; Optimization; Problem Solving; Iterative Solution*

**20070029328** Lawrence Livermore National Lab., Livermore, CA USA

### **Parallel Eigensolver for H (curl) Problems using H1 Auxiliary Space AMG Preconditioning**

Kolev, T. V.; Vassilevski, P. S.; Nov. 16, 2006; 13 pp.; In English

Report No.(s): DE2007-900179; UCRL-TR-226197; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes an application of the recently developed H1-auxiliary space preconditioner for H(curl) problems to the Maxwell eigenvalue problem. The auxiliary space method based on the new (HX) finite element space decomposition introduced in this document, was implemented in the hypre library under the name AMS. The eigensolver considered in the present paper, referred to as the AME, is an extension of the AMS. It is based on the locally optimal block eigensolver LOBPCG and the parallel AMG (algebraic multigrid) solver BoomerAMG from the hypre library. AME is designed to compute a block of few minimal nonzero eigenvalues and eigenvectors, for general unstructured finite element discretizations utilizing the lowest order Nedelec elements. The main goal of the current report is to document the usage of AME and to illustrate its parallel scalability.

NTIS

*Algebra; Eigenvalues; Number Theory; Problem Solving*

**20070029337** Lawrence Livermore National Lab., Livermore, CA USA

### **Semantic Graph Query Language**

Kaplan, I. L.; Oct. 20, 2006; 19 pp.; In English

Report No.(s): DE2007-900170; UCRL-TR-225447; No Copyright; Avail.: Department of Energy Information Bridge

Semantic graphs can be used to organize large amounts of information from a number of sources into one unified structure. A semantic query language provides a foundation for extracting information from the semantic graph. The graph query language described here provides a simple, powerful method for querying semantic graphs.

NTIS

*Query Languages; Graphs (Charts); Semantics*

**20070029343** Lawrence Livermore National Lab., Livermore, CA USA

### **Survey of Bayesian Models for Modelling of Stochastic Temporal Processes**

Ng, B.; Oct. 13, 2006; 27 pp.; In English

Report No.(s): DE2007-900168; UCRL-TR-225272; No Copyright; Avail.: National Technical Information Service (NTIS)

This survey gives an overview of popular generative models used in the modelling of stochastic temporal systems. In particular, this survey is organized into two parts. The first part discusses the discrete-time representations of dynamic Bayesian networks and dynamic relational probabilistic models, while the second part discusses the continuous-time representation of continuous-time Bayesian networks.

NTIS

*Bayes Theorem; Stochastic Processes; Surveys*

**20070029351** Lawrence Livermore National Lab., Livermore, CA USA

**Regression Strategies for Parameter Space Exploration. A Case Study in Semicoarsening Multigrid and R**

Lee, B. C.; Schulz, M.; de Supinski, B. R.; Sep. 29, 2006; 25 pp.; In English

Report No.(s): DE2007-900144; UCRL-TR-224851; No Copyright; Avail.: National Technical Information Service (NTIS)

Increasing system and algorithmic complexity, combined with a growing number of tunable application parameters, pose significant challenges for analytical performance modeling. This report outlines a series of robust techniques that enable efficient parameter space exploration based on empirical statistical modeling. In particular, this report applies statistical techniques such as clustering, association, correlation analyses to understand the parameter space better. Results from these statistical techniques guide the construction of piecewise polynomial regression models. Residual and significance tests ensure the resulting model is unbiased and efficient. We demonstrate these techniques in R, a statistical computing environment, for predicting the performance of semicoarsening multigrid. 50 and 75 percent of predictions achieve error rates of 5.5 and 10.0 percent or less, respectively.

NTIS

*Space Exploration; Parameterization*

**20070029353** Lawrence Livermore National Lab., Livermore, CA USA

**Survey of Probabilistic Models for Relational Data**

Koutsourelakis, P. S.; Oct. 26, 2006; 29 pp.; In English

Report No.(s): DE2007-900137; UCRL-TR-225637; No Copyright; Avail.: National Technical Information Service (NTIS)

Traditional data mining methodologies have focused on DGat data i.e. a collection of identically structured entities, assumed to be independent and identically distributed. However, many real-world datasets are innately relational in that they consist of multi-modal entities and multi-relational links (where each entity- or link-type is characterized by a different set of attributes). Link structure is an important characteristic of a dataset and should not be ignored in modelling efforts, especially when statistical dependencies exist between related entities. These dependencies can in fact significantly improve the accuracy of inference and prediction results, if the relational structure is appropriately leveraged. The need for models that can incorporate relational structure has been accentuated by new technological developments which allow us to easily track, store, and make accessible large amounts of data. Recently, there has been a surge of interest in statistical models for dealing with richly interconnected, heterogeneous data, fuelled largely by information mining of web/hypertext data, social networks, bibliographic citation data, epidemiological data and communication networks.

NTIS

*Surveys; Probability Theory; Mathematical Models; Relational Data Bases*

**20070029361** Greer, Burns and Crain, Chicago, IL, USA; Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

**Methods and Program Products for Optimizing Problem Clustering**

Goldberg, D. E., Inventor; Yu, T. L., Inventor; Yassine, A., Inventor; 9 Feb 04; 19 pp.; In English

Contract(s)/Grant(s): AFOSR-F49620-00-0163; AFOSR-F49620-03-0129

Patent Info.: Filed Filed 9 Feb 04; US-Patent-Appl-SN-10-774 676

Report No.(s): PB2007-104622; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Exemplary embodiments of the present invention are directed to methods and program products for optimizing clustering of a design structure matrix. An embodiment of the present invention includes the steps of using a genetic operator to achieve an optimal clustering of a design structure matrix model. Other exemplary embodiments of the invention leverage the optimal clustering by applying a genetic operator on a module-specific basis.

NTIS

*Genetics; Models*

**20070029365** Fenwick and West, LLP, Mountain View, CA, USA

**Database Manipulations Using Group Theory**

Dixon, H. E., Inventor; Ginsberg, M. L., Inventor; Hofer, D., Inventor; Luks, E. M., Inventor; 15 Nov 04; 56 pp.; In English

Contract(s)/Grant(s): F30602-00-2-0534; F30615-02-C-4032

Patent Info.: Filed Filed 15 Nov 04; US-Patent-Appl-SN-10-989 982

Report No.(s): PB2007-104621; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Data in a database describe an application domain such as a satisfiability problem. The data are represented in a manner that expresses the structure inherent in the data and one such representation uses group theory and represents the data as one

or more 'augmented clauses,' where each clause has a pair (c, G) including a database element c and a group G of group elements g acting on it. A query is encoded in a group theory representation and is executed on the group theory representation of the data to identify database elements and associated group elements satisfying the query. If desired, the satisfying database elements are converted from the group theory representation to the native representation of the data.

NTIS

*Data Bases; Group Theory*

**20070029379** Lawrence Livermore National Lab., Livermore, CA USA

**Parallel Auxiliary Space AMG for Definite Maxwell Problems**

Kolev, T. V.; Vassilevski, P. S.; Feb. 21, 2007; 5 pp.; In English

Report No.(s): DE2007-902302; UCRL-PROC-228221; No Copyright; Avail.: Department of Energy Information Bridge

Motivated by the needs of large multi-physics simulation codes, we are interested in algebraic solvers for the linear systems arising in time-domain electromagnetic simulations. Our focus is on finite element discretizations, and we are developing scalable parallel preconditioners which employ only fine-grid information, similar to algebraic multigrid (AMG) for diffusion problems.

NTIS

*Algebra; Maxwell Equation; Linear Systems*

**20070029382** Stetina Brunda Garred and Brucker, Aliso Viejo, CA, USA

**Unattended Ground Sensor Assembly**

Kolarczyk, T. C., Inventor; Wisniewski, J. J., Inventor; 28 Jan 04; 8 pp.; In English

Contract(s)/Grant(s): N66001-98-C-85 18

Patent Info.: Filed Filed 28 Jan 04; US-Patent-Appl-SN-10-766 069

Report No.(s): PB2007-104654; No Copyright; Avail.: CASI: [A02](#), Hardcopy

There is provided a ground sensor assembly adapted for deployment from air to a selected ground location. The ground sensor assembly comprises an aerially deployable sensor housing which has upper and lower housing ends defining a longitudinally elongated aperture therebetween. A plurality of connected sensor modules are longitudinally inserted into the aperture between the upper and lower housing ends. Furthermore, an aerodynamic module is connected to the sensor modules and is disposed adjacent the upper housing end outside the aperture. This aerodynamic module has a plurality of stabilizers which radially extend outward therefrom and form a generally parallel relationship with the upper housing end. Such stabilizers provide aerodynamic stability during the deployment of the ground sensor assembly from the air to the selected ground location.

NTIS

*Aerodynamic Stability; Modules*

**20070029385** Weiss, Moy and Harris, P.C., Scottsdale, AZ, USA; International Business Machines Corp., Armonk, NY, USA

**Method and System for Interactive Modeling of High-Level Network Performance with Low-Level Link Design**

Carballo, J. A., Inventor; Nowka, K. J., Inventor; 22 Apr 05; 12 pp.; In English

Contract(s)/Grant(s): DARPA-NBCH30390004

Patent Info.: Filed Filed 22 Apr 05; US-Patent-Appl-SN-10-829 829

Report No.(s): PB2007-104100; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and system for interactive modeling of high-level network performance with low-level link design provides a tool for optimizing networked computing systems and their link components simultaneously. The method models a fixed portion of a network and specifies operational performance levels and power constraints. A solution is chosen for a non-fixed network portion and the network is simulated to determine link requirements and synthesizes links in conformity with the link requirements. The links are analyzed to determine performance (e.g., bandwidth) and requirements (e.g., power) and network performance is recalculated. An iterative loop from the selection of the non-fixed topology through synthesis and recalculation of link performance can be implemented to optimize the link and network design. The links may be links that use an adaptive management policy that trades off power and bandwidth in multiple operating modes and the method may be used to optimize the operating modes and/or management rules.

NTIS

*Computer Networks; Display Devices; Human-Computer Interface; Patent Applications; Performance Prediction*

**20070029399** Lawrence Livermore National Lab., Livermore, CA USA

**Some Experience with a H1 Based Auxiliary Space AMG for H (curl) Problems**

Kolev, T. V.; Vassilevski, P. S.; Jun. 05, 2006; 16 pp.; In English

Report No.(s): DE2007-900464; UCRL-TR-221841; No Copyright; Avail.: Department of Energy Information Bridge

This report provides several variants for constructing unstructured mesh AMG preconditioners for H(curl) problems exploiting H10 equivalent forms. The respective variants are illustrated with extensive numerical tests.

NTIS

*Algebra; Problem Solving*

**20070029423** NASA Langley Research Center, Hampton, VA, USA

**Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids**

Mazaheri, Ali R.; Kleb, Bill; June 25, 2007; 8 pp.; In English; 37th AIAA Fluid Dynamics Conference and Exhibit, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.07.05

Report No.(s): AIAA Paper 2007-4462; Copyright; Avail.: CASI: [A02](#), Hardcopy

Pure-tetrahedral unstructured grids have been shown to produce asymmetric heat transfer rates for symmetric problems. Meanwhile, two-dimensional structured grids produce symmetric solutions and as documented here, introducing a spanwise degree of freedom to these structured grids also yields symmetric solutions. The effects of grid skewness and other perturbations of structured-grids are investigated to uncover possible mechanisms behind the unstructured-grid solution asymmetries. By using controlled experiments around a known, good solution, the effects of particular grid pathologies are uncovered. These structured-grid experiments reveal that similar solution degradation occurs as for unstructured grids, especially for heat transfer rates. Non-smooth grids within the boundary layer is also shown to produce large local errors in heat flux but do not affect surface pressures.

Author

*Structured Grids (Mathematics); Unstructured Grids (Mathematics); Heat Transfer; Hypersonics; Skewness; Asymmetry; Computational Grids; Heat Flux*

**20070029449** Florida Univ., Gainesville, FL, USA; California Univ., Santa Barbara, CA, USA

**Assessing Error in PMI (Post-Mortem Interval) Prediction Using a Forensic Entomological Computer Model**

Slone, D. H.; Gruner, S. V.; Allen, J. C.; Oct. 2004; 37 pp.; In English

Contract(s)/Grant(s): NCJRS-2000-RB-CX-0002

Report No.(s): PB2007-110358; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The study described herein details investigations into the thermal behavior of forensically important maggots, the effect of internal maggot mass heat generation on maggot development time, and the sources and magnitudes of error affecting a phenological computer model that predicts the likely post-mortem interval (PMI) of human remains found long after the persons demise. Field studies were performed in north Florida and northwest Indiana with 88 domestic pigs (*Sus scrofa*) allowed to become colonized naturally in a wooded setting by blowflies (Insecta, Diptera: Calliphoridae) other carrion-feeding flies, and other insects, while being protected from larger scavengers. Adult flies found around the corpses were captured and identified, and samples from maggot masses were characterized by species and life stage. Each maggot mass was also measured for dimensions and temperature. Some pigs were further monitored with a linear probe that continuously measured the internal temperature of the pig and masses in 12 locations along the probe.

NTIS

*Computerized Simulation; Errors; Law (Jurisprudence); Entomology*

**20070029453** National Inst. of Justice, Washington, DC USA

**Digital Evidence in the Courtroom: A Guide for Law Enforcement and Prosecutors**

Jan. 2007; 81 pp.; In English

Report No.(s): PB2007-110346; NCJ-211314; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Law enforcement agencies, prosecutors, and judges are overwhelmed by the amount of information required to keep pace with the rapid changes involving the computer and its associated devices and features. Criminals continually alter, revise, or create hardware, software, viruses, and other attacks in an effort to disguise criminal activity and thwart detection. In addition to being familiar with these changes in technology, law enforcement officers and prosecutors also must stay abreast of the latest revisions of applicable laws. To assist prosecutorial offices and associated law enforcement agencies, the National Institute of

Justice (NIJ) has developed a series of guides dealing with digital evidence to address the complete investigation process. This process expands from the crime scene, through analysis, and finally into the courtroom. The guides summarize information from select groups of practitioners who are knowledgeable about the subject matter. These groups are more commonly known as technical working groups (TWGs).

NTIS

*Law (Jurisprudence); Digital Techniques*

**20070029456** National Inst. of Justice, Washington, DC USA

**Investigations Involving the Internet and Computer Networks**

Jan. 2007; 137 pp.; In English

Report No.(s): PB2007-110345; NCJ-210798; No Copyright; Avail.: CASI: [A07](#), Hardcopy

This report was developed by the Technical Working Group for the Investigation of High Technology Crimes and is intended to be a resource for individuals responsible for investigations involving the Internet and other computer networks. It is one of a series of electronic crime investigation documents already published or in development by the National Institute of Justice (NIJ). The guides are developed by technical working groups that consist of practitioners and subject matter experts brought together by NIJ to help law enforcement agencies and prosecutors deal with the growing volume and complexity of electronic crime. The series of guides will discuss the investigation process from the first responder, to the laboratory, to the courtroom. Specifically, the guides will address: Electronic crime scene investigation by first responders; Forensic examination of digital evidence; Internet and network investigations; Investigative uses of technology; Courtroom presentation of digital evidence; Development of a digital evidence forensic unit.

NTIS

*Computer Networks; Crime; Internets*

**20070029482** Lawrence Livermore National Lab., Livermore, CA USA

**Time varying Reeb Graphs. A Topological Framework Supporting the Analysis of Continuous Time varying Data**

Mascarenhas, A.; Dec. 06, 2006; 140 pp.; In English

Report No.(s): DE2007-900445; UCRL-TH-226559; No Copyright; Avail.: National Technical Information Service (NTIS)

For static data, the Reeb graph encodes the evolution of topological features and compactly represents topological information of all level sets. The Reeb graph essentially contracts each level set component to a point. It can be computed efficiently, and it has several uses: as a succinct summary of the data, as an interface to select meaningful level sets, as a data structure to accelerate level set extraction, and as a guide to remove noise. The author extends these uses of Reeb graphs to time-varying data. He characterizes the changes to Reeb graphs over time, and develop an algorithm that can maintain a Reeb graph data structure by tracking these changes over time. He stores this sequence of Reeb graphs compactly, and call it a time-varying Reeb graph.

NTIS

*Graph Theory; Topology*

**20070029486** Knobbe, Martens, Olson and Bear, LLP, Irvine, CA, USA

**Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications**

Katti, R. R., Inventor; Drewes, J. A., Inventor; Vogt, T. J., Inventor; 11 Apr 05; 16 pp.; In English

Contract(s)/Grant(s): DARPA-MDA972-98-C-0021

Patent Info.: Filed 11 Apr 05; US-Patent-Appl-SN-11-103 347

Report No.(s): PB2007-104131; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The invention relates to improving the switching reliability of a magnetic memory cell in a magnetic random access memory (MRAM). Embodiments of the invention add an antiferromagnet to a magnetic memory cell. An antiferromagnetic layer can be formed adjacent to a soft layer in the MRAM on a side of the soft layer that is opposite to a hard layer of the MRAM. One embodiment further includes an additional interlayer of non-antiferromagnetic material between the antiferromagnetic layer and the soft layer.

NTIS

*Antiferromagnetism; Computer Storage Devices; Magnetic Storage; Memory (Computers); Random Access Memory; Reliability; Switching; Valves*

**20070029487** Shumaker and Sieffert, P.A., Saint Paul, MN, USA

**Secure Peer-to-Peer Object Storage System**

Marceau, C., Inventor; Stillerman, M. A., Inventor; 1 Oct 04; 20 pp.; In English

Contract(s)/Grant(s): F30602-03-C-0041

Patent Info.: Filed 1 Oct 04; US-Patent-Appl-SN-10-957 235

Report No.(s): PB2007-104097; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A peer-to-peer (P2P) networking system is disclosed that provides a large, persistent object repository with the ability to easily scale to significant size. Data security is provided using a distributed object data access mechanism to grant access to data objects to authorized users. Data objects stored within the object repository are provided a plurality of security options including plain text data, objects, encrypted data objects, and secure, secret sharing data objects. A data object query processing component permits users to locate requested information within the P2P networking system.

NTIS

*Computer Networks; Data Storage*

**20070029506** Sandia National Labs., Albuquerque, NM USA

**Pattern Analysis of Directed Graphs Using DEDICOM: An Application to Enroll Email**

Bader, B. W.; Harshman, R. A.; Kolda, T. G.; Dec. 2006; 34 pp.; In English

Report No.(s): DE2007-900402; SAND2006-7744; No Copyright; Avail.: National Technical Information Service (NTIS)

DEDICOM is a linear algebra model for analyzing intrinsically asymmetric relationships, such as trade among nations or the exchange of emails among individuals. DEDICOM decomposes a complex pattern of observed relations among objects into a sum of simpler patterns of inferred relations among latent components of the objects. Three-way DEDICOM is a higher-order extension of the model that incorporates a third mode of the data, such as time, giving it stronger uniqueness properties and consequently enhancing interpretability of solutions. In this paper, we present algorithms for computing these decompositions on large, sparse data as well as a variant for computing an asymmetric nonnegative factorization. When we apply these techniques to adjacency arrays arising from directed graphs with edges labeled by time, we obtain a smaller graph on latent semantic dimensions and gain additional information about their changing relationships over time. We demonstrate these techniques on the Enron email corpus to learn about the social networks and their transient behavior. The mixture of roles assigned to individuals by DEDICOM showed strong correspondence with known job classifications and revealed the patterns of communication between these roles. Changes in the communication pattern over time, e.g., between top executives and the legal department, were also apparent in the solutions.

NTIS

*Computer Networks; Electronic Mail; Graph Theory; Pattern Recognition*

**20070029930** Stanford Linear Accelerator Center, Stanford, CA, USA

**Cfengine. A General Purpose Tool for Anomaly Detection in Periodic Data**

Wachsmann, A.; Cassell, E.; Mar. 01, 2007; 6 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-900590; SLAC-PUB-12379; No Copyright; Avail.: Department of Energy Information Bridge

Cfengine's environment daemon 'cfenv' has a limited and fixed set of metrics it measures on a computer. The data is assumed to be periodic in nature and cfenvd reports any data points that fall too far out of the pattern it has learned from past measurements. This is used to detect 'anomalies' on computers. We introduce a new standalone tool, 'cfetool', that allows arbitrary periodic data to be stored and evaluated. The user interface is modeled after rrdtool, another widely used tool to store measured data. Because a standalone tool can be used not only for computer related data, we have extended the built-in mathematics to apply to yearly data as well.

NTIS

*Anomalies; Data Processing*

**20070029964** Lewin Group, Inc., Fairfax, VA, USA; SRA International, Inc., San Antonio, TX, USA

**Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States**

Gardiner, K.; Fishman, M.; Glosser, A.; Langley, M.; Vennergrund, D.; Oct. 2006; 63 pp.; In English

Report No.(s): PB2007-110726; No Copyright; Avail.: CASI: [A04](#), Hardcopy

State automated child support systems support a number of functions. They must contain all data necessary to manage cases and meet Federal reporting requirements.<sup>1</sup> There are case initiation functions (e.g., accept automated referrals from the

welfare, foster care, and Medicaid agencies and other state child support programs and maintain case records); locate functions (e.g., interface electronically with state and Federal sources to obtain and verify locate, asset, and other information about parents); establishment functions (e.g., track, monitor, and report the status of paternity and order establishment); case management functions (e.g., automatically update cases and provide information to other programs, support review and adjustment of orders); enforcement functions (e.g., monitor compliance with support orders and initiate enforcement actions such as income withholding and tax refund offsets); and financial management functions (e.g., process payments received, disburse payments).

NTIS

*Support Systems; Financial Management; Automatic Control*

**20070029973** Office of the Assistant Secretary for Planning and Evaluation (HHS), Washington, DC, USA

**Development of an Assistive Technology and Environmental Assessment Instrument for National Surveys: Final Report. Part One: Recommended Modules and Instrument Development Process**

Dec. 2005; 63 pp.; In English

Report No.(s): PB2007-110286; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The purpose of this project was to develop, pilot, and disseminate a set of instruments for national surveys to measure the use of assistive technology and the environments in which they are used. The project focused on older adults (ages 50 and older) living in the community. The instruments have been designed as a series of modules that can be adopted into a computer-assisted telephone interview (CATI). The full instrument, consisting of five modules, takes approximately 8-10 minutes to administer.

NTIS

*Computer Techniques; Modules; Surveys; Technology Assessment; Telephones*

**20070029984** Mosner, Patterson and Sheridan, LLP, Shrewsbury, NJ, USA

**Multi-Description Coding for Video Delivery Over Networks**

Cheng, H., Inventor; 10 Sep 04; 10 pp.; In English

Contract(s)/Grant(s): 70NANB3H3053

Patent Info.: Filed Filed 10 Sep 04; US-Patent-Appl-SN-10-939 219

Report No.(s): PB2007-108633; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method and apparatus for reducing the number of Intra-coded pictures (I-Picture) without any quality degradation. In one embodiment, the method takes advantage of characteristics of a heterogeneous network, such as Digital Subscription Line (DSL).

NTIS

*Coding; Computer Networks; Computer Programs*

## 60

### COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

**20070026384** Illinois Univ., Urbana-Champaign, IL USA

**A Multi-Ring Framework for Survivable Group Communications**

Wang, Jun; Yurcik, William; Jun 2004; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466060; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466060>

Virtual ring is a preferable design for reliable and survivable group communication. Different implementations of virtual ring have different advantages and constraints. After studying two specific implementations of virtual ring, Virtual Ring on Embedded Tree and Virtual Ring of Traveling Salesman Tour, we propose a novel ring-based survivable architecture for group communication, called the Multi-Ring Virtual Ring (MVR). MVR is capable of tolerating one link or one node failure and is easy to implement and maintain. Performance is analyzed with respect to end-to-end hop-count delays and extra bandwidth

that is needed for backup. Results show that the MVR design is a desirable candidate to provide reliability and survivability for a group communication system.

DTIC

*Embedding; Protocol (Computers); Telecommunication*

**20070026394** Yale Univ., New Haven, CT USA

**Molecular Random Access Memory Cell**

Reed, M A; Chen, J; Rawlett, A M; Price, D W; Tour, J M; Jun 4, 2001; 4 pp.; In English

Report No.(s): AD-A466079; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466079>

Electronically programmable memory devices utilizing molecular self-assembled monolayers are reported. The devices exhibit electronically programmable and erasable memory bits compatible with conventional threshold levels and a memory cell applicable to a random access memory is demonstrated. Bit retention times >15 min have been observed.

DTIC

*Computer Storage Devices; Memory (Computers); Molecules; Random Access; Random Access Memory*

**20070026462** Virginia Univ., Charlottesville, VA USA

**Potential Thermal Security Risks**

Dadvar, Puyan; Skadron, Kevin; Jan 2005; 7 pp.; In English

Contract(s)/Grant(s): W911NF-04-1-0288; CCR-0105626

Report No.(s): AD-A466191; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466191>

Hardware and software techniques for controlling a microprocessor's power and cooling have the undesirable side effect of creating a security risk. They allow a malicious program to control the chip's operating temperature and potentially cause denial of service or even permanent damage. This paper provides an overview of the various vulnerabilities, their costs, and offers preliminary suggestions on how to reduce these risks.

DTIC

*Microprocessors; Risk; Security; Temperature Control*

**20070026588** Hypres, Inc., Elmsford, NY USA

**Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter**

Inamdar, Amol; Rylov, Sergey; Sahu, Anubhav; Sarwana, Saad; Gupta, Deepnarayan; Aug 2006; 6 pp.; In English

Contract(s)/Grant(s): N00014-06-M-0105

Report No.(s): AD-A466524; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466524>

We describe the design of a new oversampled analog-to-digital converter (ADC) based on phase modulation-demodulation (PMD) architecture. In a PMD ADC, the analog input signal modulates the phase of a periodic stream of fluxons applied to a modulator circuit for subsequent demodulation in a clocked synchronizer circuit to produce a digital code. The new modulator provides a way to quadruple the average fluxon transport rate, and hence the input dynamic range, by replacing the single junction interferometer with a high-speed symmetric divide-by-4 circuit. The divider acts as a 1:4 asynchronous demultiplexer which distributes incoming fluxons amongst its four quarter-rate outputs. This four-fold rate reduction, at the modulator output, allows one to increase the ADC maximum input slew rate to 2 fluxons per clock period, achieving 2 additional bits of resolution at the same sampling clock frequency. We have designed and fabricated a quarter-rate ADC front-end and present low frequency test results for the same. The ADC comprises a quarter-rate quantizer which has been successfully tested at an input frequency of 81.92 GHz.

DTIC

*Analog to Digital Converters; High Resolution; Modulators; Superconductivity*



**20070026702** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Using Cyclic Memory Allocation to Eliminate Memory Leaks**

Nguyen, Huu H; Rinard, Martin; Oct 26, 2005; 12 pp.; In English

Contract(s)/Grant(s): FA8750-04-2-0254; F33615-00-C-1692

Report No.(s): AD-A466771; MIT-CSAIL-TR-2005-069; MIT-LCS-TR-1008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466771>

We present and evaluate a new memory management technique for eliminating memory leaks in programs with dynamic memory allocation. This technique observes the execution of the program on a sequence of training inputs to find m-bounded allocation sites, which have the property that at any time during the execution of the program, the program accesses at most only the last m objects allocated at that site. The technique then transforms the program to use cyclic memory allocation at that site: it preallocates a buffer containing m objects of the type allocated at that site, with each allocation returning the next object in the buffer. At the end of the buffer the allocations wrap back around to the first object. Cyclic allocation eliminates any memory leak at the allocation site -- the total amount of memory required to hold all of the objects ever allocated at the site is simply m times the object size. We evaluate our technique by applying it to several widely-used open source programs. Our results show that it is able to successfully eliminate important memory leaks in these programs.

DTIC

*Allocations; Computer Storage Devices; Data Storage; Leakage*

**20070026703** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Victim Migration: Dynamically Adapting Between Private and Shared CMP Caches**

Zhang, Michael; Asanovic, Krste; Oct 10, 2005; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466772; MIT-CSAIL-TR-2005-064; MIT-LCS-TR-1006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466772>

Future CMPs will have more cores and greater onchip cache capacity. The on-chip cache can either be divided into separate private L2 caches for each core, or treated as a large shared L2 cache. Private caches provide low hit latency but low capacity, while shared caches have higher hit latencies but greater capacity. Victim replication was previously introduced as a way of reducing the average hit latency of a shared cache by allowing a processor to make a replica of a primary cache victim in its local slice of the global L2 cache. Although victim replication performs well on multithreaded and single-threaded codes, it performs worse than the private scheme for multiprogrammed workloads where there is little sharing between the different programs running at the same time. In this paper, we propose victim migration, which improves on victim replication by adding an additional set of migration tags on each node which are used to implement an exclusive cache policy for replicas. When a replica has been created on a remote node, it is not also cached on the home node, but only recorded in the migration tags. This frees up space on the home node to store shared global lines or replicas for the local processor. We show that victim migration performs better than private, shared, and victim replication schemes across a range of single threaded, multithreaded, and multiprogrammed workloads, while using less area than a private cache design. Victim migration provides a reduction in average memory access latency of up to 10% over victim replication.

DTIC

*Chips; Computer Storage Devices; Data Storage; Migration; Multiprocessing (Computers)*

**20070026769** Program Executive Office Integrated Warfare Systems, Washington, DC USA

**Open Architecture in Naval Combat System Computing of the 21st Century: Network-Centric Applications**

Strei, Thomas J; Jun 2003; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467321; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467321>

This paper describes the Navy's Open Architecture (OA) effort. At its most fundamental, OA is an integrated engineering discipline, a technical approach, and a business strategy for information systems that is based on mainstream commercial-off-the-shelf (COTS) information and computing technologies and systems. The OA initiatives seek to reduce multiple infrastructures that result from a myriad of competing architectures, and also to embrace a product-line approach that will generate true economic efficiencies. With this in mind, the Navy is developing a comprehensive strategy, plan, and program for an OA approach and strategy to address weapon system affordability, interoperability, and performance for today's fleet and the Navy after next. In the fall of 2002, the Navy stood up several new Program Executive Offices (PEOs), including the PEO for Integrated Warfare Systems (PEO IWS), which focuses on surface ship and submarine naval warfare technologies

and systems. PEO IWS will help select common standards and products in the areas of frameworks, middleware, resource management, and operating systems, using both established and evolving industry standards to avoid proprietary solutions that might constrain rather than enhance interoperability, operational effectiveness, and future technology insertion. Furthermore, the computer program architecture will enable the introduction of common functions across multiple systems and platforms.

DTIC  
*Architecture (Computers); Combat; Military Operations*

**20070027566** Federal Emergency Management Agency, Washington, DC USA

**Emergency Preparedness and the Year 2000 Challenge**

Goss, Kay C; Oct 2000; 6 pp.; In English

Report No.(s): AD-A467868; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Year 2000 (Y2K) transition created one of the greatest emergency preparedness challenges ever faced by the Federal Emergency Management Agency (FEMA) and State and local emergency management organizations in the USA. This event was unique in the annals of emergency management because it had the potential to affect many different geographical areas and systems simultaneously. FEMA's normal mission of reducing loss of life and property and protecting America's critical infrastructure from all types of disasters made it a key Federal Agency involved in Y2K preparations. FEMA used an Executive Secretariat, including representatives from all major Agency components, to lead the Y2K program. FEMA approached the problem from three perspectives: information technology, emergency preparedness, and response. This structured management approach was effective, providing coordinated decisions allowing for quick actions on the Agency's part. FEMA also supported the President's Council on Year 2000 Conversion, chairing the Emergency Services Sector Working Group, and leading the Catastrophic Disaster Response Group Federal Departments and Agencies in preparing for potential responses to Y2K consequences. The Y2K transition resulted in few disruptions and was successful in large part because of extensive preparedness, technical assistance, and outreach activities on the part of FEMA and many other organizations.

DTIC

*Computer Networks; Computers; Emergencies; Responses; United States*

61

**COMPUTER PROGRAMMING AND SOFTWARE**

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

**20070026365** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Experiences Linking Vehicle Motion Simulators to Distributed Simulation Experiments**

Jacobson, Richard W; Mar 2004; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466025; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466025>

Introduction: TARDEC Motion Simulators; Past Experiences; Current Activities; Conclusions.

DTIC

*Motion; Motion Simulators; Simulation; Simulators*

**20070026369** Sparta, Inc., San Diego, CA USA

**Challenges for Vertical Collaboration Among Warfighters for Missile Defense C2**

Lee, Laura A; Prouty, Ray C; Sepucha, David J; Jun 2004; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466039>

Implementing an effective Missile Defense plan in a Network Centric environment requires a robust collaboration scheme compatible with multiple military models and simulations. Many technology breakthroughs have occurred allowing defense plans to be rapidly exchanged with C2 systems distributed around the Globe. However, the issue of interpreting the data properly within each C2 model or simulation component remains a stumbling block to effective planning. This paper describes a global collaboration approach using the eXtensible Mark-up Language (XML) to create and validate the plans. Experimentation performed using this approach, by allowing plans to be distributed using a Java Message Service (JMS) or provided by web services, is described to highlight the issues with netted sensors and weapons in military planning. An

approach to resolving this issue through a higher level NCW model of the architecture supported by tactical element web services is shown.

DTIC

*Command and Control; Data Systems; Missile Defense*

**20070026370** Institute for Defense Analyses, Alexandria, VA USA

**The Critical Role of Intelligent Software Agents in Enabling Net-Centric Command and Control**

Lichtblau, Dale E; Jun 2004; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466040>

The Net-Centric Operations and Warfare Reference Model (NCOW RM), Version 1.0, currently under development by the Office of the Assistant Secretary of Defense for Networks and Information Integration (OASD/NII), is the architectural touchstone for all Department of Defense information systems of the near- and long-term future. The reference model prescribes four sets of fundamental functionality: user/entity interaction services; intelligent assistance capabilities; net-centric services (encompassing communities of interest (COI) services, core enterprise services (discovery, mediation, collaboration, etc.), and environment control services); and resource provisioning services. The role and critical importance of the set of services that are to provide intelligent assistance to users of the Global Information Grid (GIG), and to its envisaged Net-centric Information Environment (NCIE), has yet to be fully delineated. We argue that the envisaged net-centricity in future warfare (command and control), business operations, and enterprise management is dependent upon a robust intelligent assistance capability based on the profuse use of intelligent agents throughout the GIG's NCIE.

DTIC

*Command and Control; Expert Systems; Information Systems*

**20070026372** Science Applications International Corp., San Diego, CA USA

**Web Enabling HLA Compliant Simulations to Support Network Centric Applications**

Morse, Katherine L; Drake, David L; Brunton, Ryan P; Jun 2004; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): GS-35F-4461G

Report No.(s): AD-A466042; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466042>

The Extensible Modeling and Simulation Framework (XMSF) is defined as a modeling-&-simulation-tailored set of self-consistent standards, processes and practices employing a set of web based technologies and services to enable a new generation of Internet-distributed applications to emerge, develop and interoperate. One of the earliest XMSF uses web services to web enable the Defense Modeling & Simulation Office (DMSO)/SAIC High Level Architecture (HLA) Runtime Infrastructure (RTI) enabling communication between federates in an existing federation. As a result, existing federates and federations can be web enabled rapidly, in some cases just by relinking the federate with the Web Enabled RTI libraries instead of the standard RTI libraries. The resulting federate connects to a web server over the Internet, communicating with a federation that is unaware that the federate is not local. The Web Enabled RTI is an excellent example of the application of web technologies to the problem of making modeling and simulation capabilities available in a network centric environment, supporting the operational warfighter with network centric modeling and simulation tools.

DTIC

*Elastic Properties; Simulation; Wide Area Networks*

**20070026373** Science Applications International Corp., San Diego, CA USA

**Operational Agility: Composing and Orchestrating Mission Capability Packages Through Business Process Execution Language (BPEL)**

Shaffer, Gary R; Jun 2004; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466044; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466044>

One aspect of the Department of Defenses vision for Net-Centric Operations and Warfare is composing and orchestrating Mission Capability Packages from various disparate and geographically dispersed web services into mission-oriented application as required by the operational situation. This allows mission-oriented capabilities to be quickly composed in response to new challenges, requirements, or demands. In other words, Operational Agility. Today, web services can communicate with each other, advertise themselves, and be discovered and invoked using industry-wide specification.

However, until recently, orchestrating these fine grained services together into coherent course grained solutions required non-standard methods and procedures that were generally not interoperable with other organizations. Business Process Execution Language (BPEL) for Web Services (BPEL4WS) mitigates the issue of interoperability by providing a set of constructs, based on XML, that can be used to define the semantics of how process communicate and exchange data, control the flow of data from one services to another, and the order in which to invoke services. Furthermore, subject matter experts using graphical designer tools and not software developers writing software components can compose the processes. This will allow mission-oriented capabilities to be quickly composed in response to new challenges, requirements, or demands.

DTIC

*Commerce; Computer Networks; Interoperability; Network Analysis; Programming Languages*

**20070026374** Naval Postgraduate School, Monterey, CA USA

**Computational Experimentation with the Virtual Design Team: Bridging the Chasm between Laboratory and Field Research in C2**

Nissen, Mark E; Buettner, Raymond R; Jun 2004; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N0001401WR20304

Report No.(s): AD-A466047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466047>

A chasm exists between laboratory and field methods in C2 research. These methods are complementary but used rarely in combination. This expository article describes a research approach that bridges such chasm: computational experimentation. Computational experimentation mitigates the weakness of both laboratory and field research, yet it has its own limitations and appears suited best as a complement and not a replacement. To illustrate the power and potential of computational experimentation, we describe an implemented agent-based modeling environment called VDT. VDT benefits from accumulated research over two decades and extensive external validation. We employ this modeling environment to represent and emulate the behavior of a high-level C2 organization. Using a full-factorial experimental design, we illustrate computational experimentation through controlled manipulation of key factors associated with organizational and technological design (i.e., bureaucracy level, coordination load, knowledge inventory). This illustration includes discussion of rich operationalized constructs used to characterize a diversity of C2 organizations, task environments and performance measures. The experimental results highlight complex interactions between design factors, and they suggest fundamental tension and decision tradeoffs between important performance measures such as mission duration and risk. The article closes with key conclusions, implications for C2 in practice today, and suggestions for future research.

DTIC

*Canyons; Command and Control; Computerized Simulation; Experiment Design*

**20070026375** Naval Research Lab., Washington, DC USA

**New Navy Solutions: Developing Simulation Based C4I Applications**

Layman, Gene; Weatherly, Jim; Jun 2004; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466048; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466048>

Simulation based Mission Applications are difficult to develop due to the conflicting nature of current Command, Control, Communications, Computer and Intelligence (C4I) systems and simulations. C4I systems process real world data to produce a common operational picture as accurate and as close to real time as possible. Simulations process simulated data, operate in variable time bases and present alternate courses of action, plans, analytical results, etc. C4I systems have made few provisions for these types of processes. The Navy's Embedded Simulation Infrastructure (ESI) Program was undertaken to provide Modeling and Simulation (M&S) software components to be used as building blocks for simulation based mission applications within C4I systems that are compliant with the Department of Defense's Common Operating Environment (COE). Standard software components have been developed to link simulations to internal COE and C4I functions and to manage simulated data and variable time bases in C4I systems. A variety of sharable M&S software components are available to generate planning and training scenarios, provide simulations links to internal C4I data bases and functions, manage the simulated data within the C4I system, manage variable time bases, display simulated data, integrate simulations with other applications and perform communication tasks.

DTIC

*Computerized Simulation; Navy; Simulation; War Games*

**20070026388** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Issues and Requirements for Cybersecurity in Network Centric Warfare**

Stytz, Martin R; Banks, Sheila B; Jun 2004; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466069; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466069>

The transition to network centric warfare brings with it great promise for the effectiveness of future military operations. This promise arises from the capability for network centric warfare to empower individuals at all levels with vast amounts of relevant information and thereby lift the fog of war. By achieving the promise, commanders will be able to effectively and efficiently employ their resources to achieve objectives; in addition, individuals can exploit information in real-time to increase their effectiveness in mission accomplishment and to capitalize upon transient opportunities in the battlespace. However, a central, but generally unspoken, tenet of network centric warfare is that the information received is actionable; i.e., that the information is timely and correct. However, the increasing sophistication of computer and network attack tools and technologies coupled with the increasing technical sophistication of potential adversaries calls this central tenet into question and raises the question of how to secure the network and software against the threat of attack and subversion. Clearly, network and application security, or cybersecurity, is a broad topic, but is of pressing importance if network centric warfare is to fulfill its potential and become a key component of the future battlespace.

DTIC

*Computer Information Security; Computer Networks; Computer Programs; Protection; Security; Warfare*

**20070026420** Ministry of Defense and Aviation, Riyadh, Saudi Arabia

**An Empirical Assessment of the Impact of Requirements Uncertainty on Development Quality Performance**

Aldaijy, Ayad Y; Jun 2004; 23 pp.; In English

Report No.(s): AD-A466125; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466125>

System requirements are recognized as a critical step in the development of quality software (SW) systems and an important area of research. Being the first step in the process of software engineering, the effort has potential to shape the direction for all subsequent project activity. The main purpose of this research is to examine the impact of requirements uncertainty and task uncertainty on outcomes in software development projects, limiting the attention to process and product quality. Some of those examined projects are defense-related and aerospace-command and control systems. A cross-sectional survey of 123 participants work in software development in 34 U.S. organizations was employed to prove my research model. Analyzed data provided evidence of a significant negative association between requirements uncertainty and development quality factors: process and product. Moreover, the analyzed data showed that there is a significance positive association between requirements and task uncertainty. In addition, the data provided evidence of a negative significant association between task uncertainty and process and product quality. My study pointed to areas where there was negative impact on the developed system quality. In particular, my research focused on the uncertainty regarding user requirements, because I believed that this had the most influence. Findings from this research can provide the basis on which project managers and software practitioners can design concrete strategies that would enhance the performance of software development to high quality ends.

DTIC

*Computer Programming; Requirements; Software Engineering*

**20070026472** Northwestern Univ., Evanston, IL USA

**Qualitative Reasoning about Fluids and Mechanics**

Kim, Hyeonkyeong; Nov 1993; 166 pp.; In English

Contract(s)/Grant(s): N00014-85-K-0225

Report No.(s): AD-A466215; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466215>

Understanding people's commonsense knowledge about the physical world is a fundamental problem in building intelligent systems. If this knowledge can be represented and used by computers, they can duplicate people's ability to understand and interact with the world. Qualitative physics is the attempt to capture and formalize this knowledge. An important aspect of qualitative reasoning is the ability to derive the possible behaviors of a given physical system from the structure of the system, using minimal initial information. This thesis investigates qualitative domain theories and reasoning techniques that will enable computers to analyze the qualitative behaviors of physical systems, including both mechanical mechanisms and fluids such as internal combustion engines and hydraulic lift pumps. The author has developed a domain

theory that integrates richer models of mechanics, fluids, and geometry than previous research in qualitative physics. These theories and inference techniques are embodied in QSA, a program that produces possible behaviors of physical systems.  
DTIC

*Artificial Intelligence; Computerized Simulation; Fluid Flow; Fluid Mechanics; Kinematics; Qualitative Analysis*

**20070026479** Virginia Univ., Charlottesville, VA USA

**Exploiting Data-Flow for Fault-Tolerance in a Wide-Area Parallel System**

Nguyen-Tuong, Anh; Grimshaw, Andrew S; Hyett, Mark; Jan 1996; 11 pp.; In English

Contract(s)/Grant(s): N00014-94-1-0882; ASC-9201822

Report No.(s): AD-A466238; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466238>

Wide-area parallel processing systems will soon be available to researchers to solve a range of problems. In these systems, it is certain that host failures and other faults will be a common occurrence. Unfortunately, most parallel processing systems have not been designed with fault-tolerance in mind. Mentat is a high-performance object-oriented parallel processing system that is based on an extension of the data-flow model. The functional nature of data-flow enables both parallelism and fault-tolerance. In this paper, we exploit the data-flow underpinning of Mentat to provide easy-to-use and transparent fault-tolerance. We present results on both a small-scale network and a wide-area heterogeneous environment that consists of three sites: the National Center for Super computing Applications, the University of Virginia and the NASA Langley Research Center.

DTIC

*Fault Tolerance; Information Flow; Parallel Processing (Computers)*

**20070026486** Virginia Univ., Charlottesville, VA USA

**Protection of Software-based Survivability Mechanisms**

Wang, Chenxi; Davidson, Jack; Hill, Jonathan; Knight, John; Jan 2001; 11 pp.; In English

Contract(s)/Grant(s): F30602-96-1-0314

Report No.(s): AD-A466288; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466288>

Many existing survivability mechanisms rely on software-based system monitoring and control. Some of the software resides on application hosts that are not necessarily trustworthy. The integrity of these software components is therefore essential to the reliability and trustworthiness of the survivability scheme. In this paper we address the problem of protecting trusted software on untrustworthy hosts by software transformations. Our techniques include a systematic introduction of aliases in combination with a break-down of the program control-flow; transforming high-level control transfers to indirect addressing through aliases pointers. In so doing, we transform programs to a form that yields data flow information very slowly and/or with little precision. We present a theoretical result which shows that a precise analysis of the transformed program, in the general case, is NP-hard and demonstrate the applicability of our techniques with empirical results.

DTIC

*Computer Programs; Protection*

**20070026487** Florida Univ., Gainesville, FL USA

**Parallel Simulation of Chip-Multiprocessor Architectures**

Chidester, Matthew C; George, Alan D; Jan 2002; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466301; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466301>

Chip-multiprocessor (CMP) architectures present a challenge for efficient simulation, combining the requirements of a detailed microprocessor simulator with that of a tightly-coupled parallel system. In this paper, a distributed simulator for target CMPs is presented based on the Message Passing Interface (MPI) designed to run on a host cluster of workstations. Microbenchmark-based evaluation is used to narrow the parallelization design space concerning the performance impact of distributed vs. centralized target L2 simulation, blocking vs. non-blocking remote cache accesses, null-message vs. barrier techniques for clock synchronization, and network interconnect selection. The best combination is shown to yield speedups of up to 16 on a 9-node cluster of dual-CPU workstations, partially due to cache effects.

DTIC

*Chips; Microprocessors; Multiprocessing (Computers); Parallel Processing (Computers); Simulation*

**20070026490** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Modeling the U.S. Military Intelligence Process**

Miller, J O; Pawling, Carl R; Chambal, Stephen P; Sep 2004; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466314; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466314>

Military use of the intelligence process is vital both in and of itself and as a valuable input to Command and Control by enhancing military power through information superiority. The intelligence process begins when a need for information or intelligence is identified and encompasses how these information needs are met. As such, this process includes all of the satellites, aircraft, and communications systems used to gather and transmit data as well as the people, organizations, and resources involved in turning raw data into useful information. To support current and future Intelligence, Surveillance, and Reconnaissance (ISR) systems, more detailed analysis of the intelligence process becomes critical to determine what pieces may need to be improved or expanded. The authors' approach involves the construction of a modularized top-level computer simulation model of a generalized military intelligence process using the Arena process-oriented simulation software. The model provides the ability to perform quick-turn analysis for comparing structural modifications to the intelligence process using typical measures of performance (i.e., quality, quantity, timeliness, and information needs satisfaction). The Intelligence Process Model (IPM) consists of the following seven submodels: Planning and Direction, Collection, Processing and Exploitation, Analysis and Production, Dissemination and Integration, Mission Evaluation and Feedback, and Communications. The study also includes a statistical analysis of various configurations of this intelligence process.

DTIC

*Computerized Simulation; Intelligence; Models; Simulation*

**20070026535** Florida Univ., Gainesville, FL USA

**Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems**

Gonzalez, Damian M; George, Alan D; Chidester, Matthew C; Jan 2001; 22 pp.; In English

Report No.(s): AD-A466404; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466404>

This paper presents an analytical performance characterization and topology comparison from a latency perspective for the Scalable Coherent Interface (SCI). Experimental methods are used to determine constituent latency components and to verify the results obtained by these analytical models as close approximations of reality. In contrast with simulative models, analytical SCI models are faster to solve, yielding accurate performance estimates very quickly, and thereby broadening the design space that can be explored. Ultimately, the results obtained here serve to identify optimum topology types for a range of system sizes based on the latency performance of common parallel application demands.

DTIC

*Distributed Processing; Mathematical Models; Packet Switching; Parallel Processing (Computers); Performance Prediction; Protocol (Computers); Topology*

**20070026536** Florida Univ., Gainesville, FL USA

**Comparative Performance Analysis of Directed Flow Control for Real-Time SCI**

Todd, Robert W; Chidester, Matthew C; George, Alan D; Jan 2001; 23 pp.; In English

Report No.(s): AD-A466405; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466405>

The distributed nature of routing and flow control in a register-insertion ring topology complicates priority enforcement for real-time systems. Two divergent approaches for priority enforcement for ring-based networks are reviewed: a node-oriented scheme called Preemptive Priority Queue and a ring-wide arbitration approach dubbed TRAIN. This paper introduces a hybrid protocol named Directed Flow Control that combines node- and ring-oriented flow control to yield greater performance. A functional comparison of the three protocols as implemented on the Scalable Coherent Interface (SCI) is presented, followed by performance results obtained through high-fidelity modeling and simulation.

DTIC

*Distributed Processing; Parallel Processing (Computers); Protocol (Computers); Real Time Operation; Reliability Analysis; Topology*

**20070026537** Florida Univ., Gainesville, FL USA

**A High-Performance Communication Service for Parallel Computing on Distributed DSP Systems**

Jan 2002; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-99-1-0278

Report No.(s): AD-A466406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466406>

Rapid increases in the complexity of algorithms for real-time signal processing applications have led to performance requirements exceeding the capabilities of conventional digital signal processor (DSP) architectures. Many applications, such as autonomous sonar arrays, are distributed in nature and amenable to parallel computing on embedded systems constructed from multiple DSPs networked together. However, to realize the full potential of such applications, a lightweight service for message-passing communication and parallel process coordination is needed that is able to provide high throughput and low latency while minimizing processor and memory utilization. This paper presents the design and analysis of such a service, based on the Message Passing Interface (MPI) specification, for unicast and collective communications.

DTIC

*Computers; Digital Systems; Distributed Processing; Message Processing; Parallel Processing (Computers); Real Time Operation; Signal Processing*

**20070026546** Virginia Univ., Charlottesville, VA USA

**Mediators in Infrastructure Survivability Enhancement**

Sullivan, Kevin J; Geist, Steve; Shaw, Paul; Jan 1998; 5 pp.; In English

Contract(s)/Grant(s): F30602-96-1-0314

Report No.(s): AD-A466421; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466421>

A key research priority for the next decade is the protection of critical, software-intensive infrastructures (e.g., electric power, banking, telecommunications, and transportation). The problem is complicated by the need to enhance existing systems. The authors describe one approach to survivability enhancement. In 1997, the Internet failed when corrupt data was disseminated at the top level of the Domain Name Service. The authors replicated this failure and developed a solution based on transparent insertion of mediators to enforce survivability policies. Their approach promises to ease survivability enhancement in two ways: (1) transparent insertion eases system architectural evolution, and (2) modularization of survivability policy implementations eases the evolution of both survivability policies and the systems into which their mediators are inserted.

DTIC

*Augmentation; Computer Information Security; Computer Programming; Internets; Software Engineering*

**20070026550** Virginia Univ., Charlottesville, VA USA

**Willow System Demonstration**

Knight, John C; Hill, Jonathan; Varner, Philip; Wolf, Alexander L; Heimbigner, Dennis; Devanbu, Premkumar; Jan 2003; 4 pp.; In English

Contract(s)/Grant(s): N66001-00-8945; F30602-01-1-0503

Report No.(s): AD-A466430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466430>

Dealing with damage that arises during the operation of networked information systems is essential if such systems are to provide the dependability required by modern critical applications. Extensive damage can arise from environmental factors, malicious actions, and so on, and in most cases it is impractical to mask the effects of such damage using typical redundancy techniques. Reconfiguration is required of both the application and the underlying computing and communications fabric. Such reconfiguration is difficult to achieve because it requires communication with a significant number of nodes both to determine the problem and to effect a repair. In this demonstration, the authors present an approach to the implementation of such a reconfiguration. The approach to reactive control includes a formal description of the error states, synthesis of the implementation, a novel new communications mechanism for communication between the error detection system and the application, and a system for coordinating the effects of independent actions.

DTIC

*Computer Information Security; Computer Networks; Computer Programming; Detection; Information Systems; Software Engineering*



**20070026558** Drexel Univ., Philadelphia, PA USA

**A Distributed Parallel Embedded System for Autonomous Sonar Arrays**

Rosen, W A; George, A D; Jan 1997; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-96-1-0569; N00014-97-1-0117

Report No.(s): AD-A466450; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466450>

The U.S. Navy is developing a series of disposable air-deployed sonar arrays for undersea surveillance. The arrays must be high-gain (high-element-count), low-cost, reliable, autonomous (in-array processing), and battery-powered (30-day mission time). This briefing examines next generation architecture in which each node of the network represents a processing element of a parallel processor, essentially turning the array itself into a distributed parallel processing machine.

DTIC

*Autonomy; Parallel Processing (Computers); Sonar*

**20070026562** Swedish Defence Research Establishment, Stockholm, Sweden

**Methods and System Design of the FOI Information Fusion Demonstrator - IFD03**

Schubert, Johan; Martenson, Christian; Sidenbladh, Hedvig; Svenson, Pontus; Walter, Johan; Sep 2004; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466476; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466476>

Outline of presentation: Introduction; Information Fusion Methods: Force Aggregation, Ground Vehicle Tracking, Sensor Resource Management; System Description; Conclusion.

DTIC

*Data Processing; Intelligence; Proving; Systems Engineering*

**20070026580** National Central Univ., Chung-Li, Taiwan, Province of China

**3D Photonic Crystals Build Up By Self-Organization Of Nanospheres**

Chen, Yu-Wen; May 23, 2006; 23 pp.; In English

Report No.(s): AD-A466508; AOARD-044069; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466508>

Band gap structure is the most important information while studying electromagnetic propagation in photonic crystals. A collection of free software is used to set up an analysis tool system for simulation purpose. Because it is desired for application and has been a technique challenge to fabricate a photonic crystal possessing a complete photonic band gap operates at the optical wavelength regime, we study how to optimize the size and position of band gap from the standpoint of long range order, short range order, and material property. We show in this paper that , decreasing the variance of k points on the first Brillouin zone by choosing an appropriate lattice type and adjusting the lattice parameters is required to the formation of a larger complete photonic band gap, and for easy calculations we defined the variance quantity when the coordinates of high symmetry points are known; a local symmetry distorted along some specific directions always opens and extends the gaps, and the effects of structure inversion are considered from this viewpoint; dielectric contrast should have a optimum value to fulfill the requirements of position and size of gap simultaneously rather than an as-high-as-possible value, to prevent the wavelength shift of gap to a shorter range.

DTIC

*Brillouin Zones; Computer Programs; Crystals; Electromagnetic Wave Transmission; Energy Gaps (Solid State)*

**20070026592** Northwestern Univ., Evanston, IL USA

**Towards a Computational Model of Sketching**

Forbus, Kenneth D; Ferguson, Ronald W; Usher, Jeffrey M; Jan 2000; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466531; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466531>

Sketching is a powerful means of communication between people. While many useful multimodal systems of communication have been created, current systems are far from achieving human-like participation in sketching. A computational model of sketching would help characterize these differences and help people better understand how to overcome them. This paper is a first step towards such a model. The authors start with an example of a sketching system (nuSketch COA Creator) designed to aid military planners to provide context and a source of examples. They then describe

four dimensions of sketching -- visual understanding, conceptual understanding, language understanding, and drawing -- that can be used to characterize the competence of existing systems and identify open problems. Three research challenges are posed to serve as milestones towards a computational model of sketching that can explain and replicate human abilities in this area.

DTIC

*Computer Graphics; Graphical User Interface; Knowledge Based Systems; Military Operations; Planning; Voice Communication*

**20070026620** Defence Science and Technology Organisation, Edinburgh, Australia

**Modelling Operational Command Structures Using ORGAHEAD**

Yates, Alex; Cook, Ashley; Sproles, Noel; Jul 2005; 66 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466572; DSTO-TN-0704; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466572>

Computational modelling has been used successfully to explore the influence of organisation structure on organisation performance. Results from these explorations have helped to develop organisation science theories. This report describes the method and results of a series of experiments that were conducted to assess the suitability of ORGAHEAD, a computational modelling tool, in analysing operational command structures.

DTIC

*Computerized Simulation; Decision Making; Organizations; Software Development Tools*

**20070026643** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Analyzing the Interdiction of Sea-Borne Threats Using Simulation Optimization**

Cavallaro, Kristen L; Mar 2007; 95 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466633; AFIT/GOR/ENS/07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466633>

Worldwide, maritime trade accounts for approximately 80% of all trade by volume and is expected to double in the next twenty years. Prior to September 11, 2001, Ports, Waterways and Coastal Security (PWCS) was afforded only 1 percent of USA Coast Guard (USCG) resources. Today, it accounts for nearly 22 percent of dedicated USCG resources. Tactical assessment of resource requirements and operational limitations on the PWCS mission is necessary for more effective management of USCG assets to meet the broader range of competing missions. This research effort involves the development and validation of a discrete-event simulation model of the at-sea vessel interdiction process utilizing USCG deepwater assets. A discrete-event simulation model of the interdiction, control and boarding, and inspection processes has been developed and validated. Through a simulation optimization approach, our research utilizes the efficiency of a localized search algorithm interfaced with the simulation model to allocate USCG resources in the interception, boarding, and inspection processes with the objective of minimizing overall process time requirements. The model is tested with actual USCG data to gain insight on the development of efficient and effective interdiction operations.

DTIC

*Coasts; Computerized Simulation; Resources Management; Seas; Security; Simulation*

**20070026671** Air Force Research Lab., Rome, NY USA

**Grid Computing for High Performance Computing (HPC) Data Centers**

Ross, Virginia W; Spetka, Scott E; Mar 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-459T

Report No.(s): AD-A466685; AFRL-IF-RS-TR-2007-91; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466685>

This research project investigated techniques to develop a High Performance Computing (HPC) grid infrastructure to operate as an interactive research and development tool. Current HPC grid architectures are designed for batch applications, where users submit their job requests, and then wait for notification of job completion. In the batch environment, the user lacks direct control over the execution of their application. To meet this need for accessing and processing data interactively in near real-time, the Air Force Research Laboratory/ Information Directorate developed an environment that stresses 'near real-time' user interaction with the application. This involved evaluating the various developing protocols for interactive grid computing, using the Globus Toolkit, and then selecting the one with the most growth potential. The grid architecture was evaluated by

assembling and demonstrating an in-house interactive demonstration grid using in-house cluster assets and existing code, to verify proper operation on a small scale.

DTIC

*Data Processing; Grid Computing (Computer Networks); Information Systems; Libraries; Real Time Operation*

**20070026684** Army Communications Research and Development Command, Fort Monmouth, NJ USA

**Using a Combination of UML, C2RM, XML, and Metadata Registries to Support Long-Term Development/Engineering**

Mayk, Israel; Yariv, Avi; Goren, Bernard; Jan 2003; 70 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466711; XA-CERDEC/C2/NJ; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466711>

Objective: To facilitate C2 Architecture and Applications development in terms of a formal language for C2 based upon a C2RM; To derive the rules for analyzing and parsing C2 Products from Natural Language to Machine Language for use by C2 Applications; To leverage commercial representation and modeling languages such as the Unified Modeling Language (UML) and Extensible Markup Language (XML) and associated tools.

DTIC

*Command and Control; Document Markup Languages; Metadata; Models*

**20070026688** Texas A&M Univ., College Station, TX USA

**Modeling Command and Control in Multi-Agent Systems**

Ioerger, Thomas R; He, Linli; May 20, 2003; 45 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466716; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466716>

Intelligent agents can be quite useful as entities in combat simulations. Recently, there has been a great deal of research on developing enhanced methods for implementing intelligent agents in combat simulations, such as by introducing models of team work and collaborative behavior. However, modeling of command-and-control has lagged behind. Much is known about command-and-control in human tactical decision-making (TDM) teams from studies in cognitive science and organizational psychology. These studies suggest that human decision-makers tend to follow a Naturalistic Decision-Making process, in which situation awareness plays a key role. Hence command-and-control is heavily focused on information-gathering and information-fusion activities, oriented toward reducing uncertainty and identifying the situation, based on which an appropriate response can be applied (or adapted) from experience or training. In this paper, we provide a brief survey of multi-agent systems architectures, with a focus on combat simulations, and a survey of the cognitive literature on human situation awareness and tactical decision-making. Then we describe a new computational model for command-and-control in multi-agent systems. Primarily, the model focuses on a procedural representation of situation assessment and attempts to capture the decisions regarding information-gathering and information-management activities, though we also discuss how to integrate these activities with other on-going aspects of C2 (mission, threat-handling, etc.) using prioritization. We then discuss an approach to extending this procedure to a team task, which should automatically generate the interactions and information flow necessary to simulate distributed situation awareness.

DTIC

*Artificial Intelligence; Combat; Command and Control; Simulation*

**20070026710** Naval Research Lab., Washington, DC USA

**Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process**

Mittu, Ranjeev; Segaria, Frank; Barber, K S; Graser, Tom; Ross, Robert; Guleyupoglu, Suleyman; Jun 2003; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466787; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466787>

The CoAX demonstration was an international effort between the Defense Advanced Research Projects Agency (DARPA), Defense Science Technology Office (DSTO), Defense Scientific Technical Laboratory (DSTL), and The Technical Cooperation Program (TTCP). The CoAX participants included the Department of Defense (DoD) laboratories, industry and academia that were brought together with the purpose of showcasing the power of software agents to rapidly construct and maintain a coalition Command and Control Structure. The CoAX was conducted through numerous Technology Integration Experiments (TIEs). The purpose of the TIEs was to pair up participants in the demonstration in order to leverage the

synergistic effects of software agent technology being developed by each participant. The Naval Research Laboratory (NRL), University of Maryland (UMD) and University of Texas (UTEX) participated in a TIE which demonstrated the integration of the NRL Global Command and Control System Maritime (GCCSM) surrogate with the Interactive Maryland Platform for Agents Collaborating Together (IMPACT) system and UTEX's Adaptive Agent Organization and Information-Trust-Evaluation agents. This paper will describe the CoAX 30-month experiment and the TIE that was conducted between NRL, UMD, and UTEX to support the experiment. We will conclude with a brief summary and areas for future investigation.

DTIC

*Command and Control; Computer Programming; Software Engineering*

**20070026720** Visitech Ltd., Alexandria, VA USA

**Distributed Simulation Run Automation Capability for the Navy PRA Testbed**

Trbovich, Sarah; Reading, Richard; Photinos, William; Malone, Shala; Jan 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466815; 07S-SIW-076; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466815>

The Navy Probability of Raid Annihilation (PRA) Testbed implements HLA federated simulations of ship combat system elements against independent, reactive threat raids in a common environment to formulate an overall combat system assessment. The PRA Testbed is a cornerstone of the U.S. Navy Ship Self Defense Test & Evaluation (T&E) Enterprise. The LPD 17 ship class is the first to implement a PRA Testbed baseline as a formal component of ship class OT&E. Products and lessons from the LPD 17 baseline are being transitioned to multiple ship classes including DDG 1000, LHA 6, LCS, and CVN 21. The PRA Testbed LPD 17 baseline is deployed as a secure, geographically distributed, time managed federation with three nodes: the U.S. Naval Research Laboratory (NRL) Washington, DC; Johns Hopkins University (JHU) Applied Physics Laboratory (APL) Laurel, MD; and Naval Air Warfare Center (NAWC) Weapons Division China Lake. Federation execution is controlled centrally from the NRL node. The PRA Testbed LPD 17 baseline federation is required to conduct nearly 2000 simulation test events during the course of LPD 17 PRA Assessment. Each scenario execution involves computation intensive calculations that progress much slower than real time. The development team is using Run Automation software, dubbed OneButtonStart to automate batch runs of the federation from a single control node. OneButtonStart is an important part of the LPD 17 testing program because it dramatically reduces manning requirements and takes advantage of all available computer time to minimize schedule. Yet, there are numerous challenges to implementing automated control of a classified, non-realtime federation that includes both legacy and new software. In this paper, we describe the Run Automation capability and how it will be used in the PRA Testbed LPD 17 baseline. We also share lessons learned in automating runs for a secure, geographically distributed, time-managed simulation with multiple nodes.

DTIC

*Computerized Simulation; Evaluation; Navy; Ships; Simulation; System Effectiveness*

**20070026721** Visitech Ltd., Alexandria, VA USA

**Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed**

Reading, Richard; Trbovich, Sarah; Malone, Shala; Jan 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466816; 07S-SIW-074; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466816>

A cornerstone of the Navy T&E Enterprise is the Probability of Raid Annihilation (PRA) Testbed. The Navy PRA Testbed implements HLA federated simulations of ship combat system elements against independent, reactive threat raids in a common environment to formulate an overall combat system assessment. The LPD 17 ship class is the first to implement a PRA Testbed baseline as a formal component of ship class OT&E. Products and lessons from the LPD 17 baseline are being transitioned to multiple ship classes. While the PRA Testbed LPD 17 baseline adheres to the Federation Development and Execution Process (FEDEP), conceptual modeling is a particularly distinctive feature. The Systems Engineering Concept Model (SECM) is an extension of the Conceptual Model product of FEDEP step 2 that broadens the impact of conceptual modeling in the SE process and specifically supports federation Verification, Validation, and Accreditation (VV&A). Accreditation of the PRA Testbed for LPD 17 operational testing is a challenging proposition. The purpose of the SECM is to provide a central documentation tool for stakeholders to view the Testbed capabilities and limitations from multiple perspectives. The SECM is divided into 3 views, which generally follow sequential stages in Testbed system engineering: System View, Model View, and Federate View. Each view is intended to reveal, address, and resolve a particular class of issues for PRA Testbed accreditation. Explanation of engineering judgments is inclusive to the documentation. The SECM creates a framework of deliberate intent for making decisions and accountability for limits in capability. The SECM also establishes a persistent

documentation product that feeds the corporate knowledge base. Many lessons have been learned about conceptual modeling. In this paper, we share those lessons and describe how we overcame the trials and tribulations of documenting engineering level details in the SECM for the PRA Testbed LPD 17 baseline.

DTIC

*Annihilation Reactions; Computerized Simulation; Evaluation; Probability Theory; Ships; System Effectiveness*

**20070026749** California Inst. of Tech., Pasadena, CA USA

**Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems**

Zheng, Jie; Balasundaram, Ramkumar; Gehrke, Stevin H; Heffelfinger, Grant S; Goddard, III, William A; Jiang, Shaoyi; Dec 30, 2002; 10 pp.; In English

Report No.(s): AD-A467022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467022>

One of the bottlenecks in molecular simulations is to treat large systems involving electrostatic interactions. Computational time in conventional molecular simulation methods scales with  $O(N^2)$ , where  $N$  is the number of atoms. With the emergence of new simulation methodologies, such as the cell multipole method (CMM), and massively parallel supercomputers, simulations of 10-million atoms or more have been performed. In this work, the optimal hierarchical cell level and the algorithm for Taylor expansion were recommended for fast and efficient molecular dynamics simulations of three-dimensional (3D) systems. CMM was then extended to treat quasi-two-dimensional (2D) systems, which is very important for condensed matter physics problems. In addition, CMM was applied to grand canonical ensemble Monte Carlo simulations for both 3D and 2D systems. Under the optimal conditions, our results show that computational time is approximately linear with  $N$  for large systems, average error in total potential energy is about 0.05% for 3D and 0.32% for 2D systems, and the RMS force error is 0.27% for 3D and 0.43% for 2D systems when compared with the Ewald summation.

DTIC

*Computerized Simulation; Confinement; Monte Carlo Method; Multipoles; Simulation*

**20070026750** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Motion Coordination Using Virtual Nodes**

Lynch, Nancy; Mitra, Sayan; Nolte, Tina; Apr 6, 2005; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-01-C-1850; F49620-02-1-0325

Report No.(s): AD-A467032; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467032>

We describe how a virtual node abstraction layer can be used to coordinate the motion of real mobile nodes in a region of 2-space. In particular, we consider how nodes in a mobile ad hoc network can arrange themselves along a predetermined curve in the plane, and can maintain themselves in such a configuration in the presence of changes in the underlying mobile ad hoc network, specifically, when nodes may join or leave the system or may fail. Our strategy is to allow the mobile nodes to implement a virtual layer consisting of mobile client nodes, stationary Virtual Nodes (VNs) for predetermined zones in the plane, and local broadcast communication. The VNs coordinate among themselves to distribute the client nodes between zones based on the length of the curve through those zones, while each VN directs its zone's local client nodes to move themselves to equally spaced locations on the local portion of the target curve.

DTIC

*Coordination*

**20070026755** Naval Postgraduate School, Monterey, CA USA

**Shared Situational Awareness Environment for Tactical Level Humanitarian Emergency Operations**

Barge, Hezekiah; Davis, Mark S; Jun 2003; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467097; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467097>

The Naval Postgraduate School (NPS) is exploring key factors that affect how teams, particularly distributed teams, develop shared situational awareness (SSA) in a Complex Humanitarian Emergency (CHE) environment. This research develops the foundation for deploying the following: Network-Centric Human-Agents in CHE habitats, an integrated environment of mobile operators, deployable wireless networks, sensors, collaborative tools, and multiagent systems. We experimentally explored how to integrate a deployable wireless network with peer-to-peer (P2P) collaborative tools and situational awareness agents. This was done to establish shared awareness of the events that were taking place during the CHE

operation. The major findings include the following: a better understanding of the critical role of peer-to-peer communication, network performance monitoring, and innovative agent-based architecture for maintaining seamless access to the remote data bases and expert sources.

DTIC

*Emergencies; Situational Awareness*

**20070026763** Harvard Univ., Cambridge, MA USA

**Next Generation Systems Languages**

Morrisett, Greg; Dec 1, 2006; 14 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0298

Report No.(s): AD-A467170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467170>

The goal of this work is to explore techniques for making today's software, which is largely written in type-unsafe, low-level languages such as C, as reliable and trustworthy as code written in type-safe, high-level languages such as Java or ML. Type-safe languages automatically block or prevent common vulnerabilities such as buffer overruns, format string attacks, and overflow attacks which are all too common in today's critical software infrastructure. To this end, we have implemented a prototype compiler called Cyclone, which provides the benefits of type safety through a combination of static analysis, programmer annotations, and run-time checks. Particular emphasis has been placed on scalable, static analyses to ensure that programmers can retain good performance and high reliability.

DTIC

*Compilers; Computer Programs; High Level Languages; Languages; Safety*

**20070026765** Bolt, Beranek, and Newman, Inc., Cambridge, MA USA

**Using Templates to Support Crisis Action Mission Planning**

Mulvehill, Alice; Callaghan, Michael; Hyde, Clinton; Jun 2002; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467190; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467190>

In this paper we describe a software system called Tracker being developed under the DARPA Active Templates research program. Tracker allows users to define and use templates to support problem solving, e.g., crisis action mission planning. Our premise is that templates simplify problem solving by (a) providing flexible ways to make and record decisions, (b) reminding you to perform certain tasks, (c) encapsulating experience and domain knowledge, and (d) constraining task specification and language. In our vision, templates, when filled in and linked, can represent entire plans. In other words, the overall plan context may be embodied in a pre-existing template model that specifies how other more detailed templates are associated with each other. For example, the IRS tax forms are a collection of templates. The detailed templates that make up the IRS tax forms describe tasks or decision points and their alternatives. There is the main 1040 form, and then many schedules (detail templates) that are filled in as needed. The tax templates that make up the IRS tax forms work since each tax form is designed to collect data relative to some aspect of taxation as defined in a model that embodies the laws governing tax collection.

DTIC

*Emergencies; Management Methods; Mission Planning; Problem Solving; Templates*

**20070026782** Army Tank-Automotive and Armaments Command, Warren, MI USA

**Software to Generate 3-Dimensional Displays of Inverse Synthetic aperture Radar Data**

Jones, Jack; Bennett, John G; Evans, Roger; Aug 18, 1998; 11 pp.; In English

Report No.(s): AD-A467430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467430>

No abstract available

*Computer Programs; Display Devices; Radar Data; Radar Imagery; Synthetic Aperture Radar*

**20070026786** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Joint Synthetic Battlespace: Cornerstone for Predictive Battlespace Awareness**

Phister, Jr , Paul W; Busch, Timothy; Plonisch, Igor G; Jun 2003; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467439; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467439>

A 1995 vision statement for Air Force Modeling and Simulation highlighted the need for a Joint Synthetic Battlespace

(JSB); an environment in which warfighters can train using real-world equipment, while ‘virtually’ immersed in a realistic contingency or wartime environment. The Scientific Advisory Board has recommended the need for military information processes to be more predictive, thus enabling commanders at the strategic, operational and tactical levels to anticipate rather than react: this is referred to as ‘Predictive Battlespace Awareness (PBA).’ This ‘predictive’ capability must link national and military ISR platforms and bring a warfighting focus to the entire C2 enterprise. Although the term PBA is widely used, the pervasive cultural change required has not taken root. The problems faced by our decision makers have not changed much over time, namely: inability to accurately predict the course of action of an adversary or the inability to adequately ‘visualize’ the battlespace in order to make better informed decisions. This paper provides a top level view of PBA and explores the utility of a Joint Synthetic Battlespace that would provide the ‘core’ functionality of the PBA. The required information technologies to fully realize a JSB within the total PBA construct will also be discussed.

DTIC

*Decision Making; Military Operations; Predictions*

**20070026814** Army Communications-Electronics Command, Fort Monmouth, NJ USA

**The Right Information....and Intelligent Nodes**

Dawidowicz, Edward; Jackson, Vairzora; Bryant, Thomas E; Adams, Martin; Jun 2003; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467518>

The concept of Network-centric Warfare is powerful in terms of emphasizing the importance of accessing information by the warfighters, but just accessing information is not sufficient for future warfare. To achieve information superiority, a Warfighter-centric approach is required in addition to the Network-centric concept. In a Warfighter-centric approach, we focus on both the individual warfighter’s informational needs and the needs of decision support information flow across all echelons and services for effective achievement of decisive operations. The architecture and mechanism of Intelligent Nodes allows both the Network centric and Warfighter-centric paradigms to merge. This paper describes a multidisciplinary methodology for developing intelligent software assistants. Such assistants will continue to evolve during the military training, exercises and combat, to learn the informational needs of the individual warfighter and combat groups. This symbiotic aggregate of man and computer we call Intelligent Nodes [Dawidowicz E., et. al. 2002, and Dawidowicz E., 2001]. Such devices will communicate with humans using a Natural Language such as English and possess faculties capable of comprehending ; the commander’s intent, doctrine, mission execution process; assist in course of action development and analysis, planning and collaboration. These faculties are critical in developing the Common Operational Picture (COP), Common Relevant Operational Picture (CROP) and aiding commander’s Situational Understanding (SU). User biometric identification for system access authorization, network security, spoofed information identification and filtering are additional benefits of Intelligent Nodes.

DTIC

*Cognition; Decision Support Systems*

**20070026820** Metron, Inc., Solana Beach, CA USA

**Use of Modeling and Simulation (M&S) in Support of the Quantitative Assessment of FORCENet Systems and Concepts**

Stevens, William K; Jun 2003; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00039-01-D-2202

Report No.(s): AD-A467591; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467591>

The work to be described in this paper addresses recent advances in the application of modeling and simulation (M&S) techniques to the problem of quantifying the force-level warfighting value-added of FORCENet and related doctrine and systems in the context of realistic scenarios including Operational War Plans (OPLANs). The M&S activities discussed in this paper have been conducted in support of operational experiments and wargames, as part of analyses in support of CINC-level commands, and as a part of analyses in support of certain specific acquisition programs having the requirement to demonstrate synergy with ongoing U.S. Department of Defense (DoD) and U.S. Navy FORCENet and Network Centric Warfare (NCW) improvement programs. Lessons-learned concerning the challenges associated with representing information technology (IT) infrastructure improvements along with required FORCENet/NCW warfare process re-engineering (WPR) initiatives will be presented. An iterative cycle of WPR initiative formulation and evaluation is often a required part of an assessment of the force-level warfighting value-added of specific FORCENet/NCW improvements. This paper will also describe the extent to which the M&S approaches employed in the analyses alluded to above are consistent with the OSD (C3I) Network Centric

Warfare Conceptual Framework. This framework provides a basis for making quantitative assessments of the degree to which specific Mission Capabilities Packages (MCPs), IT infrastructure improvement initiatives, and associated warfighting process improvements yield operational value-added in the manner envisioned by the tenants of NCW.

DTIC

*Command and Control; Computerized Simulation; Quantitative Analysis; Simulation*

**20070026821** Oak Ridge National Lab., TN USA

**Suitability of Agent Technology for Military Command and Control in the Future Combat System Environment**

Potok, Thomas; Phillips, Laurence; Pollock, Robert; Loebel, Andy; Jun 2003; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467592>

The U.S. Army is faced with the challenge of dramatically improving its war fighting capability through advanced technologies. The focus of this paper is to assess the novelty and maturity of agent technology for use in the Future Combat System (FCS). FCS will rely on networked command and control (C2) to transform from the historically centralized C2 function. Achieving a networked C2 capability will require breakthroughs in current software technology. We have developed a set of software requirements for FCS based on military requirements for this system. We have then evaluated these software requirements against current computer science technology. From this analysis we find that existing technologies will not likely be sufficient to meet the networked C2 requirements of FCS due to limitations in scalability, mobility, and security. However, agent technology provides a number of advantages in these areas, mainly through much stronger messaging and coordination models. These advantages have the potential for significant improvements in scalability, mobility, and security. We believe that agent technology has the capability to support most of the networked C2 requirements of FCS. However, we would recommend proof of principle experiments to verify the theoretical advantages of this technology in an FCS environment.

DTIC

*Combat; Command and Control*

**20070026827** Defence Research and Development Canada, Valcartier, Quebec Canada

**Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information**

Labbe', Paul; Maamar, Zakaria; Abdelhamid, Elkadhi; Moulin, Bernard; Proulx, Rene; Demers, David; Jun 2002; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467620; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467620>

Seeking advances in infrastructure for e-activities over networks requires the projection of the utility (either profit or satisfaction) of such activities for organizations and individuals. Studies of defense-information systems that manage spatial- and time-dependent data for which we have assumed a decision process applied by cybernetic models with a bi-dimensional function for effector's effectiveness revealed emergent properties that must be considered in defining future e-activities over dedicated networks, intranets and the Internet. We address two aspects of improving the value of shared information for spatial- and time-dependent data for synchronized actions: (1) architecture changes, and (2) strategy adaptation to dynamic data for geographically distributed fix or mobile participants.

DTIC

*Architecture (Computers); Computer Networks; Internets; Position (Location); Security; Time Dependence*

**20070026839** Defence Science and Technology Organisation, Canberra, Australia

**Yet Another Role for Team Building and Work Motivation -Enabler of Knowledge Creation and Knowledge Sharing**

Ali, Irena M; Pascoe, Celina; Warne, Leoni; Jun 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467706; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467706>

This paper reports on the methodologies used and the findings of the research conducted by the Enterprise Social Learning Architecture (ESLA) Task into learning processes occurring in a strategic headquarters within the Australian Defence Organisation (ADO). The research focused on identifying processes and strategies that enable social learning in view of the socio-technical environment within which people work and learn. It is recognised that people are indeed essential components of the ADO s capability; this people capability is dependent on effective force structure and the forces' level of preparedness.



Similarly, effective social learning capability is also dependent on satisfactory force structure and in itself is a form of 'people' preparedness. Therefore, the identified social learning enablers have been assigned to three categories: Force Structure, Capability and Preparedness. In particular, the paper focuses on teambuilding strategies that facilitate knowledge generation and sharing. The enabling processes and strategies discussed are: team leadership, communication climate, impact of recognition and reward on team building as well as team socialising, and finally, goal alignment. The findings strongly suggest that there is a closely coupled relationship between effectiveness of these enablers and knowledge sharing and generation.

DTIC

*Knowledge Based Systems; Leadership; Learning; Motivation*

**20070026841** Netspace Corp., North Huntingdon, PA USA

**An Experimental 3-D Framework to Support C2**

Callihan, Hubert D; Balash, John A; Jun 2002; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467718; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467718>

Applications that are hosted in a web framework realize many advantages: familiarity to the user, captive environments, rapid development, mature toolsets, and reduced development time and cost. More recently, applications based on web 3-D technologies are showing considerable promise in C2. Because C2 applications tend to be very complex, casting them in a 3-D framework simplifies them considerably due to unlimited rapid drill down, visual realism, and the capacity to support C2 decision-making. We present an experimental scenario using a 3-D web-based framework to show the broad capabilities of interactive 3-D to support C2. This scenario addresses communication network infrastructure categories such as dynamic discovery and configuration, device connectivity, network performance, and device performance in a live demonstration. Although the domain of interest in this experiment targets network management in particular, we will demonstrate the ease with which this framework can be extended to many other domains of interest relevant to C2. The overall benefits realized will be shown as (1) improved understandability through a variety of visual contexts, (2) improved decision-making through manageable interfaces, (3) rapid application development using COTS tools integrated into the framework, and (4) potential for multiple collaborators to cooperate in a shared 3-D workspace.

DTIC

*Command and Control; Graphical User Interface*

**20070026852** George Mason Univ., Fairfax, VA USA

**Course of Action Analysis for Coalition Operations**

Wagenhals, Lee W; Reid, Tom; Smillie, Robert J; Levis, Alexander H; Jun 2001; 16 pp.; In English

Contract(s)/Grant(s): N66001-00-M-0724; N66001-99-D-0050

Report No.(s): AD-A468175; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468175>

A prototype Decision Support System for Coalition Operations (DSSCO) is being developed by SPAWAR Systems Center San Diego to support the Operations Planning Team (OPT) of the Commander in Chief, USA Pacific Command. The goal of DSSCO is to apply and integrate organizational design concepts and decision support technologies in planning and executing multi-national coalition operations. Within DSSCO, there is a module based on CAESAR II focused on the analysis of alternative Courses of Action (COAs). The capabilities of DSSCO and the CAESAR II / COA module were demonstrated in November 2000 at USCINCPAC. Subject matter experts (SMEs) collaborated in a distributed manner in developing the structure (the relationships between causes and effects) and the data of an Influence Net model representing a key outcome in a hypothetical military operation other than war (MOOTW) in a South Pacific scenario. The influence net was implemented in the CAESAR II / COA module, and sensitivity analysis was used to determine which actions could contribute substantially in achieving the desired effects. Those selected actions formed the basis for the construction of COAs, namely, time-phased sequences of these events. The CAESAR II / COA module was used to illustrate the impact of time-coordinated actions of the coalition partners to the decision-makers.

DTIC

*Decision Support Systems; Military Operations*

**20070026853** Defence Evaluation Research Agency, Malvern, UK

**Software Agents as Facilitators of Coherent Coalition Operations**

Allsopp, David; Beautelement, Patrick; Bradshaw, Jeffrey M; Carson, John; Kirton, Michael; Suri, Niranjana; Tate, Austin; Jun 2001; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-98-C-0170; F30602-99-1-0024

Report No.(s): AD-A468176; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468176>

Software agents can be viewed as semi-autonomous entities which help people cope with the complexities of working collaboratively in a distributed information environment. This paper describes the research that DERA is carrying out into Software Agents for use in Command Systems and the collaborative work with the 16 partners of an international Coalition Agents Experiment. Specifically, the paper aims to show that using software agent-based C2 frameworks is a useful way of dealing with the complexity of real-world problems such as supporting agile and robust Coalition operations and enabling interoperability between legacy or previously incompatible systems. In addition, Agent-enabled 'grids' can be used to rapidly integrate a wide variety of agents and infrastructures, with domain management services structuring agent relationships, limiting their behaviors and enforcing Coalition policies.

DTIC

*Command and Control; Decision Support Systems*

**20070026854** Army Research Lab., Aberdeen Proving Ground, MD USA

**An Enterprise Identifier Strategy for Global Naming Across Arbitrary C4I Systems**

Chamberlain, Sam; Jun 2001; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468177; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468177>

In any information system, a critical feature is the ability to link together disparate pieces of data and information via relationships. One way to greatly facilitate this task is to provide a common identification technique that allows data and information items be conveniently and uniformly referenced. This can be accomplished by standardizing one field across disparate data sources. Perhaps no simpler enhancement can produce such a huge benefit with as little intrusion into legacy systems. This is the objective of enterprise identifiers. If data can be globally identified using a common scheme, then one can spontaneously reference, and ultimately, plug and play disparate, arbitrary pieces of information without prior coordination.

DTIC

*Data Management; Naming*

**20070026859** University of South Florida, Tampa, FL USA

**Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis**

Gordon, Thomas R; Covert, Michael D; Riddle, Dawn L; Miles, Donald E; Hoffman, Kimberly A; King, V , Thomas S; Elliot, Linda R; Schifflett, Samuel G; Chaiken, Scott; Jun 2001; 22 pp.; In English

Report No.(s): AD-A468188; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468188>

Weapons Directors (WDs) are cognitively complex, decision making jobs involving air traffic control of friendly assets and tracking hostiles from an airborne platform. Three cognitive task analyses (CTAs) were reviewed for WD jobs on the Airborne Warning and Control System aircraft. 230 tasks were derived from this 'meta-CTA.' Nine performance categories emerged, representing a cognitive-behavioral model of the WD job domain. To test the model, 38 WDs were observed participating in a computer simulation exercise during which they verbalized aloud their thoughts. These verbal protocols were recorded, transcribed, and reduced to task statements. Using a checklist derived from the meta-CTA, subject matter experts classified each of the statements as either primarily cognitive in nature, behavioral in nature, or a combination of the two. Classifications were analyzed to determine job performance differences between experienced and inexperienced WDs. Verbal protocol analysis presents the opportunity to integrate cognitive task analyses into a job model, yielding a new classification system based on a cognitive-behavior approach. This typology for describing jobs transcends traditional job analysis and has applicability to other complex management jobs involving decision-making, problem-solving, and resource management. More research is needed to validate further the process and identify potential boundary conditions for application.

DTIC

*Decision Making; Mental Performance; Protocol (Computers); Resources Management; Tasks; Verbal Communication*

**20070026862** Air Force Research Lab., Rome, NY USA

**Building an Experimental Joint Battlespace Infosphere (YJBI-CB)**

Holzhauser, Douglas; Combs, Vaughn; Linderman, Mark; Duncomb, Robert; Quigley, Jason; Dyson, Mark; Paragi, Robert; Young, David A; Das, Digendra; Kindler, Carrie; Jun 2001; 10 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468213; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468213>

Targeting can be more complicated than just locating a facility or military column. If the target is suspected of having chemical weapons, weather forecasters and armament experts need to work cooperatively to decide how to disable the target without creating chemical fallout that endangers non-combatants or friendly forces. However, this collaboration is complicated by the fact that Air Operation Center's (AOC) functional units are often spatially distributed and have 'hard-wired' communication lines. Additionally, previous combat situations have shown that missions may change during the conflict. This condition may necessitate a change in information dissemination patterns to route information to new users that previously did not require it. The Joint Battlespace Infosphere (JBI) provides the flexible conduit to dynamically handle these changes in information needs.

DTIC

*Command and Control; Information Transfer; Metadata*

**20070026863** Naval Postgraduate School, Monterey, CA USA

**Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment**

Hutchins, Susan G; Kleinman, David L; Hocevar, Susan P; Kemple, William G; Porter, Gary R; Jun 2001; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468216; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468216>

Modified human decision-making processes are required in addition to new tactics and technology that are also currently under development to enable Joint military forces to operate in a time span that is shorter than an adversary's. Self synchronization is viewed as an essential process within military organizations that can increase speed of command and thus accelerate execution of the mission. This process of self-synchronization is described as the ability of a well-informed force to organize and synchronize complex warfare activities from the bottom up. The organizing principles are unity of effort, clearly articulated commander's intent, and carefully crafted rules of engagement. Self-synchronization is viewed as a mechanism to overcome the loss of combat power inherent in top-down, command-directed coordination that is characteristic of conventional command and control doctrine. The planning that took place to prepare for a complex, command and control, team-in-the-loop experiment, examining self synchronization, is the focus for this paper. The objective of the experiment was to determine the conditions under which self-synchronization can most effectively be achieved. In particular, we discuss the activities that led to formulating the hypotheses for the experiment, and the efforts that were needed to actually run the experiment. These efforts included conducting a pre-experiment seminar game, crafting the scenario, experimental design development, independent variable manipulation, data collection methods and instruments, and simulator software modification. Some initial results and lessons learned will also be discussed.

DTIC

*Combat; Command and Control; Decision Making; Military Operations; Synchronism; Targets; Time Dependence*

**20070026866** Defence Evaluation Research Agency, Farnborough, UK

**Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning**

Thomas, Michael; Howells, Howard; Oct 2000; 19 pp.; In English

Report No.(s): AD-A468224; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468224>

The future airborne early warning aircraft to be operated by the Royal Navy will consist of an advanced radar driven mission system that will include a datalink: this Datalink, as well as advanced sensors and an expanded role, will impose additional work on the aircrew that operate in the rear of the airborne early warning (AEW) aircraft. Operating the existing mission system is, under certain conditions, considered by AEW aircrew to be at the upper limits of tolerable workload. The deluge of information from these advanced sensor systems and datalink is likely to impact on the aircrew performance and hence overall system performance. The KBS group of the Defense, Evaluation and Research Agency (DERA) in Farnborough, UK, has been developing Knowledge Based Systems for Decision Support for over a decade. This experience has been applied

to the AEW domain with a high degree of success as demonstrated in a laboratory based concept demonstrator. However, previous work had not accounted for the impacts of the AEW aircraft operating within a digitized battlespace. This paper describes part of a project that was aimed at examining the implications of digitization on the future AEW aircraft and how that would impact the Knowledge Based Decision aids currently being developed. Specifically, the project assessed how datalink would be used and how the information conveyed over datalink could help the aircrew's decisions through greater situation awareness.

DTIC

*Airborne Equipment; Data Links; Decision Support Systems; Early Warning Systems; Knowledge Based Systems; Navy; Workloads (Psychophysiology)*

**20070027252** Air Force Research Lab., Wright-Patterson AFB, OH USA

**A Method for Including Control Effector Interactions in the Control Allocation Problem (Preprint)**

Oppenheimer, Michael W; Doman, David B; Feb 2007; 13 pp.; In English

Contract(s)/Grant(s): Proj-A0

Report No.(s): AD-A466870; AFRL-VA-WP-TP-2007-309; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Much emphasis has been placed on over-actuated systems for air vehicles. Over-actuating an air vehicle provides a certain amount of redundancy for the flight control system, thus potentially allowing for recovery from off-nominal conditions. Due to this redundancy, control allocation algorithms are typically utilized to compute a unique solution to the over-actuated problem. As the number of control effectors placed on a vehicle increases, the likelihood of the occurrence of control effector interactions increases. For example, deflection of an aerodynamic surface that is upstream of another aerodynamic surface may cause the forces and moments produced by the downstream effector to differ from those produced when the upstream effector is not deployed. Another example can be found on launch vehicles that can use a combination of differential throttles and gimbaled nozzles for attitude control. The effectiveness of gimbaled nozzles are clearly influenced by the engine thrust. The above are examples of the control effector interaction problem. In this work, a method is devised, which utilizes linear programming methods in an iterative framework, to take into account control effector interactions. While nonlinear programming techniques could be directly applied to such problems, the lack of convergence guarantees precludes their use in flight critical systems. The use of linear programming methods is appealing because an optimal solution to each linear programming sub-problem can be determined in a finite amount of time.

DTIC

*Allocations; Control Equipment; Linear Programming; Quadratic Programming*

**20070027289** Mitre Corp., McLean, VA USA

**Modeling and Simulation to Support C4ISR Acquisition and Transformation**

Dahmann, Judith; Furness, Zach; Kissin, Sidney; Starr, Stuart; Sep 2002; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467066; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recently, a C4ISR Information Superiority Modeling & Simulation Master Plan (IS M&S MP) was issued by the Office of the Secretary of Defense (OSD) addressing the application of M&S to all functional areas associated with C4ISR. In the area of acquisition, the C4ISR IS M&S MP called for the following actions: recommend and outline methods for providing improved M&S support to C4ISR acquisition, and provide recommendations of desirable policy changes and initiatives along with metrics. To implement these actions, a workshop was convened on 2-4 April 2002 under the sponsorship of the Office of the Assistant Secretary of Defense (C3I); the Director, Interoperability, Undersecretary of Defense (Acquisition, Technology, & Logistics); and the Director, Defense Modeling and Simulation Office (DMSO). Forty-four subject matter experts from government, industry, and academia were assembled to address the subject. The participants were organized into breakout groups to address C4ISR acquisition by system type (i.e., sensors, communications, C2/information processing) and systems-of-systems. A synthesis panel was convened to identify and summarize the similarities and differences in the findings and recommendations of the other breakout groups. To initiate the deliberations, the breakout groups were provided with a strawman list of M&S capability objectives to support C4ISR acquisition. For each of the major phases in the DoD Directive 5000 on the acquisition of systems, the breakout groups used the strawman list to identify and prioritize key M&S needs (i.e., the cases where critical M&S capability objectives could not be satisfied by the year 2007). This paper summarizes the highest priority M&S needs that were identified by the groups to support the acquisition and transformation of C4ISR systems over

the next 5 years. The findings and recommendations from this workshop will drive DoD's investment in M&S to support the acquisition and transformation of C4ISR systems.

DTIC

*Command and Control; Computerized Simulation; Intelligence; Procurement; Reconnaissance; Simulation; Surveillance*

**20070027298** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**PCA RAW FABRIC: Architectural Prototyping, Demonstration and Evaluation**

Amarasinghe, Saman; Agarwal, Anant; Feb 15, 2007; 42 pp.; In English

Contract(s)/Grant(s): F29601-03-2-0065; Proj-DARP

Report No.(s): AD-A467085; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is the final technical report for the project 'PCA RAW Fabric: Architectural Prototyping, Demonstration, and Evaluation.' This project successfully built and demonstrated a Raw fabric system containing 4 Raw chips, with 3 streaming fabric boards. In addition to the Raw fabric hardware, the project also developed and demonstrated StreamIt: a language and compiler specifically designed for embedded, high performance stream computing on PCA architectures such as Raw. The project also implemented, analyzed and distributed a new PCA benchmark suite called Versabench and a PCA performance metric called Versatility.

DTIC

*Parallel Programming; Programming Languages; Prototypes*

**20070027300** Naval Postgraduate School, Monterey, CA USA

**Automating the Shadow Method for Aerosol Optical Depth Retrieval**

Dombrock, Ryan M; Mar 2007; 59 pp.; In English

Report No.(s): AD-A467088; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new method for remote sensing retrieval of Aerosol Optical Depth was proposed and investigated by Vincent (2006). This shadow-based method uses the radiance difference between shadow and non-shadow regions in QuickBird high resolution commercial satellite imagery to estimate Aerosol Optical Depth. Though the process is initially time-consuming, requiring a high level of user knowledge to accomplish the procedure, great potential exists for further development into a stand-alone operational method for overland retrievals at any location and time. It is the automation of this process in order to make it more operational in nature that is the purpose of this investigation. Knowledge is gained in the realm of predicting shadow location for future times. Specific process automation is applied through computer programming to decrease the computational complexity of the method. Also the physical variations of shadow regions are investigated in terms of their brightness change across various spatial profiles. This study of shadow region variation is termed shadow morphology and seeks to provide a user with optimum radiance sampling regions within an observed shadow region. Through the integration of these automation techniques, a more unified and operationally focused iteration of the shadow method is derived.

DTIC

*Aerosols; Computer Programming; Detection; High Resolution; Morphology; Optical Thickness; Remote Sensing; Satellite Imagery*

**20070027316** Naval Postgraduate School, Monterey, CA USA

**Intrusion Deception in Defense of Computer Systems**

Goh, Han C; Mar 2007; 59 pp.; In English

Report No.(s): AD-A467120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We investigate deception in response to cyber-intrusion or trespassing on computer systems. We present a Response Framework that categorizes the types of response we can employ against intruders and show how intrusion deception has its place in this framework. To experiment, we put together tools and technologies such as Snort, VMware, and honeynets in a testbed open to attacks from the Internet. We wrote some Snort rules and ran Snort in inline mode to deceptively manipulate packets of attackers. Our results showed that attackers did react to our deceptions in some interesting ways, suggesting that intrusion deception is a viable response to intrusion.

DTIC

*Computer Networks; Computers; Deception; Intrusion*

**20070027318** Naval Postgraduate School, Monterey, CA USA

**Velocity Estimation Using Forward Looking Sonar**

Dolbec, Michael R; Mar 2007; 134 pp.; In English

Report No.(s): AD-A467123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The thesis investigates a method to estimate the forward velocity and heading rate of an autonomous underwater vehicle (AUV). Through relatively new technologies small AUVs are now able to mount a Forward Looking Sonar (FLS) on the vehicle's nose. This can be used for obstacle avoidance and feature based navigation. The sensor can also be used to estimate motion of the AUV, which can be useful for undersea navigation. The thesis focuses on a template matching technique used in computer vision. Two sequential sonar images are compared with the goal of finding the rotation and translation that best correlates the first to the second sonar image. The transformation which maximizes the correlation coefficient is then converted to forward velocity and heading rate through motion analysis. Experimentation shows that the method provides accurate estimates for both the forward velocity and heading rate of the AUV. Accuracy of the estimates for forward velocity was at the limitation of the resolution of the sonar. Using velocities estimated through image processing applied to FLS images entirely with software, the weight and energy resources currently required by standard measurement techniques could be used to increase the vehicles endurance or for additional payload capacity. Another benefit would be the reduction in acoustic and electrical interference with the FLS and side scan sonar, which would improve the vehicle's obstacle avoidance and mine-hunting capability. The vehicle could become more flexible in its capability to support additional roles vice specific missions. This method holds the promise for permitting smaller AUVs with a FLS to navigate undersea more accurately.

DTIC

*Computer Vision; Navigation; Sonar; Underwater Vehicles*

**20070027323** Naval Postgraduate School, Monterey, CA USA

**Software Communications Architecture (SCA) Compliant Software Defined Radio Design for Interim Standard 95B (IS-95B) Transceiver**

Ramdat, Upendra; Mar 2007; 165 pp.; In English

Report No.(s): AD-A467134; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The increasing demand for wireless services in both the military and civilian sectors results in the emergence of new communication standards and protocols to support these wireless services. There is a need for modern radio receivers to have the ability to receive and recover multiple wireless signals without the added complexity of additional hardware components. Fortunately, a single radio can accomplish these tasks by using software radio architectures where the radio has the ability to reconfigure itself based on the system it will be interfacing with and the functionalities it will be supporting. These radios are more commonly referred to as software defined radios (SDRs). This thesis focuses on using software radio techniques to design and implement software components for an IS-95B wireless transceiver. Furthermore, these software components were built to comply with regulations specified by the Software Communications Architecture (SCA). The open source core framework tool Open Source SCA Implementation::Embedded (OSSIE) was used to design and build the software components necessary to implement functions of an IS-95B transceiver.

DTIC

*Architecture (Computers); Elastic Properties; Radiotelephones; Software Development Tools; Transmitter Receivers*

**20070027339** Naval Postgraduate School, Monterey, CA USA

**Boot Camp for Cognitive Systems: A Model for Preparing Systems with Machine Learning for Deployment**

Lange, Douglas S; Mar 2007; 419 pp.; In English

Report No.(s): AD-A467187; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The vision for command and control and information technology capabilities for the future includes the use of machine learning to enable systems to respond to an adapting environment. Currently, our systems and software engineering processes hinder employment of machine learning, because the adaptation it provides runs counter to our notions of stability. Similarly, systems must demonstrate satisfaction of requirements before deployment, rather than learn tasks while on the job. This dissertation introduces new problems for the field of software engineering and discusses an approach for preparing cognitive systems for deployment. The model for cognitive systems being used is from the Personalized Assistant that Learns (PAL) program from the Defense Advanced Research Projects Agency (DARPA). A model for a boot camp for cognitive systems is presented along with a simulated boot camp capability. The simulation was used to experiment with the types of preparation that must be provided in order for a PAL style assistant to succeed in an operational environment. The results, providing thresholds and patterns for knowledge and observability, and the requirement for specific patterns of human use of PAL

assistants, are then used to infer requirements for a boot camp and measures for the prediction of successful employment of the assistant.

DTIC

*Artificial Intelligence; Cognition; Computer Programming; Deployment; Machine Learning; Software Engineering*

**20070027345** Naval Postgraduate School, Monterey, CA USA

**Field Level Computer Exploitation Package**

Arvizo, Adrian; Janowiak, Vincent; Mar 2007; 127 pp.; In English

Contract(s)/Grant(s): MIPR-N6600106WR00101

Report No.(s): AD-A467197; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On today's battlefield whether in Afghanistan or Iraq, ground combat forces are dealing with an adversary that has embraced the use of computers and electronic devices. Until now, there was no package of consolidated forensic tools available to the ground combat forces with the capability of conducting a quick interrogation of these devices. After a unit has captured a target that possesses electronic devices that require immediate exploitation, the devices are transferred to higher authority. Valuable time is lost locating and capturing associates of the target as the information is sent away to higher authority for analysis. The product of this thesis, Interrogator, was designed to prevent or reduce the time lost by allowing anyone to quickly retrieve data that is stored on a computer. This capability will positively aid a small unit commander's ability to exploit critical vulnerabilities of the enemy in a timely manner and improve the survivability of the unit and the ability to complete their mission.

DTIC

*Computers; Exploitation; Information Retrieval; Software Development Tools*

**20070027389** Naval Postgraduate School, Monterey, CA USA

**Simulating Candidate Missions for a Novel Glider Unmanned Underwater Vehicle**

Seguin, John M; Mar 2007; 140 pp.; In English

Report No.(s): AD-A467375; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Unmanned Underwater Vehicles (UUVs) are becoming ubiquitous in the framework of U.S. Navy operations. According to the U.S. Navy's UUV Master Plan (2004), research and development will expand UUV capabilities that enable diverse roles from Intelligence, Surveillance, and Reconnaissance (ISR) and Mine Countermeasures to Anti-Submarine Warfare (ASW) and Information Operations (IO). However, typical UUVs are severely limited in operational characteristics such as endurance and range which prevents their use conducting certain missions. A novel UUV is currently being designed that is projected to support significantly greater endurance and range characteristics. This UUV is called Seadiver and is being designed by Institute of Engineering Science of Toulon, France with support from Naval Postgraduate School. It is a low-cost glider UUV which generates propulsion not with propellers or jet pumps, but rather by controlling its buoyancy. This method of propulsion is quite efficient and maybe capable of autonomous operation up to 30 days with a range of around 700 nautical miles. A UUV with such endurance and range exposes military missions previously impractical for UUVs especially when used in concert as an array of many UUVs. This thesis creates a simulation using NPS-produced software simulation tools Simkit, Viskit and AUV Workbench that analyzes the capabilities and effectiveness of Seadiver UUVs conducting missions of tactical interest.

DTIC

*Computerized Simulation; Gliders; Simulation; Software Development Tools; Underwater Vehicles*

**20070027437** Air Force Research Lab., Rome, NY USA

**AFRL/IF Technology Transition to the Warfighter via the CAOC-X**

Phister, Jr , Paul W; Patrick, Scott; Humiston, Todd; Plonisch, Igor G; Sep 2002; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467569; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The role of information technologies has played a significant role in conducting military operations since Operation Desert Storm. Over the past ten years, the Air Force Research Laboratory's Information Directorate (AFRL/IF) located in Rome NY has directly supported the warfighter by transitioning critical technologies through the Air Force Command and Control Intelligence, Reconnaissance and Surveillance Center's (AFC2ISRC) Combined Air Operations Center Experimental (CAOC-X). The CAOC-X is part of AFC2ISRC's efforts to rapidly develop and field capabilities critical to the warfighter utilizing the spiral development model of system acquisition. These technologies are designed to support the warfighter through all phases of conflict as well as providing support to various Homeland Defense initiatives. This paper provides a short

summary of each of the various technologies that have been transitioned since the CAOC-X's inception in 2000 as well as some near term candidates for transition in the future. The technologies discussed are: Broadsword, Adaptive Sensor Fusion, Cognitive Desktop Manager, Web-enabled Timeline Analysis System (WebTAS), Information Support Server Environment (ISSE) Guard, Trusted Transfer Agent (TTA), Master Caution Panel (MCP), and lastly, the Joint Targeting Toolbox (JTT) efforts that AFRL/IF has successfully transferred to the warfighter through the CAOC-X at Langley AFB, VA.

DTIC

*Military Technology; Rapid Prototyping; Research and Development; Technology Transfer*

**20070027442** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Conditions for Achieving Network-Centric Operations in Systems of Systems**

Fisher, David A; Meyers, B C; Place, Pat; Jan 2007; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A467575; CMU/SEI-2007-TN-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The advantages of systems of systems -- such as the ability to adapt to unanticipated and unforeseen situations, eliminate single points of failure, and remain continuously operational while being dynamically updated -- guarantee their increasing importance to military and commercial environments. The advent of network-centric systems has served only to accelerate the already prevalent move toward systems of systems. At the same time, network-centric systems and systems of systems are proving difficult to acquire, develop, test, and operate. Many of them are abandoned before they can be fielded, and fielded systems often fail to satisfy their objectives -- demonstrating cost and schedule overruns in their development and sometimes catastrophic failures in operation. The increasing disparity between the normative (but nonfactual) assumptions that underlie current practices and tools used in the acquisition, development, evolution, and operation of systems and the realities of actual systems of systems contributes to those problems. Effective practices and tools for the acquisition, development, and operation of systems of systems have not yet been developed. Suggesting a context in which those practices and tools can be developed, this technical note proposes necessary conditions -- statements of what the desired future state should be -- in six areas that influence the effectiveness of network-centric systems and systems of systems: (1) social and cultural environment, (2) legal and regulatory framework, (3) management practices, (4) governance procedures, (5) engineering practices, and (6) technology base.

DTIC

*Adaptation; Computer Programming; Management Planning; Procurement; Software Engineering; System Effectiveness; Systems Integration*

**20070027443** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Topics in Interoperability: Structural Programmatics in a System of Systems**

Smith, II, James D; Oct 2006; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A467576; CMU/SEI-2006-TN-037; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This technical note presents a case study on how choices of structural programmatics (e.g., hierarchical or peer-to-peer organization, centralized or decentralized execution) affect the ability to achieve programmatic interoperability in the context of large, complex systems of systems. Key systems-of-systems concepts and definitions are introduced and explored through the case study. In addition, this report illustrates the pitfalls of focusing on only one aspect of a problem and discusses the need to balance management's desires for control with the realities of systems-of-systems programmatics. The report also introduces an alternative to conventional program management practice that addresses the pitfalls previously identified.

DTIC

*Computer Programming; Decision Making; Interoperability; Management Planning; Procurement; Software Engineering*

**20070027444** Carnegie-Mellon Univ., Pittsburgh, PA USA

**System-of-Systems Governance: New Patterns of Thought**

Morris, Ed; Place, Pat; Smith, Dennis; Oct 2006; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A467577; CMU/SEI-2006-TN-036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Systems of systems introduce complications for information technology (IT) governance because their individual system



components exhibit considerable autonomy. This technical note examines the ways in which six key characteristics of good IT governance are affected by the autonomy of individual systems in a system of systems. The characteristics discussed are as follows: (1) collaboration and authority, (2) motivation and accountability, (3) multiple models, (4) expectation of evolution, (5) highly fluid processes, and (6) minimal centrality. This report examines each characteristic in detail and, where possible, provides guidance for the practitioner.

DTIC

*Adaptation; Computer Programming; Information Systems; Interoperability; Management Planning; Procedures; Software Engineering; Systems Integration*

**20070027471** ITT Industries, Inc., Rome, NY USA

**A Distributed Parallel Processing System for Command and Control Imagery**

Spetka, Scott E; Ramseyer, George O; Fitzgerald, Dennis; Linderman, Richard E; Sep 2002; 8 pp.; In English  
Report No.(s): AD-A467654; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many modern command and control applications are driven by imagery, and imagery, in general, may originate from diverse geographically distributed sources. A rapid increase in image sizes and processing capabilities has resulted from improved hardware for collection and display. Moreover, techniques for parallel processing are keeping pace with military requirements by harnessing powerful parallel processors to facilitate the analysis of images. In addition, tools for distributed processing are under development that can be used to coordinate the processing effort across a network of parallel processing systems. This paper describes a system that can be used to request image analysis over distributed parallel processing facilities, and integrate the results into command and control systems.

DTIC

*Client Server Systems; Command and Control; Distributed Processing; Image Processing; Imagery; Parallel Processing (Computers); Photographs*

**20070027473** Space and Naval Warfare Systems Center, San Diego, CA USA

**Distributed Computing and Collaboration Framework (DCCF)**

Putnam, Cheryl D; Duffy, LorRaine; Sep 2002; 12 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467657; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Distributed Computing and Collaboration Framework has been developed by the Space and Naval Warfare Systems Center, San Diego (a Naval research and development facility), under the sponsorship of the Office of Naval Research. The focus of the effort is to provide superior performance in 'low bandwidth-high latency network conditions,' a hallmark of Naval operational environments. The software development includes a variety of mechanisms to manage and reduce latencies, with emphasis on ensuring effective, real-time collaboration at the operational user level and efficient use of limited bandwidth channels at the network level. This paper will describe an initial software development package of the peer-to-peer architecture design requirements, exploiting a transport layer (TCP/IP) protocol. This package will support information distribution and search across multiple enclaves using peer-to-peer data models, as well as models of redundancy for robustness across networks composed of a mix of wired and wireless channels. The software was tested in a ship-to-shore, ship-to-ship, and ship-to-submarine paradigm to verify that the initial design met documented Navy bandwidth standards. Results of the analysis showed this initial software to be within standards constraints. The authors provide a detailed presentation of their Collaboration Evaluation Laboratory (and methodology) that they have used to manage their development and transition efforts.

DTIC

*Active Control; Client Server Systems; Command and Control; Computer Programming; Distributed Parameter Systems; Distributed Processing; Narrowband; Software Engineering; Wide Area Networks*

**20070027547** Naval Postgraduate School, Monterey, CA USA

**Experiments with the Sun Java Real-Time System -- Part 2**

Auguston, Mikhail; Cook, Thomas S; Drusinsky, Doron; Michael, James B; Otani, Thomas W; Shing, Man-Tak; May 11, 2007; 24 pp.; In English

Contract(s)/Grant(s): MD7080101P0630

Report No.(s): AD-A467836; NPS-CS-07-005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the authors' first report on the Sun Java Real-Time System (RTS), they concluded that it is preferable to use real-time Java threads that use heap memory rather than no-heap real-time threads (NHRTTs) for the Global Integrated Fire Control

System (GIFC) due to the difficulty of writing correct Java programs using NHRTTs. However, they also found that such an architecture could not be implemented using RTS 1.0. Experiments with the RTS 2.0 alpha release (August 2006) showed that it supports the real-time garbage collector (RTGC), and they used it to explore viable software architectures for the GIFC software. Although the alpha version of RTS 2.0 incorporated a number of improvements over RTS 1.0, its RTGC fell short of their expectations and needs. In this second report, they describe the results of their study of the RTS 2.0 beta release (December 2006), which includes a new RTGC. They performed a number of experiments to determine whether the improved RTGC would result in better software architecture for the GIFC -- a component of the C2BMC element of the Ballistic Missile Defense System (BMDS). Their experiments showed that the new RTGC performed in a satisfactory manner and has met their expectations. They also found that it is possible to use only the real-time Java threads that use heap memory for the GIFC software. SUN RTJ 2.0 gives programmers more control over the priority of the garbage collection. The authors developed a real-time monitor design pattern to support the implementation of time-constrained computations that use heap memory, and a methodology to determine the RTS run-time parameters (thread priorities, memory usage, process load, and task deadlines) necessary for the timely execution of these time-constrained computations.

DTIC

*Computer Programming; Java (Programming Language); Real Time Operation; Software Engineering; Sun*

**20070027564** Naval Postgraduate School, Monterey, CA USA

**Automatic Generation of Best Emergency Routes and Procedures on a Brazilian Frigate**

Sicuro, David L; Rowe, Neil C; Jun 2000; 9 pp.; In English

Report No.(s): AD-A467862; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe prototype software we have written that addresses the serious problem of management of damage control on naval vessels. Human reasoning and judgment may be strongly affected by stress and panic when several simultaneous events occur in a damaged-ship environment. Thus it would be helpful in times of emergency to dispassionately calculate the best courses of action to follow and suggest them to personnel. We describe two tested modules for the decision-aid system of the new Niteroi-Class Frigate Damage Control System project: an emergency-route generator for people and casualties, and a smoke-extraction-procedure generator. Our modules gather and organize sensor data and reports about rooms, gateways and equipment. They reason automatically to determine the best routes and procedures, and can present the damage-related information in a concise manner to users both in the command center and throughout the ship. This system is implemented as an expert system using the CLIPS shell. The ship is represented as a graph where the compartments are nodes and the doors and hatches are the edges between them; costs reflect the difficulty in passing from a compartment to another. For finding emergency routes for people, a cost-minimizing search is done using the current ship data. A different search is done for smoke extraction to determine routes for ventilation of the smoke, with processing that checks conditions and fills in details.

DTIC

*Brazil; Damage; Decision Support Systems; Emergencies; Routes*

**20070027584** Naval Surface Warfare Center, Dahlgren, VA USA

**An Inverse of the Incomplete Beta Function (F-(Variance Ratio) Distribution Function)**

Didonato, Armido; Aug 2005; 17 pp.; In English

Report No.(s): AD-A467901; NSWCDD/TR-05/91; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes an algorithm, IBETA, to evaluate an inverse of the Incomplete Beta Function or, equivalently, an inverse of the F Distribution Function. A Fortran 95 double-precision subroutine, INVBETA, is available that is based on IBETA. It produces the inverse up to 10 significant digits whenever the word length of the computer used is not limiting.

DTIC

*Algorithms; Distribution Functions; FORTRAN; Subroutines*

**20070027680** Maryland Univ., College Park, MD USA

**Dataflow Integration and Simulation Techniques for DSP System Design Tools**

Hsu, Chia-Jui; Jan 2007; 224 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAH01-03-C-R236

Report No.(s): AD-A468090; No Copyright; Avail.: Defense Technical Information Center (DTIC)

System-level modeling, simulation, and synthesis using dataflow models of computation are widespread in electronic design automation (EDA) tools for digital signal processing (DSP) systems. Over the past few decades, various dataflow models and techniques have been developed for different DSP application domains; and many system design tools incorporate

dataflow semantics for different objectives in the design process. In addition, a variety of digital signal processors and other types of embedded processors have been evolving continuously; and many off-the-shelf DSP libraries are optimized for specific processor architectures. To explore their heterogeneous capabilities, we develop a novel framework that centers around the dataflow interchange format (DIF) for helping DSP system designers to integrate the diversity of dataflow models, techniques, design tools, DSP libraries, and embedded processing platforms. The dataflow interchange format is designed as a standard language for specifying DSP-oriented dataflow graphs, and the DIF framework is developed to achieve the following unique combination of objectives: (1) developing dataflow models and techniques to explore the complex design space for embedded DSP system; (2) porting DSP designs across various tools, libraries, and embedded processing platforms; and (3) synthesizing software implementations from high-level dataflow-based program specifications.

DTIC

*Data Processing; Flow; Measure and Integration; Signal Processing; Simulation; Systems Engineering*

**20070027700** Naval Research Lab., Washington, DC USA

**C4I-Simulation Interoperability Using the DII COE and HLA**

Layman, Gene; Daly, John; Furness, Zach; Womble, Jennie; Jun 2001; 9 pp.; In English

Report No.(s): AD-A468266; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Technologies and methods have been developed within C4I systems that permit them to function as federates using the High Level Architecture (HLA). The HLA Runtime Infrastructure (RTI) has been shown to run successfully on C4I system hardware that is based on the Defense Information Infrastructure Common Operational Environment (DII COE). The most prominent example to date has been the operation of the RTI with the Global Command and Control System (GCCS) and GCCS/Maritime that both utilize the DII COE. The GCCS HLA interface has been used successfully with simulations such as the Joint Theater Level Simulation (JTLS), the Navy Simulation System (NSS), and the Pegasus Federation. These federations span the range of potential military applications from training, to experimentation, planning, and course of action (COA) analysis. This paper provides an overview of the various federation applications in which GCCS has been used to date, and also discusses the benefits of using HLA and the DII COE to improve C4I-Simulation interoperability.

DTIC

*Interoperability; Simulation*

**20070027715** Massachusetts Univ., Lowell, MA USA

**Development and Assessment of a Complete ATR Algorithm Based on ISAR Euler Imagery**

Baird, R G; Nixon, W E; May 2007; 13 pp.; In English

Report No.(s): AD-A468361; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Euler decomposition, when applied to the polarization scattering matrix, attempts to extract phenomenological information about the scattering target. Because the Euler parameters constitute a more physically relevant set of parameters than the traditional HH-VV ISAR representations, they have potential to improve ATR performance. The Euler parameter's usefulness in target recognition, however, is effected by several layers of signature variability. Unfortunately, many of the variability layers are often omitted in a typical ATR study. A complete ATR algorithm was therefore developed that allows for all layers of variability and requires no previous knowledge of the target's position, orientation, or average reflectivity. The complete ATR algorithm was then used to assess the effectiveness of Euler ISAR imagery in target recognition when all layers of variability are considered. The general approach and sub-methods used to construct the complete ATR system will be presented, including the methods to determine the targets orientation, registration, and to compare it to a library of pre-rendered target images. Finally, the performance of the Euler parameters in target recognition using the complete ATR algorithm will be presented.

DTIC

*Algorithms; Imagery; Radar Imagery; Synthetic Aperture Radar; Target Recognition*

**20070027727** Mitre Corp., McLean, VA USA

**A Methodology for End-to-End Evaluation of Arabic Document Image Processing Software**

Herceg, Paul M; Ball, Catherine N; Jun 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W15P7T-07-C-F600; Proj-0707G01Z

Report No.(s): AD-A468394; MP-06W0000108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes a methodology for end-to-end evaluation of Arabic document image processing software. Various software solutions have been proposed for digitization and understanding of noisy, complex Arabic document images.

Optical-character-recognition-based (OCR-based) solutions have been available for decades; however this technology is often tailored to the most common document image type: clean, monolingual documents. Real-world documents often involve multiple languages, handwriting, logos, signatures, pictures, stylized text, and other document aspects. Real-world documents involve noise introduced by document aging, reproduction, or exposure to environment factors. Document image processing solutions are maturing to deal with such complexities. Such systems include image clean-up algorithms and page segmentation, followed by various recognition or digitization algorithms: OCR, handwritten word recognition (HWR), logo identification, signature identification, sub-image or picture identification. Indexing digitized document renditions into a search engine enables ad hoc querying of the collection. Some researchers have proposed semi-automation, a process in which human readers interpret complex documents and record a spoken rendition; the audio recordings are then processed by a spoken document retrieval (SDR) system, employing automatic speech recognition (ASR) for digitization and an information retrieval solution to enable ad hoc queries. To handle foreign language, machine translation may be included in any of the aforementioned document image processing systems. This array of approaches results in widely varying performance. This paper discusses a methodology for evaluating the end-to-end retrieval performance of these systems: the ad-hoc use case. The methodology can be easily tailored to other languages, and to other document formats (e.g., audio and video).

DTIC

*Computer Programs; Evaluation; Image Processing; Information Retrieval; System Effectiveness*

**20070027739** Naval Postgraduate School, Monterey, CA USA

**Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control**

Hutchins, Susan G; Kemple, William G; Poirier, John; Hocevar, Susan P; Kleinman, David L; Sovereign, Michael G; Jun 2001; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468438; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The need for rapid access to current, relevant, and accurate information is at an all-time premium -- especially for military operations. Many new Information Technology (IT) Tools were introduced to facilitate these information-related interactions in the Global Wargame 2000, held at the Naval War College, in Newport, RI. A web-based architecture, called the Wargame Information Grid System (WIGS), and a collaborative planning and operational environment, the Information Work Space (IWS), provided an alternative means to communicate, collaborate, and share information among decision makers than is seen in today's current operational environments. In addition to WIGS and IWS, the following tools were provided to participants: Text Documents, the Knowledge Wall, Email, Text Chat, Voice, and Video Teleconferencing. Developing an understanding of the implications and effects of distributed gaming was a key goal of Global 2000 with one objective being to provide insight into future operations for a distributed, network-centric joint force. A sub-objective was to obtain empirical data as to the effectiveness of these new tools, and to identify user defined enhancements that would better meet the decision makers' requirements. In order to collect the data with which to assess user perceptions of the utility of IT Tools, an IT Tool Functionality Questionnaire was developed. This paper presents the results of analysis of data from 112 respondents' replies to the questionnaire designed to assess the utility of the IT Tools with respect to supporting the users accessing and sharing of information, decision-making, collaboration, and how they might be improved in future versions.

DTIC

*Command and Control; Decision Support Systems; Information Systems*

**20070027751** Army Construction Engineering Research Lab., Champaign, IL USA

**ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual**

Niemoeller, Ben; Nykaza, Edward T; May 2007; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MIPR-6FXXR3A563

Report No.(s): AD-A468466; ERDC/CERL-SR-07-6; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army Engineer Research and Development Center Construction Engineering Research Laboratory has developed software that interfaces with an array of Larson-Davis Model 870 (LD-870) Environmental Noise Monitors for Aberdeen Test Center. This document provides step-by-step instructions for operating the software program used to setup and download data from these noise monitors. It provides a troubleshooting guide for resolving known issues with the monitoring system and contains information regarding modem communications between an LD-870 and the central computer.

DTIC

*Computer Programs; Data Management; Environmental Monitoring; Manuals; Monitors; User Manuals (Computer Programs)*

**20070027761** Army Engineer Research and Development Center, Vicksburg, MS USA

**WABED Model in the SMS: Part 2. Graphical Interface**

Demirbilek, Zeki; Lin, Lihwa; Zundel, Alan; May 2007; 16 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468499; ERDC/CHL-CHETN-I-74; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Coastal and Hydraulics Engineering Technical Note (CHETN) describes the graphical interface for the Wave-Action Balance Equation Diffraction (WABED) model that has been added to the U.S. Army Corps of Engineers (USACE) Surface-water Modeling System (SMS). WABED is intended for applications in calculating wave transformation at coastal inlets and is part of the Coastal Modeling System (CMS) developed under the Coastal Inlets Research Program (CIRP) for simulating combined waves, currents, sediment transport, and morphology change. This CHETN describes the graphical interface of WABED available in SMS Version 9.2, which is similar to that of the half-plane STWAVE Version 3.0 (Smith et al. 2001). The SMS (Zundel 2006) is a graphically interactive computer program designed to facilitate the preparation and application of USACE numerical models. This package currently supports several circulation, wave, and sediment transport models and has recently been modified to generate input files for and visualize computed results of WABED. Various features, tools, and analysis capabilities outlined in this document are designed to enhance the ability of engineers to efficiently utilize WABED in the CMS. The model and its interface are expected to evolve with additional applications, and the current interface will continue to undergo revision. The theoretical background and user's manual for WABED are given by Lin et al. (2006) [see ADA452387, Wave-action balance diffraction model tests of wave diffraction and reflection at inlets, ERDC/CHL CHETN-III-73] and Demirbilek et al. (In preparation. WABED: A nearshore spectral wave processes model for coastal inlets and navigation projects).

DTIC

*Balance; Computerized Simulation; Diffraction; Graphical User Interface; Wave Equations*

**20070027762** Army Engineer Research and Development Center, Vicksburg, MS USA

**Infra-Gravity Wave Input Toolbox (IGWT): User's Guide**

Demirbilek, Zeki; Nwogu, Okey G; Zundel, Alan K; May 2007; 12 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468500; ERDC/CHL-CHETN-I-73; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Most harbor structures and harbor layouts are designed for protection against wind-generated (short-period) waves with periods of order 3-20 sec. However, Infra-Gravity (IG) waves, also referred to in this note as low-frequency or long-period waves, with periods on order of 30-600 sec, are generated by groups of short-period waves through nonlinear wave-wave interactions. These long-period waves can cause oscillations and resonance problems in harbors. Such low-frequency waves are responsible for harbor downtime, causing oscillation problems to ships that could significantly degrade on-loading and off-loading operations inside ports. IG waves can also damage mooring lines because the natural periods for the horizontal motion of large moored vessels are typically the same order of magnitude. Predicted IG wave input is required in modeling of long-waves affecting harbors. IG waves may also influence navigation, coastal inlets, and coastal structural design projects; IG waves contribute to the prediction of bedload transport, wave setup and setdown, and wave runup and overtopping in a variety of coastal engineering applications. This Coastal and Hydraulic Engineering Technical Note (CHETN) is a user's guide for the Infra-Gravity Wave Toolbox (IGWT) developed as an activity of the Coastal Inlets Research Program (CIRP) of the U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory. The IGWT is a calculator inside the CGWAVE interface in SMS. Users can access the toolbox through the CGWAVE Model Control dialog. This calculator allows users to input wave conditions from a deepwater buoy location or user-defined site, and then accesses several utilities including BOUSS-1D to estimate the generation of long-wave energies affecting nearshore projects. The IGWT thereby generates input wave conditions at the offshore boundary of the CGWAVE domain.

DTIC

*Gravity Waves; Software Development Tools; Surface Waves; Wave Equations*

**20070028441** Naval Surface Warfare Center, Dahlgren, VA USA

**Counter-Trafficking Integrated Display System (CIDS): A GIS-Based Command & Control Environment for Coalition Nations**

D'Andrea, Elizabeth R; Bogue, Charles R; Sep 2004; 33 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466529; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA466529>

Coalition nations involved in the global war on narco-terrorism may rely on an inadequate foundation upon which to base command and control activities. The inability to exploit multiple levels of information overlaid on a geospatial background

and the lack of a robust communication system to share inherently large datasets all contribute to reducing the quality and quantity of decision making among front-line forces. As the fidelity of data sources continues to improve, users continue to search for an effective ability to fuse sensor, infrastructure, map and intelligence feeds in a near-real time environment. While several robust solutions are available to US agencies, many coalition countries do not have access to these applications due to issues of reliability. As part of the U.S. Government's strategy to equip selected coalition forces with better tools to improve their ability to analyze, formulate, prosecute and evaluate activities which support counter-trafficking missions, the U.S. Department of Defense Counter-Narcoterrorism Technology Program Office has developed a customized command & control tool built upon COTS-based software. By using an industry standard GIS application, the value of public domain mapping data is leveraged and interoperability between the US and coalition nations is enhanced.

DTIC

*Command and Control; Display Devices; Multisensor Fusion; Systems Integration*

**20070028484** Naval Postgraduate School, Monterey, CA USA

**Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking**

Hutchins, Susan G; Kemple, William G; Adamo, Ron; Boger, Dan; Nelson, Brian W; Penta, Heather L; May 1, 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467671; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467671>

Military forces, operating as a networked force, can plan, decide, and act collaboratively and concurrently to accomplish many tasks simultaneously. Operating in a collaborative information environment will enable the joint force to transition from the use of a hierarchical, serial planning process to the use of a parallel, collaborative planning process to produce reduced decision times and an increased tempo of operations. Collaboration tool suites were introduced during two recent events to support operational planning and decision making processes by providing an alternative means to communicate, collaborate, and share information among warfighters that extends what is available in today's current operational environments. One goal for these events was to develop an understanding of the implications and effects of distributed planning. A second goal was to obtain feedback on the effectiveness of these new tools for supporting future military operations in a distributed, network-centric joint force and to identify user-defined enhancements that would better meet future joint operational requirements. New information technology tools, to be used as part of a networked, web-based collaborative system were also introduced. This paper discusses the strengths and weaknesses of the tool suites and describes additional capabilities needed for future collaborative information environments.

DTIC

*Command and Control; Decision Making; Management Planning; Military Operations; Planning*

**20070028557** Naval Research Lab., Washington, DC USA

**Formal Methods for Developing High Assurance Computer Systems: Working Group Report**

Heimdahl, Mats P; Heitmeyer, Constance L; Jan 1998; 6 pp.; In English

Report No.(s): AD-A464973; XB-NRL/MR/5540; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Second International Workshop on Industrial- Strength Formal Techniques (WIFT'98) was held in October, 1998, in Boca Raton, Florida. At the workshop, four different discussion groups investigated various topics. This report summarizes the discussions conducted on the topic 'Formal Methods for Developing High Assurance Systems.' High assurance computer systems are computer systems where convincing evidence is required that the system satisfies a collection of critical properties. To operate correctly, these systems must satisfy properties such as safety and security. Examples of high assurance systems include flight control systems, medical systems, and control systems for nuclear plants. In addition, increased reliance on communications is moving many communications systems, such as telephone networks and cellular and satellite communications systems, into the domain of high assurance systems. The aim of the 1998 discussion was to revisit and continue a discussion began in the working group with the same name at the first WIFT in 1995. A report describing the discussions at WIFT'95 is available at the web site: <http://www.cse.msu.edu/WIFT98/>

DTIC

*Computer Programs; Computer Systems Design*

**20070028685** Virginia Univ., Charlottesville, VA USA

**Using Formal Methods to Reason about Architectural Standards**

Sullivan, Kevin J; Socha, John; Marchukov, Mark; Jan 1997; 13 pp.; In English

Contract(s)/Grant(s): CCR-9502029; CCR-9506779

Report No.(s): AD-A466375; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466375>

We present a study in which we used formal methods to reason precisely about aspects of a widely used software architectural standard, namely Microsoft's Component Object Model (COM). We developed a formal theory of COM to help us reason about a proposed compositional architectural style based on COM, intended for use in a novel commercial multimedia authoring system. The style combined COM objects, integration mediators, and the COM reuse mechanism of aggregation. Our use of formal methods averted an architectural disaster by revealing essential but subtle and counterintuitive properties of COM. We partially validated our theory by subjecting it to review by the designers of COM and by testing it against other available data. The theory has good evidential support.

DTIC

*Architecture (Computers); Multimedia; Standards*

**20070028691** Mitre Corp., Bedford, MA USA

**Army Fire Support Investment Framework**

Moynihan, Richard; Shimi, Tony; Doesch, Curt; Jun 2004; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466788; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466788>

The goal of the analysis was to develop a framework to support System-of-Systems investment decisions using the Army Fire Support Battlefield Operating System as a pilot. The concept is to apply a capability-based analysis approach.

DTIC

*Fires; Military Operations; Decision Making; Command and Control*

**20070028704** Research and Technology Organization, Neuilly-sur-Seine, France

**Enhancing Information Systems Security through Biometrics**

December 2005; In English; RTO Information Systems Technology Panel (IST) Workshop, 18-20 Oct. 2004, Ottawa, Canada; See also 20070028705 - 20070028726

Report No.(s): RTO-MP-IST-044; AC/323(IST-044)TP/30; Copyright; Avail.: CASI: **C01**, CD-ROM

The Information Systems Technology (IST) Panel of the NATO Research and Technology Organisation (RTO) sponsored a workshop on Enhancing Information Systems Security through Biometrics. This workshop was hosted by Defence Research and Development Canada and was held in Ottawa (October 2004). This report includes the workshop presentations, summaries of discussions from the breakdowns sessions, main findings, and recommendations to the IST Panel.

Author

*Biometrics; Information Systems; Computer Information Security; Military Technology; Program Verification (Computers)*

**20070028705** Michigan State Univ., East Lansing, MI, USA

**Multimodal Biometric Systems**

Jain, Anil; Enhancing Information Systems Security through Biometrics; December 2005, pp. 16-1 - 16-2; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: **A03**, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Automatic user authentication is becoming a necessity to counter (physical and information) security threats. There is no optimal biometric. Performance claims by vendors are overly optimistic. Popular misconception that biometric authentication is a solved problem; fundamental research is needed for deployment of biometrics in large database (millions of users) applications. No security system, including biometric system, is foolproof. Multibiometrics improves population coverage and performance. We demonstrated that a multimodal biometric system using state-of-the-art (COTS) fingerprint and face biometrics has better performance than unimodal systems on a database of approx.1000 users. Performance improvement depends on normalization and fusion methods used.

Author

*Biometrics; Warning Systems; Computer Information Security; Deployment*

**20070028706** ComnetiX, Inc., Oakville, Ontario, Canada

**An Enterprise Solution for Biometric Authentication and Identification**

Escubedo, Edward F.; Enhancing Information Systems Security through Biometrics; December 2005, pp. 22-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A viewgraph presentation on using a business approach for biometric identification and authentication is shown. Illustrative examples and essential components used for biometric authentication and identification are also shown.

Derived from text

*Biometrics; Commerce; Identifying; Access Control*

**20070028707** National Research Council of Canada, Ottawa, Ontario, Canada

**Usability and Acceptability of Biometric Security Systems**

Patrick, Andrew S.; Enhancing Information Systems Security through Biometrics; December 2005, pp. 3-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Drivers: a) sensors (ergonomics, robustness, reliability, cost); b) algorithms (performance, transparency); and c) associating systems (access control, encryption) Concerns: a) performance; b) accuracy vs. convenience; and c) physical characteristics (aging population).

Derived from text

*Biometrics; Security; Acceptability; Access Control; Reliability; Human Factors Engineering; Warning Systems*

**20070028708** National Defence Headquarters, Ottawa, Ontario, Canada

**The Accuracy of a Fingerprint/Voice Multimodal Verification System**

Pellerin, Karine; Enhancing Information Systems Security through Biometrics; December 2005, pp. 7-1; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The integration of multiple biometrics does not always result in accuracy improvement The accuracy improvement of a multimodal system in comparison to its subsystems is highly dependable on the initial accuracy of its subsystems and the fusion strategy used

Derived from text

*Speech Recognition; Systems Integration; Biometrics; Accuracy*

**20070028709** Ottawa Univ., Ontario, Canada

**Vulnerabilities in Biometric Encryption Systems**

Adler, Andy; Enhancing Information Systems Security through Biometrics; December 2005, pp. 23-1; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Many biometric vendors have claimed its impossible or infeasible to recreate the enrolled image from a template. Reasons: a) templates record features (such as fingerprint minutiae) and not image primitives; b) templates are typically calculated using only a small portion of the image; c) templates are much smaller than the image; and d) proprietary nature of the storage format makes templates infeasible to 'hack'. Tests were performed against three commercial face recognition algorithms. Two of the vendors participated in the 2002 face recognition vendor test. Regenerated image always compared at over 99.9% Prob. Correct Verification.

Derived from text

*Biometrics; Vulnerability; Security; Cryptography*

**20070028710** Naples Univ., Italy

**Technical and Non-Technical Problems in Biometric Physical Access Control Systems**

Savastano, Mario; Riccardi, Luisa; Enhancing Information Systems Security through Biometrics; December 2005, pp. 2-1 - 2-6; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The increase in security measures due to the complex international situation is forcing the realization of physical access control systems equipped with biometric identifiers. The identification based on physical or behavioural characteristics



represents one of the most sophisticated ways to protect buildings or sensible sites but, unfortunately, at the same time, requires the resolution of many different problems. While the technical difficulties may be considered ‘internationally transversal’, and therefore reasonably ‘known’ into the scientific community, non-technical issues may differ from country to country, thus involving often the lack of reference cases. Aspects such as labour legislation or privacy protection reflect national guidelines and may result in significant constraints on the implementation of biometrics. The present document highlights some of the constraints and problems encountered in the project of a biometric access control system for a large compound of the Italian Ministry of the Defence (MoD), attended by a reasonably high number of employees and characterized by a strong personnel degree of dishomogeneity. In addition, the present contribution intends to highlight the role played by societal and psychological issues in the implementation of a biometric project.

Author

*Access Control; Biometrics; Security; Protection; Law (Jurisprudence)*

**20070028711** Bioscrypt, Inc., Mississauga, Ontario, Canada

### **ISO/IEC JTC1 SC37 Overview**

McIver, Rene; Enhancing Information Systems Security through Biometrics; December 2005, pp. 19-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A general overview of the International Standards Organization (ISO)/International Electrotechnical Commission (IEC) Joint Technical Committee (JTC1) and Subcommittee on Biometrics (SC37) is presented. The topics include: 1) Creation; 2) Members; 3) Scope; 4) Structure; 5) Projects; 6) The Onion; and 7) Liaisons.

CASI

*Biometrics; General Overviews; Technology Utilization; Automation*

**20070028712** Allan Security and Privacy Consulting, Inc., AK, USA

### **Security Strategy for a Biometrics Deployment**

Allan, Catherine; Enhancing Information Systems Security through Biometrics; December 2005, pp. 4-1 - 4-2; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

I. Business Drivers: a) Document integrity; b) Identity management across programs. II. The Challenge: a) Technology study; b) Business requirements; c) Real world deployments; d) Scope; and e) Complexity. III. Issues: a) Facilitation versus Security; b) Enrollment; c) Client diversity; and d) Entitlements. IV. Assets: a) Reference biometrics; b) System(s) that use biometrics; c) Programs

Derived from text

*Biometrics; Deployment; Security*

**20070028714** Government Communications HQ, Cheltenham, UK

### **Biometric Security Issues**

Statham, Philip; Lewis, Matthew; Enhancing Information Systems Security through Biometrics; December 2005, pp. 6-1; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Biometrics have had a bad press: a) Unreasonable expectations; b) Inequitable comparisons; c) They re not perfect ergo they re no good! Biometrics have strengths and limitations (just like other technologies) a) Understand the strengths and weaknesses; b) Use the strengths to your advantage; c) Address the weaknesses. Look on Biometrics as another tool in the security toolbox Use the best tools for the job; Use biometrics where they solve a problem; Don t criticise them or use them for what they are not good for. Security is a holistic subject: a) Assess the threats and risks realistically; b) Don t depend on technology alone; c) Create a balanced technical, procedural and environmental security approach. Focus on the whole picture: a) Don t assume or expect perfection, nothing is perfect!; b) Be sceptical, but be reasonable; c) Determine what performance and security you actually need d) Apply balanced security measures across the board.

Derived from text

*Biometrics; Risk; Security*

**20070028715** International Biometric Group, LLC, New York, NY, USA

**Independent Testing of Iris Recognition Technology (ITIRT)**

Thieme, Michael; Enhancing Information Systems Security through Biometrics; December 2005, pp. 25-1; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ITIRT evaluates accuracy and usability of iris recognition acquisition systems, including sensors and enrollment/matching algorithms, deployed in access control and ID applications. Acquisition systems configured, installed, and tested in a fashion consistent with usage in a controlled, indoor environment. .. ITIRT predicated on real-time acquisition of iris images from Test Subjects, as opposed to utilizing existing databases of iris images. ITIRT measures transaction times and level of effort involved in Test Subject-sensor interaction. ITIRT encompasses an interoperability component whereby matching performance is calculated based on gallery and probe data collected through different imager subsystems. ITIRT also encompasses testing as implemented via ANSI 379 Iris Interchange Standard

Derived from text

*Real Time Operation; Interoperability; Access Control; Deployment*

**20070028716** DigitalPersona, Inc., Redwood City, CA, USA

**DigitalPersona - Case Study: Department of Defense**

Bjorn, Vance; Enhancing Information Systems Security through Biometrics; December 2005, pp. 26-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

DigitalPersona Pro's innovative approach to Biometric Enterprise Authentication uses fingerprint recognition technology to: a) Reduce Costs - Eliminate password related help desk overhead; b) Increase Security - Address 'Inside the firewall' security vulnerabilities; c) Increase Convenience - Added convenience automatically creates end-user secure behavior; and d) Enhances Compliance - Address major security/privacy regulations.

Derived from text

*Biometrics; Computer Information Security; Cost Reduction; Privacy; Regulations*

**20070028717** Royal Canadian Mounted Police, Ottawa, Ontario, Canada

**Real Time Identification**

Bunbury, Lloyd G.; Enhancing Information Systems Security through Biometrics; December 2005, pp. 21-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

'RTID' will use highly advanced AFIS and C/R technologies to greatly reduce the requirement for human intervention in the criminal records process (Not Lights Out). Expert Human resources will be retrained, reallocated and used for: a) Exception processing; b) Certification of all identifications. RTID will supply the infrastructure to support: a) Timely identification of individuals in custody; b) Timely civil security clearances; c) Immediate update of NPS criminal records using electronically transmitted data from the source; d) Electronic submission of disposition information from law enforcement agencies and courts; e) Continued emphasis on the quality of our records.

Derived from text

*Certification; Security; Law (Jurisprudence); Clearances; Identifying*

**20070028718** Fraunhofer-IGD, Darmstadt, Germany

**Challenges for Biometrics Systems: Performance and Fake Resistance**

Busch, Christoph; Enhancing Information Systems Security through Biometrics; December 2005, pp. 28-1; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chances for Biometrics: a) Large scale border control applications ahead; b) System developers try to remove technical obstacles; c) We do see progress in the maturity of biometric systems. Challenges for Biometrics: a) Unsupervised use remains a risk; b) 3D face recognition may improve biometric performance and fake resistance; c) The proliferation of biometric systems is only one (small) step to improve homeland security.

Derived from text

*Biometrics; Risk; Security; Proving*

**20070028719** dataPrivacy Partners, Ltd., Mississauga, Canada

**Human Factors and Privacy**

Hope-Tindall, Peter; Enhancing Information Systems Security through Biometrics; December 2005, pp. 13-1 - 13-2; In English; See also [20070028704](#); Original contains color and black and white illustrations

Report No.(s): IST-044-RWS-007; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation discusses the issues affecting human factors engineering and data privacy. The topics include: 1) Infrastructure of surveillance potential; 2) Risk of biometrics becoming the default method of identification/authentication; 3) Potential for covert usage; 4) Risks of improper reliance; and 5) Performance and reliability.

CASI

*Biometrics; Human Factors Engineering; Privacy; Data Processing*

**20070028720** Visionsphere Technologies, Kanata, Ontario, Canada

**Digital Convergence Authenticated Video, Voice, & Text**

Khan, Sal; Enhancing Information Systems Security through Biometrics; December 2005, pp. 33-1; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Current Status includes: Texas Instruments partner, Embedded face recognition (TI DSP), Embedded integration with various peripheral devices, IP digital Intelligent video surveillance (TI DSP), Embedded secure video instant messaging (SVIM) Embedded secure distributed or centralized authentication

Derived from text

Derived from text

*Digital Television; Computer Information Security; Surveillance; Embedding*

**20070028721** Labcal., Quebec, Quebec, Canada

**Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers**

McConnell, Gregory; Enhancing Information Systems Security through Biometrics; December 2005, pp. 31-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Applications of mobile and handheld readers include: a) Travel document: Land border (up-stream pre-clearance), Seaport (ID verification onboard ship), Airport, land border customs b) Employee ID Card: Seafarer, Military, Transportation, Customs/Immigrations, Utilities employee, etc. c) Physical Access Control / Time and Attendance: 1) RA: airport, seaport, power plant, government buildings, etc 2) Gate Access control: Military Base, tarmac, secured perimeter 3) ID verification on board vessels, busses, troop carriers, trains, etc. d) Civilian ID applications: 1) National ID (Plane pre-boarding, Land boarder, legal age proof) 2) Drivers license, healthcare card, permanent resident card, etc.

Derived from text

Derived from text

*Biometrics; Access Control; Military Operations; Airports; Transportation; Readers; Proving*

**20070028722** Defence Research and Development Canada, Ottawa, Ontario, Canada

**Challenges and Potential Research Areas in Biometrics**

Xiao, Qinghan; Dahel, Karim S.; Enhancing Information Systems Security through Biometrics; December 2005, pp. 8-1; In English; See also [20070028704](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Topics covered include: I.) Spoofing & Anti-Spoofing a) Liveness detection; b) Anti-spoofing. II.) Face Recognition: a) The most reliable passive biometric technology; b) Problems with 2D face recognition; c) Advantages and challenges of 3D face recognition. III.) Multimodal Biometrics: a) Multiple biometrics; b) Multi-modal biometrics. IV.) Privacy Issue

Derived from text

Derived from text

*Biometrics; Research and Development; Privacy*

**20070028723** Canada Border Service Agency, Ottawa, Ontario, Canada

**CANPASS Air/NEXUS Air - Border Clearance in the Blink of an Eye**

Fraser, Daine; Enhancing Information Systems Security through Biometrics; December 2005, pp. 18-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A viewgraph presentation explaining the background and process of CANPASS Air/NEXUS Air is shown. The contents

include: 1) CANPASS Air & NEXUS Air: What are they? Background? When?; 2) Iris Biometric Recognition Technology: Why did we choose it?; 3) CANPASS Air & NEXUS Air: How do they work? Application, Enrollment and Kiosk Passage; and 4) What are the benefits to members and airports?

CASI

*Canada; Biometrics; Air Transportation; Airports*

**20070028724** Defence Research and Development Canada, Ottawa, Ontario, Canada

**Future Applications in Using Biometrics to Enhance Security Level of Coalition Information Sharing Networks**

Xiao, Qinghan; Enhancing Information Systems Security through Biometrics; December 2005, pp. 32-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Define common requirements to fulfill the NATO coalition information sharing needs. Share the ideas, needs and results. Formulate policies to secure handling of biometrics Develop standards on Template format, Transmission methods, and Testing and evaluation procedures, etc.

Derived from text

*Biometrics; Policies; Security*

**20070028725** Communications Security Establishment, Ottawa, Ontario, Canada

**Communication Security Establishment Briefing on Government of Canada Biometrics Reports**

Smeaton, Drew; Enhancing Information Systems Security through Biometrics; December 2005, pp. 34-1; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Biometrics technology must be coupled with appropriate Identity Proofing to provide a strong claim of identity and to support very strong authentication in conjunction with other authentication factors. It can improve auditing for physical access control and is easy to use. The aim is to provide an introduction to Biometrics technologies and devices, highlight important issues surrounding the use of Biometrics devices and situate Biometric devices in the GoC I&A Framework as an authentication factor.

Derived from text

*Computer Information Security; Biometrics; Identities; Access Control*

**20070028726** Office of the Information and Privacy Commissioner, Toronto, Ontario, Canada

**Privacy and Biometrics: The Human Factors**

Anderson, Ken; Enhancing Information Systems Security through Biometrics; December 2005, pp. 10-1 - 10-2; In English; See also [20070028704](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Biometrics, if designed and implemented with privacy principles from the outset, can be deployed in a way that protects personal information and privacy. There are challenges to overcome to achieve this: a) Immaturity and reliability of the technology; b) Risk of biometric database being compromised; c) Potential for biometric to become de facto identity card; and d) Potential use of biometric for purposes not considered at time of collection.

Derived from text

*Privacy; Biometrics; Human Factors Engineering; Deployment; Risk*

**20070028773** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**The Effects of Social Network Centrality on Group Satisfaction**

Choi, Peter M; Mar 2007; 74 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467555; AFIT/GEM/ENV/07-M2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research was to identify how various social network centralities affect a person's satisfaction level. Simple degree centrality has been utilized to specify an individual's location in a network by measuring the number of direct links with other members in the organization (Brass & Burkhardt, 1992, 1993). This study examines how location in friendship, task, and avoidance networks affect an individual's satisfaction with the group. To determine the relationship between social network centrality and work group satisfaction, a longitudinal field study was conducted on 440 active duty enlisted military members in a leadership development training course. While most research has indicated a positive

relationship between task or friendship network centrality and satisfaction (Kilduff, Krachardt, 1993), other research suggests otherwise (Brass, 1981). The results of this study are similarly inconclusive. Task centrality only predicted work group satisfaction in one of six time periods, however the relationship was negative. Similarly, friendship network centrality predicted satisfaction in two time period, with a negative relationship. Avoidance network centrality negatively predicted work group satisfaction in two periods. These inconsistent results suggest that the relationship between network position and attitudes such as satisfaction are dynamic. This paper proposes that researchers must not neglect the dynamic nature of social networks as well as the dynamic nature of attitudes, and how they interact to influence individuals within social networks.

DTIC

*Networks; Sociology; Leadership*

**20070028833** NASA Langley Research Center, Hampton, VA, USA

**Discrete Data Transfer Technique for Fluid-Structure Interaction**

Samareh, Jamshid A.; June 25, 2007; 12 pp.; In English; 18th AIAA Computational Fluid Dynamics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 389018.02.13.01.46

Report No.(s): AIAA Paper-2007-4309; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028833>

This paper presents a general three-dimensional algorithm for data transfer between dissimilar meshes. The algorithm is suitable for applications of fluid-structure interaction and other high-fidelity multidisciplinary analysis and optimization. Because the algorithm is independent of the mesh topology, we can treat structured and unstructured meshes in the same manner. The algorithm is fast and accurate for transfer of scalar or vector fields between dissimilar surface meshes. The algorithm is also applicable for the integration of a scalar field (e.g., coefficients of pressure) on one mesh and injection of the resulting vectors (e.g., force vectors) onto another mesh. The author has implemented the algorithm in a C++ computer code. This paper contains a complete formulation of the algorithm with a few selected results.

Author

*Algorithms; Structured Grids (Mathematics); Unstructured Grids (Mathematics); Data Transfer (Computers); Computational Fluid Dynamics; Discrete Functions*

**20070029509** Carnegie-Mellon Univ., Pittsburgh, PA USA

**A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications**

Kendall, Richard P; Post, Douglass E; Carver, Jeffrey C; Henderson, Dale B; Fisher, David A; Jan 2007; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A468594; CMU/SEI-2006-TN-039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468594>

Because the development of large-scale scientific/engineering application codes is an often difficult, complicated, and sometimes uncertain process, success depends on identifying and managing risk. One of the drivers of the evolution of software engineering, as a discipline, has been the desire to identify reliable, quantifiable ways to manage software development risks. The taxonomy that follows represents an attempt to organize the sources of software development risk for scientific/engineering applications around three principal aspects of the software development activity: the software development cycle, the development environment, and the programmatic environment. These taxonomic classes are divided into elements and each element is further characterized by its attributes.

DTIC

*Computer Programming; Risk; Software Engineering; Taxonomy*

**20070029511** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Modeling and Analysis of Information Technology Change and Access Controls in the Business Context**

Moore, Andrew P; Antao, Rohit S; Mar 2007; 58 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A468600; CMU/SEI-2006-TN-040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468600>

Ongoing field work centered at the Information Technology Process Institute (ITPI) makes clear that processes that

control change and access within information technology (IT) management and operations simultaneously reduce security risk and increase efficiency and effectiveness. The CERT Coordination Center is building on this work. This technical note describes a system dynamics model that embodies CERT's current hypothesis of why and how these controls reduce the problematic behavior of the low-performing IT operation. CERT has also started to extend the model in ways that reflect the improved performance seen by high performers. In the longer term the hope is that this model will help to specify, explain and justify a prescriptive process for integrating change and access controls into organizations business processes in a way that most effectively reduces security risk and increases IT operational effectiveness and efficiency.

DTIC

*Access Control; Commerce; Computer Programming; Information Systems; Numerical Control; Software Engineering; System Effectiveness*

**20070029522** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Quality-Attribute-Based Economic Valuation of Architectural Patterns**

Ozkaya, Ipek; Kazman, Rick; Klein, Mark; May 2007; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A468620; CMU/SEI-2007-TR-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468620>

Quality attribute requirements are a driving force for software and system architecture design. Architectural patterns can be used to achieve quality attribute requirements. Consequently, architectural patterns generate value based on the present and future utility of the quality attributes they achieve. This report makes the case that architectural patterns carry economic value, in part in the form of real options, providing software architects the right, but not the obligation, to take subsequent design actions. The report shows, via a simple example, how an analysis of the options embodied within architectural patterns allows an architect or manager to make reasoned choices about the future value of design decisions, considering this value along multiple quality attribute dimensions.

DTIC

*Architecture (Computers); Computer Programming; Economics; Software Engineering*

**20070029541** Atlantic Fleet, Norfolk, VA USA

**Building the Readiness Data Warehouse**

Tysor, Sue; Jun 2000; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468682; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468682>

Organizations must manage information assets. To meet the requirement, corporate data must be analyzed, comprehended, transformed and delivered. This is the role of the data warehouse. The data warehouse will deliver business intelligence based on operational data, decision support data and external data to all business units in the organization. The program managers and resource managers at Command-in-Chief, U.S. Atlantic Fleet (CINCLANFLT) need consistent and reconciled business intelligence to manage the level of readiness of active and reserve forces. As a component command and force provider, readiness information is used by the fleet commands (FLTCINCs) to make business management decisions about which assets should be used for assigned missions. Our goal is to build a readiness data warehouse that will enable information management to change the way organizations leverage and value their information assets. With the ability to easily access information, mission delivery, resource management and data dissemination can be raised to levels previously unimagined. This paper will identify the many issues associated with the process of building our readiness data warehouse. Specifically, it addresses the need to manage complexity and presents the development methodology, data architecture and technical architecture for the readiness data warehouse.

DTIC

*Data Processing; Maintainability; Military Operations*

**20070029596** Teledyne Scientific and Imaging, LLC, Thousand Oaks, CA USA

**Ocean Wave Energy Harvesting Devices**

Cheung, Jeffrey T; Childress, III, Earl F; Apr 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): HR001-06-C-0030

Report No.(s): AD-A468837; RC71273.FR; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468837>

Development of an ocean wave energy-harvesting device that can be used as a renewable energy source for ocean

monitoring systems. The core technology is a mass-spring based high efficiency, low frequency linear generator that was integrated to a spar buoy to form a robust unit. Its dynamic sensitivity is improved by the use of a near zero friction liquid bearing. Through extensive theoretical modeling and wave tank testing, we studied the effect of enhanced heave motion due to resonance with waves and applied it to improve the energy harvesting efficiency. We also developed a computer simulation model that can accurately predict the device performance driven by a single frequency, sinusoidal forcing function. Full-scale models were fabricated and field tested in non-random waves. Power output was measure from 1.6 W to more than 6 W, depending on the device size, oscillator characteristic and wave conditions. Finally, we carried out extensive studies to build and characterize several small underwater motion energy harvesters of different designs. A complete performance metrics was established.

DTIC

*Buoys; Computerized Simulation; Energy Transfer; Marine Environments; Ocean Surface; Oceans; Water Waves*

**20070029751** Florida Univ., Gainesville, FL USA

**Path Planning Software and Graphics Interface for an Autonomous Vehicle, Accounting for Terrain Features**

Hurezeanu, Vlad; Dec 2000; 135 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469030; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469030>

A Navigation Test Vehicle (NTV) is being developed at the Center for Intelligent Machines and Robots at the University of Florida under the sponsorship of the Air Force Research Laboratory at Tyndall Air Force Base. This vehicle performs tasks to include surveying fields, laying mines, and teleoperation. The capability of the vehicle will be increased if its supporting software plans paths that take into account the terrain features. The objective of this work is to plan a survey path for a specified region taking terrain elevation data into account. A survey path is defined as a path that provides complete coverage of a defined polygonal region. This work is an extension of previous work that assumed that the region to be surveyed was flat. Now the characteristics of the vehicle, specifically the maximum allowable pitch and roll, will be accounted for when planning the path. Data that contains elevation points are available from government databases. Using three different programs the data are transformed from the vector format in which it is found to a Virtual Reality Modeling Language format in order to be viewed with a common web browser. Data are stored into a grid of m x n elements and the user selects the coordinates of the region that will be surveyed. The previous 2D algorithm is then executed in which the primary direction of the survey varies from zero to 180 degrees. For each path a cost is computed in which the cost is based on pitch and roll knowing the maximum that the vehicle can withstand. For the NTV the maximum roll and pitch angle is 15 degrees. If the pitch or roll is larger than 15 degrees a very high cost is associated with that part of the path. After each path is processed, the path with overall minimum cost is written to a file. If the minimum path contains any slopes that are inaccessible they are recorded as obstacles. The last step is an obstacle avoidance algorithm, which generates small sub-paths around the inaccessible regions.

DTIC

*Autonomous Navigation; Autonomy; Software Development Tools; Terrain; Trajectory Planning*

**20070029782** Library of Congress, Washington, DC USA

**The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities**

Figliola, Patricia M; Jul 1, 2004; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469096; CRS-IB10130; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469096>

In the early 1990s, Congress recognized that several federal agencies had ongoing high-performance computing programs, but no central coordinating body existed to ensure long-term coordination and planning. To provide such a framework, Congress passed the High-Performance Computing and Communications Program Act of 1991 (P.L. 102-194) to enhance the effectiveness of the various programs. In conjunction with the passage of the act, the White House Office of Science and Technology Policy (OSTP) released Grand Challenges: High-Performance Computing and Communications. That document outlined a research and development (R&D) strategy for high-performance computing and a framework for a multiagency program, the High-Performance Computing and Communications (HPCC) Program. The HPCC Program has evolved over time and is now called the Networking and Information Technology Research and Development (NITRD) Program, to better reflect its expanded mission. The NITRD Program is composed of 12 agencies; its members work in collaboration to increase the overall effectiveness and productivity of federal information technology (IT) R&D. A National

Coordinating Office coordinates the activities of the NITRD Program and reports to OSTP and the National Science and Technology Council.

DTIC

*Computer Programming; Federal Budgets; Information Systems; Management Planning; Productivity; Research and Development; Software Engineering*

**20070029812** Electronic Systems Center, Hanscom AFB, MA USA

**CASE Planning and the Software Process**

Humphrey, Watts S; May 1989; 33 pp.; In English

Report No.(s): AD-A469159; CMU/SEI-89-TR-026; ESD-TR-89-034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469159>

Automating a software process both magnifies its strengths and accentuates its weaknesses. Automation can make an effective process more effective, but it can make a chaotic process even worse and at considerable expense. Anyone who buys expensive tools to solve an ill-defined problem is likely to be disappointed. Unless procuring such tools is part of a thoughtful software process improvement plan, the purchase could be an expensive mistake. This report discusses software process maturity and its relationship to planning and installing computer-aided software engineering (CASE) systems. While process is not a magic answer (there isn't one), the key issues are discussed from a process perspective, and guidelines are given for avoiding the most common pitfalls. Since CASE systems can involve significant investment, an economic justification may be necessary. The relevant financial considerations are therefore discussed, and some basic steps for producing such justifications are outlined. Finally, some key considerations for introducing and using CASE systems are discussed.

DTIC

*Computer Programming; Computer Programs; Computer Techniques; Software Engineering*

**20070029831** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI**

Wall, Daniel S; McHale, James; Pomeroy-Huff, Marsha; Jun 2007; 35 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A469180; CMU/SEI-2007-TR-013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469180>

This report describes how two U.S. Naval Air Systems Command (NAVAIR) organizations integrated the use of the Software Engineering Institute's (SEI) Team Software Process (SM) methodology and the Capability Maturity Modeling (trademark) framework to progress from Maturity Level 1 to Maturity Level 4 in 30 months. This is less than half of the average time it has taken other organizations to accomplish the same maturity level progression. This case study describes the process improvement efforts of both NAVAIR groups and how they integrated the two SEI technologies to accelerate process improvement within their organizations. Finally, the report presents the key factors that allowed NAVAIR to achieve these rapid results.

DTIC

*Acceleration (Physics); Computer Programming; Software Engineering*

**20070029935** Army Research Inst. for the Behavioral and Social Sciences, Fort Benning, GA USA

**Assessment of Two Desk-Top Computer Simulations Used to Train Tactical Decision Making (TDM) of Small Unit Infantry Leaders**

Beal, Scott A; Apr 2007; 105 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A468772; ARI-RR-1869; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468772>

Fifty-two leaders in the Basic Non-Commissioned Officer Course (BNCOC) at Fort Benning, Georgia, participated in an assessment of two desk-top computer simulations used to train tactical decision making. Thirteen leaders trained with the Soldier Visualization Station (SVS) simulation, while 39 others trained with Simulation Field Exercise, or SimFX. Pre-simulation exercise measures included military and simulation experience, decision-making style, and tactical situation judgment. A questionnaire administered to leaders following simulation exercises documented their sense of personal



involvement during mission execution and their perceptions of the training value of the simulations. Leaders in both groups were assessed individually for their ability to recognize and implement sound tactical decisions while serving as a squad leader of a light Infantry squad during patrol and defense missions in an urban environment. Results suggest that, in general, the use of desk-top simulations have potential value for training the tactical decisions leaders make during exercises that require greater expenditures of resources. However, the methods used to train with simulations impacted leaders' tactical decision making, their perceptions of the training value of simulations, and their ideas about what they learned from the experience.

DTIC  
*Computerized Simulation; Decision Making; Personal Computers; Personnel*

**20070030007** Office of the Project Manager Radar Systems Intel and C3CM Systems, Hanscom AFB, MA USA

**Incident Management Capability Metrics Version 0.1**

Dorofee, Audrey; Killcrece, Georgia; Ruefle, Robin; Zajicek, Mark; Apr 2007; 229 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A468688; CMU/SEI-2007-TR-008; ESC-TR-2007-008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468688>

Successful management of incidents that threaten an organization's cyber security is a complex endeavor. Frequently an organization's primary focus on the response aspects of security incidents results in its failure to manage incidents beyond simply reacting to threatening events. The metrics presented in this document are intended to provide a baseline or benchmark of incident management practices. The incident management functions provided in a series of questions and indicators define the actual benchmark. The questions explore different aspects of incident management activities for protecting, defending, and sustaining an organization's computing environment in addition to conducting appropriate response actions. This benchmark can be used by an organization to assess how its current incident management capability is defined, managed, measured, and improved. This will help assure the system owners, data owners, and operators that their incident management services are being delivered with a high standard of quality and success, and within acceptable levels of risk.

DTIC

*Computer Information Security; Crime; Computer Networks*

## 62

### COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

**20070026361** Mitre Corp., Eatontown, NJ USA

**Applying Executable Architectures to Support Dynamic Analysis of C2 Systems**

Pawlowski, Tom; Barr, Paul C; Ring, Steven J; Jun 2004; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466014; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466014>

This paper describes the development of a methodology to import key products of the DoD Architecture Framework into an executable form to conduct a dynamic analysis of the Command and Control (C2) system or capability represented by the architecture. Dynamic analysis of these models enables a user to assess the impact of change and determine measures of performance and effectiveness. The research team successfully implemented the methodology in a demonstration that made a three-way link among a business process model, a communications network model, and a combat simulation representing the system's operational environment. We linked these models together via the Runtime Infrastructure (RTI) of the High Level Architecture (HLA). Basic HLA interactions that we established allowed key events in the combat simulation to initiate one or more business processes in the process model. As a business process proceeded in time, the process model requested from the communications model a delay time that represented the time required to pass information through the network from one node to another. We extracted measures of performance and effectiveness from the simulation runs to conduct the dynamic analysis of the system in question.

DTIC

*Command and Control; Systems Analysis*

**20070026363** Evidence Based Research, Inc., Vienna, VA USA

**Network Centric Operations Conceptual Framework Air-to-Ground Case Study**

Jun 2004; 58 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466016>

Overview of the Air/Ground Case Study: Objective; Operational Context; Scope and Assumptions; Approach; Peer Reviewers; Analysis-Vignettes, Observations, Findings, Interpretation; Conclusions, Recommendations.

DTIC

*Computer Networks; Military Operations*

**20070026392** Space and Naval Warfare Systems Center, San Diego, CA USA

**Coalition Operations with the Combined Enterprise Regional Information Exchange System (CENTRIXS)**

Carter, Brad; Harlor, Debora; Jun 2004; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466073; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466073>

This paper discusses the continued development and operation of coalition networks in support of U.S. Pacific Command's initiative to provide classified, permanent network service for bilateral and multilateral communities of interest for combined and coalition operations. The Combined Operations Wide Area Networks (COWAN) project, headed by SSC San Diego personnel, continued to grow and has recently been consolidated with the Combined Enterprise Regional Information Exchange System (CENTRIXS) program, originally designed to support U.S. Central Command requirements. The consolidation of these efforts has created a dynamic team of personnel working to meet the increasing need for secure global connectivity. Challenges continue to confront the team, primarily in getting approved and accredited technical solutions for connecting multiple classified domains to facilitate the Global War on Terrorism.

DTIC

*Information Systems; Wide Area Networks*

**20070026421** Space and Naval Warfare Systems Center, San Diego, CA USA

**Secure Enterprise Access Control (SEAC) Role Based Access Control (RBAC)**

Fernandez, Richard; Jun 2004; 85 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466126; SSC-TD-3182; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466126>

Access to resources such as applications and web services are becoming increasingly difficult to manage via access control lists (ACLs). ACLs usually consist of a client's name or unique identifier. However, resource access is usually based on client characteristics such as command assignments, clearances, and/or pay grade. If a user is reassigned, changes clearance, or is promoted, access to resources should also change. Instead, with ACLs, resource managers constantly have to evaluate personnel records to determine resource access. Such a task can become overwhelming as the number of personnel within an organization grows. Limited access to personnel records by resource managers could compound the problem. This paper discusses a government off-the-shelf-solution (GOTS) for Secured Enterprise Access Control (SEAC) Role-Based Access Control (RBAC) proposed by Richard Fernandez, Space and Naval Warfare Systems Center, San Diego (SSC San Diego) for Commander, U.S. Pacific Fleet (COMPACFLT). In an RBAC solution, a resource manager does not have to constantly query personnel records to determine resource access. The resource manager establishes conditions based on a user's characteristics (command assignments, clearances, and/or pay grade) versus their name or unique identifier. The SEAC RBAC design surpasses the NIST RBAC standard requirements and can be used by any U.S. Government organization. Chapter 1 provides the reader with a general background on RBAC and other access

DTIC

*Access Control; Security*

**20070026498** Johns Hopkins Univ., Baltimore, MD USA

**Wireless Intrusion Detection**

Tomko, Albert A; Rieser, Christian J; Buell, Louis H; Zaret, David R; Turner, William M; Mar 2007; 138 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-1-0273; Proj-4519

Report No.(s): AD-A466332; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466332>

This report describes a Wireless Intrusion Detection (WIND) system that utilized physical layer features, derived from

individual radio frequency packets, to identify network intrusions. The features considered include those intrinsic to the packet source, as well as those related to the propagation path between the source and a network access point. It is shown that the statistics of a set of packet features can be used to fingerprint each packet source in the network, thereby providing a mechanism for identifying rogue node activity, such as a spoofing attack. Empirical results are presented for IEEE 802.11b networks. Initial test results suggest WIND can achieve a 99% probability of detection with a 10% false alarm rate.

DTIC

*Detection; Local Area Networks; Warning Systems; Wireless Communication*

**20070026505** Maryland Univ., College Park, MD USA

**Key Establishment in Heterogeneous Self-Organized Networks**

Taban, Gelareh; Safavi-Naini, Rei; Jan 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-3-0001

Report No.(s): AD-A466341; TR-2007-6; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466341>

Traditional key pre-distribution schemes in sensor and ad hoc networks rely on the existence of a trusted third party to generate and distribute a key pool. The assumption of a single TTP however can be very strong in practice, especially when nodes belong to different domains and they come together in an ad hoc manner. Other important motivations to omit a TTP include preservation of privacy in a network as well as reducing the required knowledge base for the usage of sensor networks. In this work we show the shortcomings of the previous approaches [3, 13] in terms of both efficiency and security. By incorporating a heterogeneous network we show that we can dramatically reduce the load on resource constrained while also increasing their security. We also propose a new strengthened security model for self-organized ad hoc networks and evaluate the security of our protocol in this model. We evaluate the correctness of the protocol and show that we can achieve network connectivity with very high probability.

DTIC

*Computer Information Security; Heterogeneity; Networks*

**20070026508** NGI Systems, Manlius, NY USA

**Integrated Information Management (IIM)**

McIlvain, Jason; Mar 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-C-0263; Proj-IIMS

Report No.(s): AD-A466348; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466348>

Information Technology is the core capability required to align our resources and increase our effectiveness on the battlefield by integrating and coordinating our preventative measures and responses along with the tools used to perform them. To win the War on Terrorism, the US defense strategy requires information superiority to secure our advantage over adversaries. This focus on technology is identical to Joint Vision 2020's goal of information dominance, and the Joint Services' focus on network-centric warfare. As learned through the RestOps and CASPOD ACTDs, systems must be built to shift, grow, and shrink as the context of their use changes. As stated in Joint Vision 2020, this capability will allow commanders to bring together the correct mix of assets at the place and time most favorable to success. Systems providing these characteristics are largely unavailable and a high priority need for battle management. This report discusses the requirements of an integrated management system and progress on the effort.

DTIC

*Data Processing; Information Management; Information Systems; Systems Integration*

**20070026526** Florida Univ., Gainesville, FL USA

**Multicast Performance Analysis for High-Speed Torus Networks**

Oral, S; George, A; Jan 2002; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466383; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466383>

Overall efficiency of high-performance computing clusters not only relies on the computing power of the individual nodes, but also on the performance that the underlying network can provide to the computational application. Although modern high-performance networks, especially System Area Networks (SANs), have high unicast performance, they do not support multicast communication in hardware. This research experimentally evaluates the performance of various protocols

for unicast-based and path-based multicast communication on high-speed torus networks. Software-based multicast performance results of selected algorithms on a 16-node Scalable Coherent Interface (SCI) torus are given. The strengths and weaknesses of the various protocols are illustrated in terms of startup and completion latency, CPU utilization, and link utilization and concurrency.

DTIC

*Communication Networks; High Speed; Interprocessor Communication; Reliability Analysis; Topology; Toruses*

**20070026529** Florida Univ., Gainesville, FL USA

**Adaptive Sampling for Network Management**

Hernandez, Edwin A; Chidester, Matthew C; George, Alan D; Jan 2000; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466387; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466387>

High-performance networks require sophisticated management systems to identify sources of bottlenecks and detect faults. At the same time, the impact of network queries on the latency and bandwidth available to the applications must be minimized. Adaptive techniques can be used to control and reduce the rate of sampling of network information, reducing the amount of processed data and lessening the overhead on the network. Two adaptive sampling methods are proposed in this paper based on linear prediction and fuzzy logic. The performance of these techniques is compared with conventional sampling methods by conducting simulative experiments using Internet and video conference traffic patterns. The adaptive techniques are significantly more flexible in their ability to dynamically adjust with fluctuations in network behavior, and in some cases they are able to reduce the sample count by as much as a factor of two while maintaining the same accuracy as the best conventional sampling interval. The results illustrate that adaptive sampling provides the potential for better monitoring, control, and management of high-performance networks with higher accuracy, lower overhead, or both.

DTIC

*Adaptation; Networks; Sampling*

**20070026540** Virginia Univ., Charlottesville, VA USA

**Efficient Hierarchic Management for Reconfiguration of Networked Information Systems**

Rowanhill, Jonathan C; Varner, Philip E; Knight, John C; Jan 2004; 11 pp.; In English

Contract(s)/Grant(s): N66001-00-8945; F30602-01-1-0503

Report No.(s): AD-A466410; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466410>

The management of modern distributed systems is complicated by scale and dynamics. Scalable, decoupled communication establishes flexible, loosely coupled component relationships, and these relationships help meet the present demands on management. However, traditional decoupled addressing mechanisms tend to focus the addressing on only one of the parties involved in communication while, in general, a communication relationship involves a sender, communicated content, and receivers. The state of all three are simultaneously relevant to correctness of a management relationship and its communications. We introduce Selective Notification, a scalable, decoupled event dissemination architecture supporting simultaneous and combined addressing of senders, receivers, and events. We demonstrate its application to programming dynamic, scalable management relationships. We then discuss its implementation, and present measurements of its effective capabilities.

DTIC

*Information Systems; Interprocessor Communication; Management Information Systems*

**20070026547** Virginia Univ., Charlottesville, VA USA

**User-Level QoS-Adaptive Resource Management in Server End-Systems**

Abdelzaher, Tarek F; Shin, Kang G; Bhatti, Nina; May 2003; 9 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0576; EIA-980620

Report No.(s): AD-A466422; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466422>

Proliferation of QoS-sensitive client-server Internet applications such as high-quality audio, video-on-demand, e-commerce, and commercial web hosting has generated an impetus to provide performance guarantees. These applications require a guaranteed minimum amount of resources to operate acceptably to the users, thus calling for QoS-provisioning

mechanisms. One good place to locate such mechanisms is in server communication subsystems. Server-side communication subsystems manage an increasing number of connection end-points, thus readily controlling important bottleneck resources. We propose, implement, and evaluate a novel communication server architecture that maximizes the aggregate utility of QoS-sensitive connections for a community of clients even in the case of overload. A contribution of this architecture is that it manages QoS from the user space and is transparent to the application. It does not require modifications to the OS kernel, which improves portability and reduces development cost. Results from an experimental evaluation on a microkernel indicate that it achieves end-system overload protection and traffic prioritization, improves insulation between independent clients, adapts to offered load, and enhances aggregate service utility.

DTIC

*Adaptation; Client Server Systems; Internets; Interprocessor Communication; Resources Management*

**20070026590** Lockheed Martin Corp., Orlando, FL USA

**Combined Enterprise Regional Information Exchange System (CENTRIXS): Supporting Coalition Warfare World-Wide**

Boardman, Jill L; Shuey, Donald W; Apr 2004; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466528>

The joint Combatant Commanders require responsive information exchange between combined forces and the joint combatant commands region-to-region for global operations. CENTRIXS (Combined Enterprise Regional Information Exchange System) is the premier network for coalition interoperability in support of military operations. Ongoing coalition operations continue to test and prove the viability of the CENTRIXS enterprise. Information flow to coalition partners via the multiple versions of CENTRIXS networks achieved unprecedented volume and continues to expand. CENTRIXS dissemination capabilities must become even more robust as the trend to move more command and control operations to the coalition networks continues. CENTRIXS is designed to one day form a single, common, global, multinational data network. To achieve this goal, a certified security technology solution to allow confidential, multi-level information sharing over a single network is desperately needed. The only option today is proliferation of multiple separate networks to support the various coalition operations and bilateral exchanges. Security technology to allow separate, simultaneous communities of interest across common network transport is key to future coalition networking.

DTIC

*Command and Control; Information Systems; Warfare*

**20070026638** Library of Congress, Washington, DC USA

**Network Centric Operations: Background and Oversight Issues for Congress**

Wilson, Clay; Mar 15, 2007; 56 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466624; CRS-RL32411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466624>

Network Centric Operations (also known as Network Centric Warfare) is a key component of DOD planning for transformation of the military. Network Centric Operations (NCO) relies on computer equipment and networked communications technology to provide a shared awareness of the battle space for U.S. forces. Proponents say that a shared awareness increases synergy for command and control, resulting in superior decision-making, and the ability to coordinate complex military operations over long distances for an overwhelming war-fighting advantage. NCO technology saw limited deployment in Afghanistan and, more recently, increased deployment in Operation Iraqi Freedom (OIF). This report describes technologies that support NCO, and includes (1) questions about possible vulnerabilities associated with NCO; (2) a description of electronic weapons, and other technologies that could be used as asymmetric countermeasures against NCO systems; (3) descriptions of several key military programs for implementing NCO; (4) a list of other nations with NCO capabilities; and, (5) a description of experiences using NCO systems in recent operations involving joint and coalition forces. The final section raises policy issues for NCO that involve planning, network interoperability, acquisition strategies, offshore outsourcing, technology transfer, asymmetric threats, coalition operations, and U.S. military doctrine. Appendices to this report give more information about the global network conversion to Internet Protocol version 6 (IPv6), views on Metcalfe's Law of Networks, and possible perverse consequences of data-dependent systems. This report will be updated to accommodate significant changes.

DTIC

*Command and Control; Internets; Warfare*

**20070026654** Defence Science Technology Lab., Malvern, UK

**Potential System Vulnerabilities of a Network Enabled Force**

Houghton, Peter; Sep 2004; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466659; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466659>

The intent of the UK Network Enabled Capability (NEC) initiative is to gain military advantage through greater inter-working of organizations, people and equipment. It aims to achieve this by exploiting commercial sector information technology, and associated organizational concepts, and adapting them to the defense environment. However, the technology and associated concepts do not only confer benefits, they also bring with them penalties, risks and system vulnerabilities. Such penalties, risks and system vulnerabilities could potentially be very harmful, particularly if they occur at operationally critical times. It is thus imperative that the military and research communities remain vigilant, do not seek to emphasize only the positive and consider how such penalties and vulnerabilities might occur and how they might be mitigated. This paper provides a brief review of some of the potential negative consequences of moving to a Network-Enabled future that have appeared in the open literature. As a consequence, this paper will not expose genuinely new or novel issues, particularly as the ground of vulnerabilities has previously been relatively well-trodden. However, it does attempt to aid those engaged in NCW endeavors in understanding the potential scale and extent of the problems they face, by bringing a number of the different sources and sets of issues together in a single place.

DTIC

*Communication Networks; Vulnerability*

**20070026704** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Proving Atomicity: An Assertional Approach**

Chockler, Gregory; Lynch, Nancy; Mitra, Sayan; Tauber, Joshua; Jul 22, 2005; 17 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0121; F33615-01-C-1896

Report No.(s): AD-A466773; MIT-CSAIL-TR-2005-048; MIT-LCS-TR-995; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466773>

Atomicity (or linearizability) is a commonly used consistency criterion for distributed services and objects. Although atomic object implementations are abundant, proving that algorithms achieve atomicity has turned out to be a challenging problem. In this paper, we initiate the study of systematic ways of verifying distributed implementations of atomic objects, beginning with read/write objects (registers). Our general approach is to replace the existing operational reasoning about events and partial orders with assertional reasoning about invariants and simulation relations. To this end, we define an abstract state machine that captures the atomicity property and prove correctness of the object implementations by establishing a simulation mapping between the implementation and the specification automata. We demonstrate the generality of our specification by showing that it is implemented by three different read/write register constructions: the message-passing register emulation of Attiya, Bar-Noy and Dolev, its optimized version based on real time, and the shared memory register construction of Vitanyi and Awerbuch. In addition, we show that a simplified version of our specification is implemented by a general atomic object construction based on the Lamport's replicated state machine algorithm.

DTIC

*Atomic Physics; Distributed Processing; Linearity*

**20070026768** National Defense Univ., Washington, DC USA

**Transforming Intra- and Interagency Processes through Advanced Models and Simulations: An Information Assurance Model**

Hunt, Carl W; Jun 2003; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467318; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467318>

Collaboration among government organizations offers a venue for dramatic improvement in times of national stress. In no technical area is there a greater requirement for collaboration and cooperation than in the field of Information Assurance. Recent innovations in agent-based modeling and other information technologies offer potential for significant progress in improving intra- and interagency processes in Information Assurance and other disciplines. This paper demonstrates how a convergence of Stuart Kauffman's Patches Theory with Agent-Based Evidence Marshaling can lead to new ways of visualizing

and leveraging areas for cooperation among US government organizations and the policies that guide them.  
DTIC

*Access Control; Models; Numerical Control; Simulation*

**20070026789** National Security Space Architect, Alexandria, VA USA

**Communications Architecture Recommendations to Enable Joint Vision 2020**

Armstrong, R B; Jun 2003; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467450; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467450>

The Mission Information Management (MIM) Communications Architecture provides a framework to develop an integrated space, air, and terrestrial communications network that supports all national security users (DoD, Intelligence Community, and civil), all information domains, and all levels of classification. The architecture provides a basis for developing a communications investment strategy to satisfy Joint Vision 2020 imperatives. The architecture framework consists of an integrated, internetted high capacity space backbone, high capacity terrestrial gateways, fiber entry points, airborne communications nodes, and software programmable tactical terminals that are handheld or embedded on weapons platforms. Dynamic routing, prioritization, and bandwidth allocation in space, air, and terrestrial layers ties the architecture together, eliminates stovepipes. An NSSA led Architecture Development Team comprised of thirty stakeholder organizations developed the architecture and a set of proposed recommendations for presentation to the NSSA Senior Steering Group.

DTIC

*Communication Networks; Security*

**20070026790** Air Force Research Lab., Brooks AFB, TX USA

**Using Work-Centered Support System Technology to Enhance Command and Control**

Kuper, Samuel R; Scott, Ron; Eggleston, Robert G; Jun 2003; 44 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467451; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467451>

As information systems technology continues to evolve, new opportunities arise to more fully harness its power to enhance user and organizational performance. Concepts such as Network Centric Warfare envision unprecedented access to types and amounts of information and data. User interface technologies and system design methodologies must also evolve in order to fulfill the Network Centric Warfare vision and allow us to build human-centered systems which leverage these advances without overloading or confusing the end user -- systems that work together with the user to enable efficient work. We are developing Work-Centered Support System technology, which focuses on supporting all user work activities, including decisions, through a single interface client designed to capitalize on universally available data as afforded by the Network Centric Warfare and similar concepts. The WCSS technology is an analysis and design methodology for building interface clients which enable a tight coupling of the human and computer with a goal of maximizing work effectiveness and efficiency. This paper describes a demonstration prototype of the WCSS technology called the Work-Centered Support System for Global Weather Management. The WCSS-GWM uses intelligent agent technology, cognitive analysis and new user interface design techniques to enable command and control users in an airlift services firm to proactively manage and mitigate mission impacts due to changing weather events. It has also begun to provide insight into ways interface agents can be efficiently incorporated into user interface clients.

DTIC

*Command and Control; Information Systems; Support Systems; Technology Assessment*

**20070026822** Air Force Research Lab., Rome, NY USA

**Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management**

Rico, Helen M; Hall, Fred; Paugh, Francesca; Smith, Jacqueline; Born, Frank; Bosco, Wayne; Jun 2003; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467593; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467593>

Timely, accurate, and secure information is essential to the Air Force Research Laboratory (AFRL), Information Directorate (IF), Rome, New York, whose mission is to provide superior information systems in support of the war fighter. With such information, improved decisions can be made regarding financial, acquisition, and personnel matters. In this paper the authors describe an automated Program Management capability newly deployed for use by all scientists, engineers,

contracting, financial and management personnel working at the Air Force Research Laboratory, Information Directorate. It is important to recognize, the application currently has over 66% of its users logging into a .mil network from a .com or .edu world. Security is a significant factor that must be considered when allowing users outside of a .mil environment to access this Program Management System. Moreover, current Department of Defense (DoD) and Air Force (AF) regulations do not adequately address this new environment. This paper will describe the Program Management System and the local procedures implemented to ensure the system remains secure and the challenges associated with the effort. Additionally, this paper will include a description of user's roles and responsibility, how access is granted, the traceability aspect of the system, and finally sustainment issues.

DTIC

*Internets; Laboratories; Project Management; Research Management; Security*

**20070026861** Naval Postgraduate School, Monterey, CA USA

**Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000**

Hutchins, Susan G; Kemple, William G; Poirier, John A; Hocevar, Susan P; Jun 2001; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468208; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468208>

Global Wargame 2000 addressed the theme of Network Centric Operations (NCO) with the objective of providing insight into future operations for a distributed, network-centric Joint Force. Network-centric operations are postulated to offer information advantages that include significantly improved capabilities for accessing and sharing information. These improved capabilities will be dependent on emergent technologies, new processes, and novel ways of organizing to enable operators to leverage the anticipated information advantage and reap the full benefits afforded by a distributed, networked organization. New variables and metrics to assess these benefits are currently under development. One variable, described as the information domain is influenced by several factors, including the performance of operators, the performance of sensors, and the characteristics and performance of the relevant information infrastructure, or infostructure, that links battlespace entities. Global Wargame 2000 was an attempt to gain insight into how to implement these new organizational forms and processes, with the information infrastructure provided by a networked set of well-informed but geographically dispersed forces. This paper will address some of the issues that contributed to developing an effective infostructure for an interoperable command and control organization during global Wargame 2000.

DTIC

*Decision Making; Decision Support Systems; Information Transfer; Interoperability; War Games*

**20070027329** Naval Postgraduate School, Monterey, CA USA

**Route Optimization for Mobile IPV6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis**

Kandirakis, Ioannis; Mar 2007; 121 pp.; In English

Report No.(s): AD-A467151; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Mobile IPv6 is an IP-layer mobility protocol that is designed to provide mobility support, allowing an IPv6 node to arbitrarily change its location on the IPv6 Internet and still maintain existing connections by handling the change of addresses at the Internet layer using Mobile IPv6 messages, options, and processes that ensure the correct delivery of data regardless of the mobile node's location. Return Routability is an infrastructureless, lightweight procedure that enables a mobile IPv6 node to request another IPv6 node (maybe unaware of mobility) to test the ownership of its permanent IPv6 address in both its home network and its temporary address in the current IPv6 network; and authorizes a binding procedure by the use of a cryptographic token ezohange The main objective of this research effort is to build a test bed for investigating the vulnerabilities of the Mobile IPv6 OR procedure. The test bed shall facilitate the enactment and analysis of the effects of specific threats on the hosts and the network. While this thesis is not about discovering new vulnerabilities or evaluating countermeasures, the resulting test bed and software shall lay the necessary groundwork for future research in those directions.

DTIC

*Computer Information Security; Internets; Mobility; Routes; Security; Test Stands; Wide Area Networks*

**20070027330** Naval Postgraduate School, Monterey, CA USA

**Static Reachability Analysis and Validation Regarding Security Policies Implemented via Packet Filters**

Kantz, Stephen M; Mar 2007; 69 pp.; In English

Report No.(s): AD-A467157; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ability to statically determine what kinds of packets can be exchanged between two hosts on a network is desirable



to those who design and operate networks but this is a difficult and complex problem. Factors affecting reachability analysis are packet filters routing policies and packet transformations. The number of variables within and among networks is intractable for manual computation. A proposed solution to this mess is a tractable framework for which to map networks into thus creating a single unified model for analysis. It depends heavily on the use of transforming the problem into a classical graph problem that can be solved with polynomial time algorithms such as transitive closure. This research develops an automated validation process to test the reachability upper bound calculated from a recent implementation of the framework which focuses specifically on the packet filter aspect namely access control lists. Real-world network configuration files and network packet flow data from a Tier-i Internet Service Provider is supplied as the data set. A significant contribution of this thesis is the application of real-world data to the proposed method for static reachability analysis as it pertains to the static testing of security policies applied via packet filters.

DTIC

*Communication Networks; Policies; Protocol (Computers); Security; Static Tests*

**20070027334** Naval Postgraduate School, Monterey, CA USA

**An Evaluation Methodology for Protocol Analysis Systems**

Hoffmeister, Chris W; Mar 2007; 263 pp.; In English

Report No.(s): AD-A467175; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Current day communication systems rely on protocols to provide secure communications among parties. Weaknesses in protocols, at first thought to be secure, have been found through deep analysis. There are many systems that have been designed to provide a means to test the various security characteristics of communication protocols. We present an evaluation methodology that can be used to evaluate protocol analysis systems based on their scope, correctness, performance, and usability characteristics. We apply portions of the methodology to a set of protocol analysis systems to show the evaluation methodology in action.

DTIC

*Cryptography; Protocol (Computers); Telecommunication*

**20070027336** Naval Postgraduate School, Monterey, CA USA

**A Security Risk Measurement for the RAdAC Model**

Britton, David W; Brown, Ian A; Mar 2007; 89 pp.; In English

Report No.(s): AD-A467180; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this thesis is to provide a quantification process for the risk module of the NSA RAdAC model. The intent is to quantify the risk involved in a single information transaction. Additionally, this thesis will attempt to identify the risk factors involved when calculating the total security risk measurement. This list is not intended to be an all-inclusive list of every factor associated with a transaction. Rather, we intend to supply a pragmatic list that is easily scalable to specific situations to include those factors which have the greatest effect on the total security risk measurement. In addition, we have asked experts in multiple fields to provide us with their opinion on the weighting of the risk factors. Finally, these weight sets and concomitant risk factors will be tested for accuracy in an Excel model.

DTIC

*Access Control; Numerical Control; Risk; Security*

**20070027359** Naval Postgraduate School, Monterey, CA USA

**Extending Simple Network Management Protocol (SNMP) Beyond Network Management: A MIB Architecture for Network-Centric Services**

Gateau, James; Mar 2007; 183 pp.; In English

Report No.(s): AD-A467271; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The promise of the Global Information Grid (GIG) includes connecting sensors, shooters and decision-makers who may not be physically co-located in a manner efficient for combat employment, decision-making and information sharing. Current information architecture strategies, such as Network-Centric Enterprise Services have started down one path, requiring the implementation of a Service Oriented Architecture (SOA) and all the requisite underpinnings thereof. These are, for an organization the size of the DoD, a very large problem set in and of themselves. An additional unfortunate side effect of choosing a conventional SOA as the backdrop for the GIG is that only those devices capable of running an entire web server/database stack are able to participate in the architecture, effectively excluding computationally constrained devices. Additionally, the connectivity requirements in a conventional SOA restrict participation by bandwidth-constrained and

intermittently connected entities. This thesis investigates one possible solution, utilizing SNMP as the language and mechanism for sharing data between disparate systems. Specific decision-support MIBs will be developed to allow transmission of decision-specific information in both push (TRAP/SET) and pull (GET) directions.

DTIC

*Networks; Protocol (Computers)*

**20070027378** Naval Postgraduate School, Monterey, CA USA

**Analysis of USA' Broadband Policy**

Uzarski, Joel S; Mar 2007; 163 pp.; In English

Report No.(s): AD-A467327; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Broadband Internet access has become an important service that affects the economic and social makeup of a country. Broadband penetration is becoming extremely important as globalization starts to interweave the economies and policies of nations around the world. With every month that passes, the USA fails to close the gap in the digital divide both inside its borders as well as among the other countries that lead the world in broadband penetration. The lack of strong market competition among broadband providers and failing governmental policies is partly to blame. A brief overview of broadband technologies as well as an analysis of the USA broadband market is undertaken and compared with some other countries in order to establish a baseline comparison. The USA has long been known as a leading innovator in technology and services. However, the lack of competition to bring higher speeds, lower costs, and universal access has pushed the USA out of the top ten world-wide in broadband Internet penetration. This Thesis explores how the USA could close the digital divide and become a world leader in broadband penetration and innovation.

DTIC

*Broadband; Internets; Penetration; Policies; United States*

**20070027386** Naval Postgraduate School, Monterey, CA USA

**Risk of Cyberterrorism to Naval Ships Inport Naval Station Everett: A Model Based Project Utilizing SIAM**

Tester, Rodrick A; Mar 2007; 95 pp.; In English

Report No.(s): AD-A467365; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Based on numerous high level concerns that the cyber threat is expected to increase, as well as the already documented uses of cyber warfare, it is necessary to ensure our naval ships are hardened against such attacks. In doing so, an influence net model was designed to discover the likelihood of a successful cyber attack. However, first it was necessary to establish what the best mitigation tools are in defense of cyber attack methods. In order to do so, an expert opinion survey was designed and completed by individuals currently working in the field of network security. In combination with the expert opinion surveys and in looking at research and established security techniques it should become apparent whether or not ships are taking all the required steps to best secure themselves against an attack. Though the initial model was designed around a theoretical Naval Station Everett ship, with modification the model can be utilized for any naval asset throughout the USA and the risk for each particular U.S. asset can be evaluated. Additionally, this tool can also facilitate security funding as well as establishing a means of prioritizing the tools for protection if the network needs to be hastily re-established after an attack. Ultimately, the protection of a ship's computer networks against cyber terrorist threats is fundamental in ensuring continued effective command and control and ultimately the security of this nation.

DTIC

*Risk*

**20070027388** Naval Postgraduate School, Monterey, CA USA

**Hacking Social Networks: Examining the Viability of Using Computer Network Attack Against Social Networks**

Schuhart, II, Russell G; Mar 2007; 73 pp.; In English

Report No.(s): AD-A467374; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Social Network Analysis (SNA) has been proposed as a tool to defeat transnational terrorist groups such as Al Qaeda. However, SNA is a descriptive tool that is a product of sociology and not an offensive tool used to attack a social network. SNA was not designed to destabilize covert networks that are difficult to observe and penetrate. This work presents a possible way to improve SNA's performance against a covert social network by employing the Computer Network Attack (CNA) model. The CNA model is used by computer network security to represent the traditional approach to hacking a computer network. Although not tested in this paper, it is argued that the CNA model should be able to improve the accuracy of SNA when applied to a covert social network by standardizing the destabilization process and allowing for frequent challenges of

operating assumptions. A history and overview of both computer networks and social networks is covered to allow for a comparison of the two networks. The networks have enough similarities to allow the application of the CNA model without major modification from its original form. Assumptions about the security of computer and social networks are examined to clarify how the CNA model can attack a social network. The model is examined for validity and the conclusion is that the CNA model can incorporate SNA into a more methodical approach to achieve better results than using SNA alone. The final portion of the paper details a possible implementation of the CNA model and how it can be used as part of an offensive effort to destabilize a covert social network.

DTIC

*Computer Networks; Network Analysis; Viability*

**20070027446** Naval Postgraduate School, Monterey, CA USA

**A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking**

Bordetsky, Alex; Cook, Glenn R; Kemple, Bill; Thate, Timothy; Sep 2002; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467581; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The implications of using peer-to-peer communications within an urban environment are significant for military applications. From a networking perspective, the use of wireless technologies to support collaborative communications may have impacts on bandwidth and spectrum utilization. This paper explores the effects of wireless peer-to-peer (P2P) network behavior on the performance of collaboration support applications. The results achieved during the limited objective experiment conducted by the Naval Postgraduate School demonstrate significant effects of roaming on application-sharing performance and integration with client-server applications. The authors discuss the wireless network operation challenges leading to the solutions for scaling up application-sharing and improving collaborators' self-organizing behavior.

DTIC

*Client Server Systems; Communication Networks; Local Area Networks; Warfare; Wireless Communication*

**20070027480** General Accounting Office, Washington, DC USA

**Defense Acquisitions. Improved Management and Oversight Needed to Better Control DOD's Acquisition of Services**

May 10, 2007; 22 pp.; In English

Report No.(s): AD-A467693; GAO-07-832T; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Numerous persistent problems have resulted in reduced effectiveness and have exposed DOD to unnecessary risks when acquiring services. The growth in obligations on service contracts from \$85.1 billion in fiscal year 1996 to more than \$151 billion in fiscal year 2006 reflects a growing reliance on contractors to provide a range of mission-critical services. At the same time, DOD's civilian workforce was downsized without sufficient attention to requisite skills and competencies. Within this environment, our work, as well as that of some agency Inspectors General, have identified numerous instances of weak business practices poorly defined requirements, inadequate competition, insufficient guidance and leadership, inadequate monitoring of contractor performance, and inappropriate uses of other agencies contracts and contracting services. Collectively, these problems expose DOD to unnecessary risk, complicate efforts to hold DOD and contractors accountable for poor acquisition outcomes, and increase the potential for fraud, waste, or abuse of taxpayer dollars. DOD's structure and processes for managing services do not position the department to make service acquisitions a managed outcome. DOD has taken some actions to improve its management of services, including developing a competency model for its contracting workforce; issuing policies and guidance to improve DOD's management of contractors supporting deployed forces and its use of interagency contracts; and developing an integrated assessment of how best to acquire services. DOD leadership will be critical for translating this assessment and other actions into effective frontline practices. At this point, however, DOD does not know how well its services acquisition processes are working and whether it is obtaining the services it needs while protecting DOD's and the taxpayer's interests.

DTIC

*Acquisition; Leadership; Systems Integration*

**20070027489** Naval Postgraduate School, Monterey, CA USA

**Bridging the Gap in Port Security; Network Centric Theory Applied to Public/Private Collaboration**

Wright, Candice L; Mar 2007; 80 pp.; In English

Report No.(s): AD-A467714; No Copyright; Avail.: Defense Technical Information Center (DTIC)

'Achieving awareness in the maritime domain, including intelligence and information sharing at all levels of government

is a key to our maritime security. Better awareness of what is out there leads to better unity of effort in maritime planning and operations. We need to have a common operating picture. We also need to integrate our operational capabilities and efforts with our private sector partners to better prepare for, respond to, and recover from incidents.' Admiral Thad Allen, 2007 The application of Network Centric Warfare theory enables all port stakeholders to better prepare for a disaster through increased information sharing and collaboration. Currently, a significant gap in connectivity exists among the many entities responsible for securing the intermodal supply chain throughout the port complex. The research conducted in this thesis creates an architecture using the theory of Network Centric Warfare to perpetuate a cycle of preparedness in a seaport, thus enhancing situational awareness for improved security. As a result of the research conducted in this thesis, the architecture is being applied in the Port of Los Angeles/ Long Beach in the form of a public/private 'virtual maritime fusion center' to fill the gap between stakeholders thus improving overall maritime domain awareness.

DTIC

*Computer Networks; Security*

**20070027544** Library of Congress, Washington, DC USA

### **Homeland Security -- Reducing the Vulnerability of Public and Private Information Infrastructures to Terrorism: An Overview**

Seifert, Jeffrey W; Dec 12, 2002; 27 pp.; In English

Report No.(s): AD-A467827; CRS-RL31542; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report assesses the impact of the September 11, 2001 attacks on public and private information infrastructures in the context of critical infrastructure protection, continuity of operations (COOP) planning, and homeland security. Analysis of the effects of the terrorist attacks suggests various lessons learned. These lessons support three general principles. The first principle emphasizes the establishment and practice of comprehensive continuity and recovery plans. One lesson learned in this area is to augment disaster recovery plans. Businesses and agencies, who now must consider the possibility of complete destruction and loss of a building, may need to augment their disaster recovery plans to include the movement of people, the rapid acquisition of equipment and furniture, network connectivity, adequate workspace, and more. A corollary to this lesson learned is the need to assure that recovery procedures are well-documented and safeguarded so that they can be fully utilized when necessary. A second lesson is the need to back up data and applications. Without a comprehensive backup system that captures more than just an organization's data files, a significant amount of time can be lost trying to recreate applications, organize data, and reestablish user access. A corollary to this lesson learned is the need to fully and regularly test backup sites and media to ensure their reliability and functionality. The second principle focuses on the decentralization of operations and the effectiveness of distributed communications. Industry experts suggest recovery sites be located at least 20-50 miles away from the primary work site. Another lesson in this area is to ensure the ability to communicate with internal and external constituencies. The third principle involves the institutionalization of system redundancies to eliminate single points of weakness. The lesson of employing redundant service providers is applied primarily to telecommunications services.

DTIC

*Protection; Redundancy; Security; Vulnerability*

**20070027713** Space and Naval Warfare Systems Command, San Diego, CA USA

### **Bilateral Interoperability through Enterprise Architecture**

Catania, Glen A; Hamilton, Jr , John A; Rosen, J D; Melear, John; Oct 2000; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468341; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper addresses the important role of architecture planning for ensuring system interoperability in a network-centric coalition environment. As U.S. forces become more dependent upon coalition partners to support crises around the globe, systems interoperability becomes a major concern. This problem is more acute in the Pacific theater, where the USA has numerous bilateral agreements with allied nations and the degree of interoperability varies from country to country. A key to understanding interoperability shortfalls is documenting the 'as is' architecture for each allied nation to identify key information exchange requirements for critical C2 nodes. Enterprise architecture planning considers both the tactical and strategic need for information exchange in supporting the organization's mission. This is especially true with the plethora of C4ISR systems scattered throughout the U.S. Pacific Command (USPACOM) theater of operations where access to secure, quality data is vital to ongoing operations. HQ USPACOM recognized the need for documenting baseline architectures with the publication of USCINCPAC Instruction 2010-4. This instruction provided guidance to component commands on how to describe and construct systems and operational architectures. The Joint Forces Program Office was asked to assist with this effort at U.S. Alaskan Command (USALCOM) in the fall of 1999. The USALCOM architecture study, using a prototype

version of the Joint C4I Architecture Planning System (JCAPS), illustrated the utility of having a clearer picture of the enterprise architecture described in common lexicon, and the need to consolidate the numerous architectures that had been developed in recent years. In this paper, the authors outline a practical strategy for consolidating existing C4ISR architectures. Using their practical architectural success at USALCOM, they suggest that this methodology can be applied across large, combined, theaters of operation.

DTIC

*Command and Control; Consolidation; Interoperability; Military Operations*

**20070028425** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Approximate Analysis of an Unreliable M/M/2 Retrial Queue**

Crawford, Brian P; Mar 2007; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468454; AFIT/GOR/ENS/07-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis considers the performance evaluation of an M/M/2 retrial queue for which both servers are subject to active and idle breakdowns. Customers may abandon service requests if they are blocked from service upon arrival, or if their service is interrupted by a server failure. Customers choosing to remain in the system enter a retrial orbit for a random amount of time before attempting to re-access an available server. We assume that each server has its own dedicated repair person, and repairs begin immediately following a failure. Interfailure times, repair times and times between retrials are exponentially distributed, and all processes are assumed to be mutually independent. Modeling the number of customers in the orbit and status of the servers as a continuous-time Markov chain, we employ a phase-merging algorithm to approximately analyze the limiting behavior. Subsequently, we derive approximate expressions for several congestion and delay measures. Using a benchmark simulation model, we assess the accuracy of the approximations and show that, when the algorithm assumptions are met, the approximation procedure yields favorable results. However, as the rate of abandonment for blocked arrivals decreases, the performance declines while the results are insensitive to the rate of abandonment of customers preempted by a server failure.

DTIC

*Approximation; Client Server Systems*

**20070028427** Northern Command, Peterson AFB, CO USA

**USNORTHCOM Integrated Architecture: A Means to an End**

Beamer, Raymond; Henning, Paul; Cullen, Richard; Sep 14, 2004; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466477; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466477>

Overview of the presentation: USA Northern Command-Who We Are; Architecture in the Federal Government; Architecture Development and Processes at US Northern Command; US Northern Command Architecture Tool; US Northern Command Architecture Status and Progress.

DTIC

*Architecture (Computers); United States*

**20070028454** PA Consulting Group, Inc., London, UK

**Application of NCO Conceptual Framework to US/UK Coalition Combat Operations during Operation Iraqi Freedom**

Boehmer, Greg; McDougall, Ian; Jun 15, 2004; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466123>

Research objectives: Assess the effectiveness of a networked force relative to a non-networked comparator utilizing the NCO Conceptual Framework as the vehicle for research; Identify levels of effectiveness related to the degree of networking; Evaluate the following hypothesis: During Operation TELIC/IRAQI FREEDOM, the direct accessibility to network centric operations (NCO) capabilities by UK and US units provided: Improved individual sense-making; Enhanced the quality of interactions; Improved shared sense-making; Increased mission effectiveness & relative to previous operations and training without NCO capabilities.

DTIC

*Combat; Networks; System Effectiveness*

**20070028507** Veridian, Brooks AFB, TX USA

**Distributed Command and Control Research: Networking Multiple Simulation Platforms**

Barnes, Christopher; Elliott, Linda R; Tessier, Phil; Petrov, Plamen; Sep 2002; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467660; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Air Force is positioned to take full advantage of Internet2 technologies and apply them to Command and Control (C2) research. This paper summarizes and updates progress on the Air Force's Distributed Mission Training Research Network (DMT-Rnet), an Internet2 based network for collaborative research and training via distributed PC-based systems. This network hosts complex environments for multi-operator simulation-based training and performance research.

DTIC

*Active Control; Command and Control; Control Simulation; Distributed Parameter Systems*

**20070028596** Northrop Grumman Information Technology, Inc., Reston, VA USA

**Applying the Concept of Minimal Essential to Maintain Operational Continuity and Attain Mission Assurance During Internal and External Attacks on the Information Environment**

McCallam, Dennis H; Luzwick, Perry; Jun 2002; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467520; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467520>

Operational continuity while under sustained physical and cyber attack is possible using the concept of operational continuity. To achieve operational continuity, in addition to a synchronized and coherent defense of the information environment, data resiliency must also be used. What takes data resiliency from theory to practice is the use of minimum essential data sets on critical information. Through frequent updating of critical information and its dispersion throughout a network, robust sets of essential data can be maintained. Because network centric warfare and information superiority are important in achieving military successes, data resiliency for operational continuity is essential for achieving mission assurance. Data resiliency and operational continuity are important features within Coherent Knowledge-based Operations(trademark). Continued research and operational testing is needed to mature the concept of operational continuity, such as integrated physical and cyber continuity of operations.

DTIC

*Computer Information Security; Knowledge Based Systems*

**20070028746** BAE Systems, Burlington, MA USA

**Decentralized Control Using Global Optimization (DCGO) (Preprint)**

Flint, Matthew; Khovanova, Tanya; Curry, Michael; Mar 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-02-C-3262; Proj-A013

Report No.(s): AD-A467371; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The coordination of a team of distributed air vehicles requires a complex optimization, balancing limited communication bandwidths, non-instantaneous planning times and network delays, while at the same time trying to allocate limited resources to spatially diverse locations in a near-optimal fashion in a dynamic and uncertain environment. Given that, in this environment, the optimality of a given plan will not last very long when the information state is constantly changing and being updated, a new approach is proposed in this paper. Global-scope plans for the team are generated and distributed using the principle of emergent leadership to provide efficient plan generation and execution with minimal performance degradation compared to a centralized controller under delayed communications. This type of protocol is labeled the Decentralized Control Global Optimization (DCGO) protocol, and is discussed in this paper, along with some simulation results showing that this premise can produce good results in a realistic environment.

DTIC

*Protocol (Computers); Optimization; Communication*

**20070028749** Naval Research Lab., Washington, DC USA

**Cooperative Multi-Agent Systems in Mobile Ad Hoc Networks**

Macker, Joseph P; Chao, William; Abramson, Myriam; Downard, Ian; Jan 2006; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466587; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466587>

Two important enabling but evolving technologies supporting future DoD network-centric systems at the tactical edge are

mobile ad hoc networking (MANET) and Multi-Agent Systems (MAS). Despite their value in enabling more autonomous network system operation scenarios, open research and engineering questions remain regarding robust interoperability, standardization, and design of these two technologies. We describe recent research and development that is helping to better understand cross-layer design issues within both MAS and MANET. We describe the problem area and the open software components developed to support our research. We summarize recent modeling and simulation advances in a mixed MAS and MANET scenario environment. MANET multicast approaches for interagent communications are discussed and described. Some early analysis of MAS performance is presented using a variety of inter-agent MANET communication models. The behavior of MAS autonomous cooperative teamwork and role allocation within disruptive and dynamic MANET environments is examined. We conclude by outlining open issues and areas of further work.

DTIC

*Communication Networks; Computer Programs; Standardization*

**20070028767** Echelon 4, LLC, Mequon, WI USA

**Performance Measurement in C2 Systems**

Bayne, Jay S; Paul, Raymond; Jun 2003; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467386; XD-OASD/C3I; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467386>

The continuous transformation of the US military into an integrated and a dominant 'full spectrum' capability requires a comprehensive and evolutionary system model (the objective) and a prescribed set of transformation processes (the means) whose incremental results are measurable against operational requirements. Given its sheer size and complexity, this military system must be partitioned into logical and semi-independent elements. The individual and ensemble performance of system elements must be objectively measured, and characterized by specific and reusable metrics. Taken together, the system model and the classes of metrics define a performance measurement framework (PMF). This paper outlines the design of a generalized and scalable performance measurement framework for the Navy's FORCENet environment.

DTIC

*Command and Control; Performance Tests*

**20070028787** Library of Congress, Washington, DC USA

**Critical Infrastructure: Control Systems and the Terrorist Threat**

Shea, Dana A; Jan 20, 2004; 23 pp.; In English

Report No.(s): AD-A467307; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Much of the U.S. critical infrastructure is potentially vulnerable to cyber-attack. Industrial control computer systems involved in this infrastructure are specific points of vulnerability, as cyber-security for these systems has not been previously perceived as a high priority. Industry sectors potentially affected by a cyber-attack on process control systems include the electrical, telephone, water, chemical, and energy sectors. The federal government has issued warnings regarding increases in terrorist interest in the cyber-security of industrial control systems, citing international terrorist organization interest in critical infrastructure and increases in cyber-attacks on critical infrastructure computer systems. The potential consequences of a successful cyber-attack on critical infrastructure industrial control systems range from a temporary loss of service to catastrophic infrastructure failure affecting multiple states for an extended duration.

DTIC

*Security; Chemical Energy; Failure*

**20070028798** Mitre Corp., Bedford, MA USA

**The DoD Architecture Framework Views as Requirements Vehicles in a Model Driven Architecture Systems Development Process**

Bienvenu, Michael P; Godwin, Keith A; Jun 2004; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466019>

Agenda: Architecture Framework Overview; A Systems Engineering Perspective of Architecture Views; An Integrated Architecture Approach; Application to JSSEO Model Driven Architecture Development; Tool Adaptation; Requirements Management; Summary. The Purpose: \*Describe our Approach to Extending DoDAF(Department of Defense Architecture

Framework) to Unify Architecture, Requirements and Requirements Traceability; \*Demonstrate that the DoDAF can be Inline with the Systems Engineering Process Purpose.

DTIC

*Systems Engineering; Architecture (Computers); Systems Integration*

**20070029572** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks**

Cappelli, Dawn M; Desai, Akash G; Moore, Andrew P; Shimeall, Timothy J; Weaver, Elise A; Willke, Bradford J; Mar 2007; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A468801; CMU/SEI-2006-TN-041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468801>

The Insider Threat Study, conducted by the U.S. Secret Service and Carnegie Mellon University's Software Engineering Institute CERT Program, analyzed insider cyber crimes across U.S. critical infrastructure sectors. The study indicates that management decisions related to organizational and employee performance sometimes yield unintended consequences that increase risk of insider attack. The problem is exacerbated by a lack of tools for understanding insider threat, analyzing risk mitigation alternatives, and communicating results. The goal of Carnegie Mellon University's Management and Education of the Risk of Insider Threat (MERIT) project is to develop such tools. MERIT uses system dynamics to model and analyze insider threats and produce interactive learning environments. These tools can be used by policy makers, security officers, information technology and human resource personnel, and management. The tools help these users to understand the problem and assess risk from insiders based on simulations of policies, and on cultural, technical, and procedural factors. This technical note describes the MERIT insider threat model and simulation results.

DTIC

*Computer Information Security; Education; Information Systems; Personnel Management; Risk; Sabotage*

**20070029761** Library of Congress, Washington, DC USA

**Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth**

Smith, Marcia S; Moteff, John D; Kruger, Lennard G; McLoughlin, Glenn J; Seifert, Jeffrey W; Moloney Figliola, Patricia; Dec 29, 2004; 48 pp.; In English

Report No.(s): AD-A469049; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469049>

The growth of the Internet may be affected by a number of issues being debated by Congress. This report summarizes several key technology policy issues. 1. Internet privacy issues encompass concerns about information collected by website operators and by spyware, and about the extent to which law enforcement officials are allowed to monitor an individual's Internet activities. Congress has passed several laws already, but continues to debate what other legislation may be needed. 2. Concerns about computer and Internet security are prevalent in both the government and private sectors. Issues have also been raised about the vulnerability of the nation's critical infrastructures (e.g. electrical power supply) to cyber attacks. Issues for Congress include oversight and improvement of the protection of federal computer systems and cooperation with and between the private sectors. 3. Broadband Internet access gives users the ability to send and receive data at speeds far greater than current Internet access over traditional telephone lines. With deployment of broadband technologies beginning to accelerate, Congress is seeking to ensure fair competition and timely broadband deployment to all sectors and geographical locations of American society. 4. Since the mid-1990s, commercial transactions on the Internet called electronic commerce (e-commerce) have grown substantially. Among the issues facing Congress are encryption procedures to protect e-commerce transactions, extension of the three-year tax moratorium on domestic e-commerce taxation, the impact of the USA PATRIOT Act, and how the policies of the European Union and the World Trade Organization (WTO) may affect U.S. e-commerce activities.

DTIC

*Electronic Commerce; Internets; Policies; Security; Technologies*



## CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

**20070026360** Soar Technology, Inc., Ann Arbor, MI USA

### **An Intelligent Interface-Agent Framework for Supervisory Command and Control**

Wood, Scott D; Jun 15, 2004; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DASW01-03-C-0019

Report No.(s): AD-A466009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466009>

(1) Agents are a useful, perhaps necessary, technology for implementing NCW goals; (2) Need common and well-defined language for human-agent and agent-agent interaction; (3) Can't depend on acceptable results to just emerge from independently-designed systems -- there must be a rigorous definition of authority, permission, obligation, and jointly-held goals for multi-agent systems to work; (4) With agent and system organization in place, next step is human interaction.

DTIC

*Command and Control; Robots*

**20070026405** Qualtech Systems, Inc., Wethersfield, CT USA

### **PHM Integration with Maintenance and Inventory Management Systems (Preprint)**

Tu, Fang; Ghoshal, Sudipto; Luo, Jianhui; Biswas, Gautam; Mahadevan, Sankaran; Jaw, Link; Navarra, Kelly R; Nov 2006; 14 pp.; In English

Contract(s)/Grant(s): FA8650-06-M-5228; Proj-3005

Report No.(s): AD-A466108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466108>

Prognostic techniques are intricately tied to the physics of incipient-fault-to-failure progression, and hence most prognostic research has focused on developing techniques for a range of components such as rotating machinery parts. The research and development of such techniques has relied on the theories of material science, structural mechanics, domain expertise, as well as empirical studies such as accelerated run-to-failure testing. Even after prognostic models have been developed and operationally validated for various components of a system, the challenge remains how prognostic assessments from individual components of a system (such as the aircraft engine) should be used to make maintenance and inventory management decisions. In this paper, we describe our research where the primary focus is to bridge the gap between the individual component prognostics and the system-level reasoning required to support maintenance and inventory management decisions. The research involves integration of component health assessment and an information fusion mechanism that operates in conjunction with a higher-level reasoning engine which utilizes system level structural and functional dependencies to generate a system availability analysis that leads directly actionable decision-making tasks for the inventory and maintenance management systems. The inventory management decision systems involve predicting spares requirements and when integrated with remote health monitoring and intelligent diagnostics and prognostics, can assess different spares allocation schemes and optimize inventory management by maximizing system availability within budget constraints.

DTIC

*Autonomic Nervous System; Decision Support Systems; Health; Inventory Management; Logistics; Maintenance; Management Systems*

**20070026431** Army Communications Research and Development Command, Fort Monmouth, NJ USA

### **An Expose of Autonomous Agents in Command and Control Planning**

Matthews, Christopher; Jun 2004; 44 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466145; XA-CERDEC/C2/NJ; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466145>

Autonomous agents are a value-added technology to facilitate integrating logistics into the in-theater maneuver planning processes. Conventionally, logistics impacts that can affect the successful prosecution of a maneuver plan are only analyzed or discovered after the maneuver course of action (COA) has been finalized. Logistic oversights, assumptions, or faulty assessments can lead to an unsupportable maneuver plan that must be re-planned or thrown away; a situation that may require unafforded time. We implemented autonomous agents to provide a near-real-time, logistics feedback loop to augment the on-going, dynamic battle planning processes. As the battle plan is progressing, a logistics plan, too, is being formulated

whereby logistic assets are being tasked to support the tentative maneuver plan, dynamically. This logistics plan that maps to the current battle plan is the mechanism whereby resource management and allocation impacts are discovered and, thus, can alert the command and control (C2) planners of logistics issues. The coupling of logistics and C2 planning saves time, effort, and better utilizes resources and personnel. But, the major benefit is the adaptation of this model when applied to the execution-monitoring and real-time prosecution of a maneuver plan using unfolding battlefield events as re-planning inputs to the current, executing plan.

DTIC

*Autonomy; Command and Control; Logistics*

**20070026467** ZMP, Inc., Tokyo, Japan

**Information Fusion for Hypothesis Generation under Uncertain and Partial Information Access Situation**

Kitano, Hiroaki; Jul 21, 2006; 83 pp.; In English

Contract(s)/Grant(s): FA5209-04-C-0003

Report No.(s): AD-A466198; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466198>

The challenge for most artificial systems that operate autonomously in the real world environment is how to cope with dynamic environment with limited, uncertain, and noisy information. Artificial intelligence and intelligent robotics research has been trying to solve such a problem by either improving accuracy of recognition systems or by integrating multiple source of information. In addition, architectural issues has been discussed on whether classical Sense-Model-Plan-Act architecture or the subsumption architecture better suits for autonomous agents. Information fusion issue is tightly coupled with behavioural control as overall performance of the autonomous system is the ultimate concern. The work performed focused on identifying possible system architecture for realistic information fusion and corresponding reactions under uncertain environments. Our research starts from analysing issues in existing paradigm of autonomous agent and AI architectures, redefine needs, and propose a suitable architecture. In this research, it was essential to learn from biological systems where various species has evolved to adapt to uncertain and dynamic environment for survival.

DTIC

*Artificial Intelligence; Autonomy; Hypotheses; Robotics*

**20070026468** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**Introducing Actions into Qualitative Simulation**

Forbus, Kenneth D; Aug 1988; 14 pp.; In English

Contract(s)/Grant(s): N00014-85-K-0225

Report No.(s): AD-A466199; UIUCDCS-R-88-1452; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466199>

Many potential uses of qualitative physics, such as robot planning and intelligent computer-aided engineering, require integrating physics with actions taken by agents. This paper proposes to augment qualitative simulation to include the effects of actions to form action-augmented envisionments. The action-augmented envisionment incorporates both the effects of an agent's actions and what will happen in the physical world whether or not the agent does something. Consequently, it should provide a richer basis for planning and procedure generation than any previous representation. This paper defines action augmented envisionments and an algorithm for directly computing them, along with an analysis of its complexity and suitability for different kinds of problems. We describe our initial implementation and discuss potential extensions, including incremental algorithms.

DTIC

*Artificial Intelligence; Computer Aided Design; Simulation*

**20070026481** SRA International, Inc., Fairfax, VA USA

**Self-Organized Air Tasking: Examining a Non-Hierarchical Model for Joint Air Operations**

Bordeaux, John; Jun 2004; 89 pp.; In English

Report No.(s): AD-A466243; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466243>

The hypothesis of this paper proposes that it is possible to structure a non-hierarchical approach to air tasking in the conduct of Joint air operations. For the private sector, advances in information and communication technologies have led to innovations in organizational structures in order to know more across the enterprise. However, the application of these 'value

network' principles has not been fully applied to the processes upon which the U.S. organizes for Joint force operations. A non-hierarchical model is constructed for the tasking of air assets in order to test an agent-based approach to the servicing of targets in an air campaign, using agent-based simulation techniques and models established by Epstein & Axtell (SugarScape) within the Santa Fe Institute's Swarm agent modeling environment.

DTIC

*Computerized Simulation; Self Organizing Systems; Simulation*

**20070026545** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**The Logic of Occurrence**

Forbus, Kenneth D; Dec 1986; 17 pp.; In English

Contract(s)/Grant(s): N00014-85-K-0225

Report No.(s): AD-A466418; UIUCDCS-R-86-1300; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466418>

A general problem in qualitative physics is determining the consequences of assumptions about the behavior of a system. If the space of behaviors is represented by an envisionment, many such consequences can be represented by pruning states from the envisionment. This paper provides a formal logic of occurrence which justifies the algorithms involved and provides a language for relating specific histories to envisionments. The concepts and axioms are general enough to be applicable to any system of qualitative physics. We further propose the concept of transverse quantities as a general solution to qualitative versions of Zeno's paradox. The utility of these ideas is illustrated by a rational reconstruction of the pruning algorithms used in FROB, a working AI program.

DTIC

*Artificial Intelligence; Qualitative Analysis; Systems Analysis*

**20070026548** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**Qualitative Kinematics of Linkages**

Kim, Hyun-Kyung; May 1990; 41 pp.; In English

Contract(s)/Grant(s): N00014-85-K-0225

Report No.(s): AD-A466423; UIUCDCS-R-90-1603; UILU-ENG-90-1742; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466423>

An important aspect of qualitative spatial reasoning is understanding mechanisms. This paper presents a qualitative analysis of motion for mechanical linkages. In particular, we describe how to analyze the behavior of a mechanism which has a movable axis. The basic idea of our approach is to represent relative motions of the link in terms of quadrants (qualitatively representing the direction relative to a global reference frame) and relative inclinations relative to the x-axis. Using this representation ; we can derive all the possible motions of a system of linkages. This idea has been implemented and tested on several examples.

DTIC

*Kinematics; Linkages; Qualitative Analysis*

**20070026549** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**Dynamic Across-Time Measurement Interpretation: Maintaining Qualitative Understandings of Physical System Behavior**

DeCoste, Dennis M; Feb 1990; 130 pp.; In English

Contract(s)/Grant(s): N00014-85-K-0225

Report No.(s): AD-A466425; UIUCDCS-R-90-1572; UILU-ENG-90-1710; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466425>

Incrementally maintaining a qualitative understanding of physical system behavior based on observations is crucial to real-time process monitoring, control, and diagnosis . This paper describes the DATMI theory for dynamically maintaining a pinterp-space, a concise representation of local and global interpretations consistent with the observations over time. Each interpretation signifies alternative paths of states in a qualitative envisionment . Representing a space of interpretations, instead of just a 'current best' one, avoids the need for extensive backtracking to handle incomplete or faulty data. Domain-specific knowledge about state and transition probabilities can be used to maintain the best working interpretation as well.

Domain-specific knowledge about durations of states and paths of states can also be used to further constrain the interpretation space. When all these constraints lead to inconsistencies, faulty-data hypotheses are generated and then tested by adjusting the interpretation space. The time and space complexity of maintaining the interpretation space is polynomial in the number of measurements and environment states.

DTIC

*Artificial Intelligence; Qualitative Analysis; Systems Analysis; Time Measurement*

**20070026555** Illinois Univ., Urbana-Champaign, IL USA

**A Qualitative Approach to Rigid Body Mechanics**

Nielson, Paul E; Nov 1988; 157 pp.; In English

Contract(s)/Grant(s): N00014-85-K-0225

Report No.(s): AD-A466441; UIUCDCS-R-88-1469; UILU-ENG-88-1775; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466441>

In order for a program to interact with the world as well as people do, we must provide it with a great deal of commonsense about the way things work. Reasoning about the geometric interactions and motions of objects is an important part of that commonsense. Some of the most complex problems we solve involve reasoning about mechanical devices, such as gears, cams, and docks. Qualitative mechanics is the symbolic analysis of the motions and the geometric interactions of physical objects. This thesis describes a theory for analysis of rigid body mechanisms, an important subset of qualitative mechanics problems. This theory has been implemented and tested on several mechanisms including a mechanical clock. Beginning with drawings of the parts involved we compute a discrete symbolic description showing changes in position and motion of the parts of the mechanism as well as its global behavior.

DTIC

*Artificial Intelligence; Kinematics; Problem Solving; Rigid Structures*

**20070026586** Battle Command, Fort Leavenworth, KS USA

**AI on the Battlefield: An Experimental Exploration (Preprint)**

Rasch, Robert; Kott, Alexander; Forbus, Kenneth D; Jul 2002; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466516; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466516>

The US Army Battle Command Battle Lab conducted an experiment with the Integrated Course of Action Critiquing and Elaboration System (ICCES) -- an integrated decision aid for performing several critical steps of a US Army Brigade Military Decision Making Process: from capturing a high-level Course of Action to producing a detailed analysis and plan of tasks. The system integrated several available technologies based largely on AI techniques, ranging from qualitative spatial interpretation of course-of-action diagrams to interleaved adversarial planning and scheduling. The experiment dispelled concerns about potential negative impacts of such tools on the creative aspects of the art of war, showed a potential for dramatic time savings in the MDMP process, and confirmed the maturity and suitability of the technologies for near-future deployment.

DTIC

*Decision Support Systems; Military Operations; Planning*

**20070026708** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Ultra-fast Object Recognition from Few Spikes**

Hung, Chou; Kreiman, Gabriel; Poggio, Tomaso; DiCarlo, James J; Jul 6, 2005; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA972-04-1-0037; N00014-02-1-0915

Report No.(s): AD-A466783; MIT-CSAIL-TR-2005-045; AIM-2005-022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466783>

Understanding the complex brain computations leading to object recognition requires quantitatively characterizing the information represented in inferior temporal cortex (IT), the highest stage of the primate visual stream. A read-out technique based on a trainable classifier is used to characterize the neural coding of selectivity and invariance at the population level. The activity of very small populations of independently recorded IT neurons (~100 randomly selected cells) over very short

time intervals (as small as 12.5 ms) contains surprisingly accurate and robust information about both object identity and category, which is furthermore highly invariant to object position and scale. Significantly, selectivity and invariance are present even for novel objects, indicating that these properties arise from the intrinsic circuitry and do not require object-specific learning. Within the limits of the technique, there is no detectable difference in the latency or temporal resolution of the IT information supporting so-called categorization (a.k. basic level) and identification (a.k. subordinate level) tasks. Furthermore, where information, in particular information about stimulus location and scale, can also be readout from the same small population of IT neurons. These results show how it is possible to decode invariant object information rapidly, accurately and robustly from a small population in IT and provide insights into the nature of the neural code for different kinds of object-related information.

DTIC

*Cerebral Cortex; Coding; Pattern Recognition; Visual Stimuli*

**20070026816** Twenty-First Century Technologies, Inc., Austin, TX USA

**Link Analysis for Dynamic Planning and Scheduling**

Marcus, Sherry E; Frantz, Albert G; Beyerle, John A; Jun 2002; 16 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467521; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467521>

This paper discusses an innovative approach to military campaign planning and resource allocation, and scheduling based on link analysis and mixed integer programming. Link analysis explores relations among large numbers of similar or different types of objects. Mixed integer programming solves problems containing both integer variable constraints, like aircraft numbers, as well as linear (real) variable constraints like probability of destruction or risk to aircraft. ATO Link (Air Tasking Order Link Analysis) combines these software technologies to more optimally use resources throughout all phases of the air campaign planning and execution process. These two mature, matrix-based and computationally well behaved technologies (link analysis and mixed integer programming) have the potential to scale to very large plans, while more optimally allocating and scheduling limited resources. The ATO Link prototype is implementing an effects-based operations (EBO) concept for the air campaign-planning domain. This effort has the potential to significantly accelerate the military campaign planning and execution replanning process. The planner will be able to rapidly explore more courses of action, resulting in more dynamic planning and execution to achieve full spectrum dominance in military operations more responsive to the strategic goals of the NCA (National Command Authority).

DTIC

*Expert Systems; Military Operations; Planning; Scheduling*

**20070026817** Twenty-First Century Systems, Inc., Omaha, NE USA

**Intelligent Agent-Based Software Architecture for Tactical Decision Aid under Overwhelming Information Inflow and Uncertainty**

Hicks, Jeffrey D; Petrov, Plamen V; Stoyen, Alexander D; Zhu, Qiuming; Jun 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467522; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467522>

In the highly dynamic and information rich environment of military submarine operations, the Commanding Officer must make split second decisions that could ultimately result in the destruction or survival of Ownship or the accomplishment of its designated mission. Despite extensive training and expertise, the fog of war often shadows real world encounters. Pieces of the tactical puzzle may be scattered, broken, and/or even missing. It is the Commanding Officer's job to meld the fog into a clear tactical picture and intuitively decide upon the optimal course of action to obtain his mission goals and objectives. A mathematically derived optimal solution could be used as a decision making aid for the Commanding Officer to enhance Ownship's performance. A highly innovative hybrid Bayesian/differential game modeling approach is being developed utilizing 21CSI's Agent Enhanced Decision Guide Environment (AEDGE(TradeMark)), a COTS based agent architecture, to tackle this problem. The resulting decision aid will facilitate submarine operations by addressing such practical problems as tradeoff evaluation for course of action and maintaining tactical advantage while avoiding counter detection.

DTIC

*Decision Support Systems; Warfare*

**20070027299** Naval Postgraduate School, Monterey, CA USA

**Automatic Author Profiling of Online Chat Logs**

Lin, Jane; Mar 2007; 289 pp.; In English

Report No.(s): AD-A467087; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Now that the Internet has become easily accessible and more affordable, a larger number of people spend more time in front of a computer. Some spend so much time on the Internet that they develop virtual friendships and relationships with people with whom they have regular contact via a computer screen and the Internet. While most of the dialogue exchanged online is not harmful or illegal, there are those with dishonest intentions lurking online. These people can be breaking the law by seducing a minor virtually or even going as far as meeting a minor in person. Terrorists can also use the Internet to facilitate communication and plan attacks. Since e-mail is one of the original means of communication on the Internet, methods for determining the author of an e-mail have already been studied. So far, however, no significant experimentation with online chat logs exists. The first part of this study is comprised of generating an unbiased, random, and broad corpus of online chat logs. Having a general corpus with a wide-range of topics allows the results of this research to be applied in the most general case. Because developing a complete solution to the authorship attribution problem for chat logs is difficult, we limit our scope to predicting gender and age. The ultimate goal of this work, then, is to facilitate the jobs of law enforcers in tracking down criminals who attempt to use the Internet as a hiding place.

DTIC

*Artificial Intelligence; Information Retrieval; Microcomputers*

**20070027301** Naval Postgraduate School, Monterey, CA USA

**Capacity Building and Sustainment: Focusing on the End-State for Homeland Security**

Burch, James A; Mar 2007; 143 pp.; In English

Report No.(s): AD-A467089; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since 9/11, the U.S. has developed policies to counter the terrorist threat. Integral to those policies is preparedness. Homeland Security Presidential Directive 8 states that preparedness will include, 'capacity building prevention activities such as information gathering, detection, deterrence, and collaboration related to terrorist attacks.' Despite the criticality of capacity building in relation to preparedness, the term is not defined. There has been no discussion on what capacity building means. The term is often equated to federal assistance or used interchangeably with capabilities and capability based planning. Capacity building strategies, however, are distinct and link into wider economic, political, and societal issues. Despite capacity building's criticality to preparedness and sustainment, various or ambiguous interpretations will translate to differences in strategic priorities. This thesis will examine the existing strategies to determine the linkage between capacity building, preparedness, sustainment, capability, capability based planning, and the envisioned end-state. It will also address sustainment issues and homeland security costs based on differing capacity building interpretations. The end product is a capacity building definition that captures the costs and variables with building and sustaining capabilities. This thesis will also demonstrate how capacity building measures serve as the foundational premise for a sound homeland security strategic plan.

DTIC

*Security; Warning Systems*

**20070027498** University of South Florida, Tampa, FL USA

**Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance**

Covert, Michael D; Riddle, Dawn L; Gordon, Thomas; Miles, Donald; Hoffman, Kimberly; King, Thomas; Elliott, Linda; Dalrymple, Mathieu; Schiflett, Samuel; Chaiken, Scott; Jun 2001; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467735; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Air Force's E-3 AWACS is a highly mobile early warning platform providing both surveillance and command and control functions for tactical and air defense forces. The weapons suite within the AWACS is occupied by multiple weapons directors (WD) and a Senior Director (SD), is critical to mission success. The cognitive demand placed on these team members is extremely high. Elliott, Stoyen and Chaiken (2000) note the limits of human cognitive processing relative to this demand and suggest agent technology has the potential to offer effective information and decision support the human operator. This paper examines relationships among experience, performance and the use of agent technology in a decision support role within a synthetic task. We first examine experience related factors leading to utilization of the agent, and subsequently explore the relationship between experience and performance, and how the presence of an automated agent might impact that relationship. Two interesting findings are presented: 1) differences in qualitative experience impact the degree to which

weapons directors utilize agent assistance, and 2) the nature of the experience performance relationship changes when agent assistance is available.

DTIC

*Decision Support Systems; Human Performance; Tasks*

**20070027688** Georgia Inst. of Tech., Atlanta, GA USA

**Lethality and Autonomous Robots: An Ethical Stance**

Arkin, Ronald C; Moshkina, Lilia; Jan 2007; 4 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0252

Report No.(s): AD-A468122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper addresses a difficult issue confronting the designers of intelligent robotic systems: their potential use of lethality in warfare. To fully understand the consequences of the deployment of autonomous machines capable of taking human life under military doctrine and tactics, a systematic ethical evaluation needs to be conducted to guide users (e.g., warfighters), system designers, policy makers, and commanders regarding the intended future use of this technology. This study needs to be conducted prior to the deployment of these systems, not as an afterthought. Toward that end, a 3-year research effort on this topic is being conducted at the Georgia Institute of Technology for the Army Research Office, of which the authors are currently in the first year. Two topics are being investigated: What is acceptable?, and What can be done? A survey is being conducted on the use of lethality by autonomous systems. The survey investigates the points of view of various demographic groups on this issue, including the public, robotics researchers, policy makers, and military personnel. The authors also are designing a computational implementation of an ethical code within an existing autonomous robotic system (i.e., an artificial conscience) that will be able to govern an autonomous system's behavior in a manner consistent with the rules and laws of war. This paper describes the survey's design and administration. The independent variables used for the survey are as follows: (1) community type; (2) level of authority; (3) demographic variables, such as age, gender, level of education, etc.; and (4) the extent of participants' knowledge of robots and their capabilities. In addition to finding out what the terms of acceptance are for using lethal robots in warfare, the authors would like to see if, and how, the level of acceptance varies among the different community types, according to certain demographics factors, and for the three levels of autonomy.

DTIC

*Acceptability; Autonomy; Ethics; Lethality; Robots; Surveys; Warfare*

**20070027705** Air Univ., Maxwell AFB, AL USA

**Signals Intelligence Support to the Cockpit**

Van Nederveen, Gilles; Jun 2001; 16 pp.; In English

Report No.(s): AD-A468296; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A continuing challenge for the operational and intelligence communities, is the quest to get relevant cryptological products to warfighters engaged in combat operations. During World War II both 8th and 9th Air Forces used specialized signals intelligence squadrons (low-grade ciphers or open transmissions) to defeat the Luftwaffe in the air and on air fields. After the surprise of the MiG-15 in Korea the USAFSS established intercept sites to monitor controller to pilot radio links in MiG alley. Data collected was passed to radar sites that helped to place USAF F-86 in optimal intercept position. The Air Force established Teaball at NKP AB, in Thailand which incorporated EC-121 data, highly classified voice intercept data and IFF data to develop a composite air picture. The three case studies examine the balance between operational immediacy and the intelligence communities desire to protect intelligence sources and develop analysis prior to passing intelligence. Linguistic challenges and need to protect operational security are factors in the study.

DTIC

*Cockpits; Cryptography; Data Acquisition; Intelligence; Security; Signal Processing*

**20070027733** Polytechnic Univ., Brooklyn, NY USA

**Source Camera Identification and Blind Tamper Detections for Images**

Memon, Nasir; Sencar, Husrev T; Apr 24, 2007; 72 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0130

Report No.(s): AD-A468411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Digital images can now be easily created, altered, and manipulated with no obvious traces of having been subjected to any of these operations. In this project, we have developed methodologies to verify the authenticity and integrity of digital images in an automatic manner. The results of our project have important implications with regard to ensuring credibility of

digital images, especially when it comes to legal photographic evidence. Our proposed techniques can be broadly categorized into three primary areas based on their focus: source camera identification, discrimination of synthetic images, and image forgery detection. In this final technical report we describe our contributions to the field.

DTIC

*Cameras; Digital Cameras*

**20070027823** Massachusetts Inst. of Tech., Lexington, MA USA

**Making Network Intrusion Detection Work With IPsec**

McLain, C D; Studer, A; Lippmann, R P; May 11, 2007; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0002

Report No.(s): AD-A468587; TR-1121; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Network-based intrusion detection systems (NIDSs) are one component of a comprehensive network security solution. The use of IPsec, which encrypts network traffic, renders network intrusion detection virtually useless unless traffic is decrypted at network gateways. One alternative to NIDSs, host-based intrusion detection systems (HIDSs), provides some of the functionality of NIDSs but with limitations. HIDSs cannot perform a network-wide analysis and can be subverted if a host is compromised. We propose an approach to intrusion detection that combines HIDS, NIDS, and a version of IPsec that encrypts the header and the body of IP packets separately. We refer to the latter generically as TwoKey IPsec. We show that all of the network events currently detectable by the Snort NIDS on un-encrypted network traffic are also detectable on encrypted network traffic using this approach. The NIDS detects network-level events that HIDSs have trouble detecting and HIDSs detect application-level events that can't be detected by the NIDS.

DTIC

*Computer Networks; Detection; Warning Systems*

**20070027825** Naval Postgraduate School, Monterey, CA USA

**Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider**

Gassier, David; Rebollo, Jerome; Dumonteil, Romain; Jan 9, 2007; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468591; NPS-MV-07-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The SeaDiver Glider is an UUV (Unmanned Underwater Vehicle) used for underwater prospecting at a low cost with a long distances coverage (approx = 1400 miles). It moves without propellers by changing its buoyancy with the help of ballast and its hydrodynamics profile reminiscent of a wing (model NACA0022). Ballast inflation makes it raise the surface, ballast deflated make it submerge the bottom. Ballast is positioned in front of its structure in an optimal position to use the lift of its shape. This up-and-down movement is converted into horizontal displacement by the wing-shape of the SeaDiver Glider. It mimics sinusoidal movements from the sea surface down to 300 feet underwater. This vehicle is able to traverse from one point to another without human intervention.

DTIC

*Autonomy; Gliders; Hydrodynamics; Low Cost; Robotics; Underwater Vehicles*

**20070028692** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Conditional Random People: Tracking Humans with CRFs and Grid Filters**

Taycher, Leonid; Shakhnarovich, Gregory; Demirdjian, David; Darrell, Trevor; Dec 1, 2005; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466726; MIT-CSAIL-TR-2005-079; AIM-2005-034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466726>

We describe a state-space tracking approach based on a Conditional Random Field (CRF) model, where the observation potentials are learned from data. We find functions that embed both state and observation into a space where similarity corresponds to L1 distance, and define an observation potential based on distance in this space. This potential is extremely fast to compute and in conjunction with a grid-filtering framework can be used to reduce a continuous state estimation problem to a discrete one. We show how a state temporal prior in the grid-filter can be computed in a manner similar to a sparse HMM, resulting in real-time system performance. The resulting system is used for human pose tracking in video sequences.

DTIC

*Pattern Recognition; Spacecraft Tracking; State Estimation*



**20070029384** Medlen and Carroll, L.L.P., San Francisco, CA, USA; Wicab Inc., Middleton, WI, USA  
**Systems and Methods for Altering Vestibular Biology**

Tyler, M. E., Inventor; Danilov, Y. P., Inventor; Bach-y-Rita, P., Inventor; 11 Jan 05; 71 pp.; In English

Contract(s)/Grant(s): NIH-R01-EY10019; NIH-R43/44-EY13487

Patent Info.: Filed 11 Jan 05; US-Patent-Appl-SN-11-033 246

Report No.(s): PB2007-104101; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The present invention relates to systems and methods for management of brain and body functions and sensory perception. For example, the present invention provides systems and methods of sensory substitution and sensory enhancement (augmentation) as well as motor control enhancement. The present invention also provides systems and methods of treating diseases and conditions, as well as providing enhanced physical and mental health and performance through sensory substitution, sensory enhancement, and related effects. In particular, the present invention provides systems and methods for altering vestibular biology to, among other things, treat diseases and conditions or enhance performance related to vestibular functions.

NTIS

*Brain; Computers; Patent Applications; Vestibules*

**20070029542** Moffitt (H. Lee) Cancer Research Inst., Tampa, FL USA

**Integration of Anatomic and Pathogenetic Bases for Early Lung Cancer Diagnosis**

Qian, Wei; Mar 2007; 93 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0291

Report No.(s): AD-A468685; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468685>

It is widely recognized that the diagnosis of early lung cancer should entail a multimodal approach taking age clinical history radiology and cytology/histopathology into consideration. Most radiological assessments should be combined with microscopic analysis of tissue samples to reach a diagnosis. Our proposed new universal computer-aided diagnosis (UCAD) system combining anatomical knowledge based CAD (AK-CAD) and computer-aided pathological diagnosis (CAPD) which provides combined and correlated radiological and cytopathological features in diagnosis of early lung cancers will give radiologists and pathologists an efficient and automatic tool for their diagnosis. The development of a novel automatic quantitative assessment of radiological-pathological combined and correlated features is proposed here for diagnosis of early lung cancer. The integrated AK-CAD and CAPD system will provide radiologists and pathologists an efficient and automatic tool for their detection and diagnosis of early lung cancers.

DTIC

*Anatomy; Cancer; Computer Techniques; Cytology; Diagnosis; Histology; Lungs; Pathology; Radiology*

**20070029599** Illinois Univ., Urbana-Champaign, IL USA

**Finding Stable Causal Interpretations of Equations**

Skorstad, Gordon; Jan 9, 1991; 15 pp.; In English

Contract(s)/Grant(s): N00014-85-K-0225

Report No.(s): AD-A468852; UIUCDCS-R-91-1654; UILU-ENG-91-1701; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468852>

The causal ordering procedure of Iwasaki and Simon [5,6] provides a means for uncovering causal dependencies among variables constrained by a set of mathematical equations. This paper examines the procedure from a qualitative modeling viewpoint and addresses one of its limitations: context sensitivity. Causal dependencies predicted by the procedure may change depending on the context or scenario in which the underlying physical system operates. This prevents the qualitative modeler from using causal ordering to determine, a priori, a single causal interpretation of equations describing some phenomenon. We show that in some cases it is possible to find clusters of equations that possess causal stability. That is, their causal dependencies are the same in all scenarios consistent with the equations' modeling viewpoint. These unidirectional equations help the qualitative modeler by providing a stable, unambiguous causal interpretation. To identify such equations we define conditions sufficient to guarantee causal stability. In addition, we show that unidirectional equation sets are causally independent of equations outside their set. Thus, they add compositionality to the causal modeling task. Lastly, we demonstrate our ideas by uncovering the causal dependencies of Hooke's law, Gauss's law for electricity, and Bernoulli's equation.

DTIC

*Equations; Mathematical Models; Stability*

**20070029711** Florida Univ., Gainesville, FL USA

**Vector Pursuit Path Tracking for Autonomous Ground Vehicles**

Wit, Jeffrey S; Aug 2000; 315 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468928; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468928>

The Air Force Research Laboratory at Tyndall Air Force Base, Florida, has contracted the University of Florida to develop autonomous navigation for various ground vehicles. Autonomous vehicle navigation can be broken down into four tasks. These tasks include perceiving and modeling the environment, localizing the vehicle within the environment, planning and deciding the vehicle's desired motion, and finally, executing the vehicle's desired motion. The work presented here focuses on tasks of deciding the vehicle's desired motion and executing the vehicle's desired motion. The third task above involves planning the vehicle's desired motion as well as deciding the vehicle's desired motion. In this work it is assumed that a planned path already exists and therefore only a technique to decide the vehicle's desired motion is required. Screw theory can be used to describe the instantaneous motion of a rigid body, i.e., the vehicle, relative to a given coordinate system. The concept of vector pursuit is to calculate an instantaneous screw that describes the motion of the vehicle from its current position and orientation to a position and orientation on the planned path. Once the desired motion is determined, a controller is required to track this desired motion. The fourth task for autonomous navigation is to execute the desired motion. In order to accomplish this task, two fuzzy reference model learning controllers (FRMLCs) are implemented to execute the vehicle's desired turning rate and speed. The controllers are designed to be dependent on certain vehicle characteristics such as the maximum vehicle speed maximum turning rate. This is done to facilitate the transfer of these controllers to different vehicles. The vector pursuit path-tracking method and the FRMLCs were first tested in simulation by modeling the Navigation Test Vehicle (NTV) developed by the Center for Intelligent Machines and Robotics (CIMAR) at the University of Florida.

DTIC

*Autonomous Navigation; Autonomy; Pursuit Tracking*

**20070029715** Florida Univ., Gainesville, FL USA

**Compliant Formation Control of an Autonomous Multiple Vehicle System**

MacArthur, Erica Z; Dec 2006; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468947; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468947>

This research identifies a new strategy called 'compliant formation control' which may be used to coordinate the navigational structure of a team of autonomous vehicles. This technique controls the team's motion based on a given, desired formation shape and a given, desired set of neighboring separation distances, wherein the formation shape is considered general two-dimensional. The strategy establishes how to select, place, and use virtual springs and dampers that conceptually 'force' proper interspacing between neighboring team members. The objective is to continuously maintain, in the most optimal way, the desired formation as team motion proceeds. Research in multiple vehicle systems has addressed follow-the-leader techniques, cooperative mapping, reconnaissance and communication, and learning and adaptation techniques. Each of these areas is interested in multiple vehicle coordination techniques... This research provides a strategy for formation control that is based on a desired formation shape. In practice, actual robot separation distances will be measured relative to smarter, leader robots that have known position and orientation information at all times (e.g., GPS or INS). The control strategy subsequently commands, in an optimal way, each vehicle by providing a heading and velocity necessary to maintain the desired formation. Such requisite commands result from modeling the compliant displacements of team members as they travel in a network of virtual springs and dampers. One of the primary contributions of this work is the development of a methodology to determine the internal behaviors for the individual mobile robots in order to achieve a desired global formation for the entire system. One of the motivations here is to reduce the cost and increase the navigational effectiveness of a team of mobile robots, since only a select few team members (leaders) are required to be equipped with expensive GPS or INS equipment.

DTIC

*Autonomous Navigation; Autonomy; Elastic Properties; Robots*

**20070029731** Florida Univ., Gainesville, FL USA

**Simultaneous Planning and Control for Autonomous Ground Vehicles**

Galluzzo, Thomas C; Jan 2006; 158 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468987; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468987>

Motion planning and control for autonomous vehicles are complex tasks that must be done in order for a ground robot

to operate in a cluttered environment. This dissertation presents the theory, implementation, and test results for some new and novel Receding Horizon Control (RHC) techniques that allow these tasks to be unified into one. The first new method is called Heuristic Receding Horizon Control (HRHC), and uses a modified A\* search to fulfill the online optimization required by RHC. The second is called Dual-Frequency Receding Horizon Control (DFRHC), and is used to simplify the trajectory planning process during the RHC optimization. Both methods are combined together to form a practical implementation, which is discussed in detail. The autonomous ground vehicle, the NaviGator, developed at the Center for Intelligent Machines and Robotics, serves as a platform for the implementation and testing discussed.

DTIC

*Autonomy; Robots*

**20070029748** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Establishment of a Center for Defense Robotics**

Overholt, Jim; Thomas, David; Apr 6, 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469023; TARDEC-17044; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469023>

This paper presents an overview of the newly formed Joint Center for Unmanned Ground Vehicles (JC-UGV) located at the Army's Detroit Arsenal in Warren, Michigan. The center will provide a focus to ground vehicle robotics by bringing together research and development as well as acquisition and sustainment to manage the life cycle of defense robotic systems. The central mechanism the center will use to bring together all of these aspect is a system integration laboratory (SIL) environment. The robotics SIL will include both hardware and simulation and be based upon a distributed simulation environment. This will allow researchers, industry and Government partners all over the country to work on very complex problem. By bringing together university, industry and Government to advance defense robotics our customer, the war fighter, will be ultimately well served in the end.

DTIC

*Military Technology; Research and Development; Robotics; Unmanned Ground Vehicles*

**20070029766** Army Tank-Automotive Research and Development Command, Warren, MI USA

**FCS Technology Insertion and Transition**

Rogers, Paul; Apr 18, 2007; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469061; TARDEC-17067; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469061>

Briefing on RDECOM S&T supporting Future Combat Systems. Topics include programs related to Ground Vehicle Power and Mobility, Survivability (Armor and KE APS) and Intelligent Systems (Robotic Vehicles, Water from Air).

DTIC

*Armor; Combat; Protection; Robotics*

## 64

### NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

**20070026480** China Scientific and Technical Univ., Hefei, China

**A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model**

Zhang, Mengping; Shu, Chi-Wang; Wong, George C; Wong, S C; Jan 2002; 45 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0405; DMS-9804985

Report No.(s): AD-A466239; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466239>

In this paper we present a high order weighted essentially non-oscillatory (WENO) scheme for solving a multi-class extension of the Lighthill-Whitham-Richards (LWR) model. We first review the multi-class LWR model and present some of its analytical properties. We then present the WENO schemes, which were originally designed for computational fluid dynamics problems and for solving hyperbolic conservation laws in general, and demonstrate how to apply these to the present model. We found through numerical experiments that the WENO method is vastly more efficient than the low order Lax-Friedrichs scheme, yet both methods converge to the same solution of the physical model. It is especially interesting to observe the small staircases in the solution which are completely missed out, because of the numerical viscosity, if a lower

order method is used without a sufficiently refined mesh. To demonstrate the applicability of this new, efficient numerical tool, we study the multi-class model under different parameter regimes and traffic stream models. We consider also the convergence of the multi-class LWR model when the number of classes goes to infinity. We show that the solution converges to a smooth profile without staircases when the number of classes increases.

DTIC

*Essentially Non-Oscillatory Schemes; Lighthill Gas Model; Models; Oscillations*

**20070026483** Florida Univ., Gainesville, FL USA

**Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors**

Li, Xi; Larsson, Erik G; Sheplak, Mark; Li, Jian; Jan 2002; 11 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0105

Report No.(s): AD-A466266; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466266>

Time-delay estimation is important in a wide range of applications in oceanic engineering. In this paper, we present a novel time-delay estimation algorithm based on maximum likelihood theory for the case that the measurements are corrupted by colored or nonuniform zero-mean Gaussian noise. It turns out that the likelihood function associated with the problem is highly oscillatory, and we propose a computationally efficient technique to maximize this function. Our algorithm first obtains an initial estimate based on a smooth approximate cost function, and then refines this estimate based on the true cost function. Simulation results show that our estimator outperforms a traditional phaseshift based estimator, and that the estimation error approaches the Cramer-Rao bound (CRB) when the signal-to-noise ratio (SNR) increases without bound.

DTIC

*Acoustics; Maximum Likelihood Estimates; Phase Shift; Signal Detectors; Time Lag*

**20070026485** Florida Univ., Gainesville, FL USA

**Fault-Tolerant Parallel Algorithms for Adaptive Matched-Field Processing on Distributed Array Systems**

Cho, Kilseok; George, Alan D; Subramaniyan, Raj; Sep 24, 2004; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-99-1-0278

Report No.(s): AD-A466282; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466282>

Continuous innovations in adaptive matched-field processing (MFP) algorithms have presented significant increases in computational complexity and resource requirements that make development and use of advanced parallel processing techniques imperative. In real-time sonar systems operating in severe underwater environments, there is a high likelihood of some part of systems exhibiting defective behavior, resulting in loss of critical network, processor, and sensor elements, and degradation in beam power pattern. Such real-time sonar systems require high reliability to overcome these challenging problems. In this paper, efficient fault-tolerant parallel algorithms based on coarse-grained domain decomposition methods are developed in order to meet real-time and reliability requirements on distributed array systems in the presence of processor and sensor element failures. The performance of the fault-tolerant parallel algorithms is experimentally analyzed in terms of beamforming performance, computation time, speedup, and parallel efficiency on a distributed testbed. The performance results demonstrate that these fault-tolerant parallel algorithms can provide real-time, scalable, lightweight, and fault-tolerant implementations for adaptive MFP algorithms on distributed array systems.

DTIC

*Algorithms; Fault Tolerance; Parallel Processing (Computers)*

**20070026497** Maryland Univ., College Park, MD USA

**A Survey of Statistical Machine Translation**

Lopez, Adam; Apr 2007; 51 pp.; In English

Contract(s)/Grant(s): HR0011-06-2-0001; FCPO81-05-4-8265

Report No.(s): AD-A466330; UMIACS-TR-2006-47; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466330>

Statistical machine translation (SMT) treats the translation of natural language as a machine learning problem. By examining many samples of human-produced translation, SMT algorithms automatically learn how to translate. SMT has made tremendous strides in less than two decades, and many popular techniques have only emerged within the last few years. This survey presents a tutorial overview of state-of-the-art SMT at the beginning of 2007. We begin with the context of the

current research, and then move to a formal problem description and an overview of the four main subproblems: translational equivalence modeling, mathematical modeling, parameter estimation, and decoding. Along the way, we present a taxonomy of some different approaches within these areas. We conclude with an overview of evaluation and notes on future directions.  
DTIC

*Decoding; Machine Learning; Machine Translation; Natural Language (Computers); Surveys; Taxonomy*

**20070026645** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Multivariate Magnitude Robust Control Chart for Mean Shift Detection and Change Point Estimation**

Harrell, Ryan M; Mar 2007; 114 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466635; AFIT/GOR/ENS/07-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466635>

Statistical control charts are often used to detect a change in an otherwise stable process. This process may contain several variables affecting process stability. The goal of any control chart is to detect an out-of-control state quickly and provide insight on when the process actually changed. This reduces the off-line time the quality engineer spends assigning causality. In this research, a multivariate magnitude robust chart (MMRC) was developed using a change point model and a likelihood-ratio approach. Here the process is considered in-control until one or more normally distributed process variables permanently and suddenly shifts to out-of-control, stable value. Using average run length (ARL) performance and the relative mean index (RMI), the MMRC is compared to the multivariate cumulative sum (MC1) and the multivariate exponentially weighted moving average (MEWMA). These results show the MMRC performs favorably to the MC1 and MEWMA when the process is initially in-control before shifting out-of-control. Additionally, the MMRC provides an estimate for the change point and out-of-control mean vector. This change point estimator is shown effective for medium to large sudden mean shifts.  
DTIC

*Charts; Multivariate Statistical Analysis*

**20070026668** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Automatic Target Recognition User Interface Tool**

Kerns, David A; Mar 2007; 150 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466682; AFIT/GOR/ENS/07-15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466682>

A computer tool to aid in selecting the best Automatic Target Recognition (ATR) algorithm is developed. The program considers many quantifiers, accepts user-defined parameters, allows for changes in the operational environment and presents results in a meaningful way. It is written for Microsoft Excel. An ATR algorithm assigns a class label to a recognized target. General designations can include 'Friend' and 'Foe.' The error of designating 'Friend' as 'Foe' as well as 'Foe' as 'Friend' comes with a high cost. Studying each algorithm's error can minimize this cost. Receiver Operating Characteristic (ROC) curves provide only information on the probabilities given a system state of declaring up to three class labels: 'True,' 'False' or 'Unknown.' Other quantifiers, including an alternate ROC curve, are developed in this study to provide information on the probability of a system state given any of multiple declarations, which is more useful to the user. Sensitivity to prior probabilities, suggestions for user-defined parameters and areas for future research are identified as the User Interface Tool is described in detail in this thesis.  
DTIC

DTIC

*Algorithms; Target Recognition*

**20070026695** Lockheed Aeronautical Systems Co., Marietta, GA USA

**A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration**

Jean, Buddy H; Younker, John; Hung, Chih-Cheng; Sep 2004; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466744; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466744>

This paper proposes a new multi-sensor track fusion model. The widely used multisensor track fusion model is based on the Extended Kalman Tracker whereas the new fusion model is based on the alpha beta gamma tracker. This new technology will integrate multi-sensor information and extract integrated multi-sensor information to detect, track and identify multiple targets at any time, in any place under all weather conditions. This technology can be applied to the development of fighter aircraft and also to the development of aircraft for Command, Control, Communication and Computer and Information, Surveillance and Reconnaissance (C4ISR). This technology will help to protect our Homeland and finally control and destroy

any enemy who dares to challenge us from the air, land or the sea. The advantage of this new Multi-Sensor Track Fusion Model over the currently used Multi-Sensor Track Fusion Model is that it is mathematically simpler. The algorithm needs no matrix inversion and no matrix element divide-by-zero. This means it is easier to implement and there will be no mid-air computer shut down or system crash. The architecture of the new Multi-Sensor Track Fusion Model includes Multi-Sensors such as radar, electronic warfare, the digital signal processor, the alpha beta gamma tracker, the multi-sensor correlation processor, the vehicle interface unit, and the flight crew. The ultimate goal of this new Multi-Sensor Track Fusion Model is to generate fused tracks from all sensor trackers, and integrate all sensor information to provide the pilot and the C4ISR headquarters with time critical target information. Finally this new integration will help establish the air, land and sea superiority on the battlefield.

DTIC

*Algorithms; Command and Control; Detectors; Multisensor Applications; Multisensor Fusion*

**20070026696** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Self-Stabilizing Mobile Node Location Management and Message**

Dolev, Shlomi; Lahiani, Limor; Lynch, Nancy; Nolte, Tina; Aug 11, 2005; 22 pp.; In English

Contract(s)/Grant(s): F33615-01-C-1896; CCR-0121277

Report No.(s): AD-A466747; MIT-CSAIL-TR-2005-052; MIT-LCS-TR-999; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466747>

We present simple algorithms for achieving self-stabilizing location management and routing in mobile ad-hoc networks. While mobile clients may be susceptible to corruption and stopping failures, mobile networks are often deployed with a reliable GPS oracle, supplying frequent updates of accurate real time and location information to mobile nodes. Information from a GPS oracle provides an external, shared source of consistency for mobile nodes, allowing them to label and timestamp messages, and hence aiding in identification of, and eventual recovery from, corruption and failures. Our algorithms use a GPS oracle. Our algorithms also take advantage of the Virtual Stationary Automata programming abstraction, consisting of mobile clients, virtual timed machines called virtual stationary automata (VSAs), and a local broadcast service connecting VSAs and mobile clients. VSAs are distributed at known locations over the plane, and emulated in a self-stabilizing manner by the mobile nodes in the system. They serve as fault-tolerant building blocks that can interact with mobile clients and each other, and can simplify implementations of services in mobile networks. We implement three self-stabilizing, fault-tolerant services, each built on the prior services: (1) VSA-to-VSA geographic routing, (2) mobile client location management, and (3) mobile client end-to-end routing. We use a greedy version of the classical depth-first search algorithm to route messages between VSAs in different regions. The mobile client location management service is based on home locations. Each client identifier hashes to a set of home locations, regions whose VSAs are periodically updated with the client's location. VSAs maintain this information and answer queries for client locations. Finally, the VSA-to-VSA routing and location management services are used to implement mobile client end-to-end routing.

DTIC

*Algorithms; Message Processing; Messages; Position (Location); Stabilization*

**20070026725** Florida Univ., Gainesville, FL USA

**Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization**

Schutte, Jaco F; Koh, Byung-Il; Reinbolt, Jeffrey A; Fregly, Benjamin J; Haftka, Raphael T; George, Alan D; Sep 23, 2004; 41 pp.; In English

Contract(s)/Grant(s): F49620-09-1-0070

Report No.(s): AD-A466833; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466833>

Optimization is frequently employed in biomechanics research to solve system identification problems, predict human movement, or estimate muscle or other internal forces that cannot be measured directly. Unfortunately, biomechanical optimization problems often possess multiple local minima, making it difficult to find the best solution. Furthermore, convergence in gradient based algorithms can be affected by scaling to account for design variables with different length scales or units. This study evaluates a recently developed version of the particle swarm optimization (PSO) algorithm to address these problems. The algorithm's global search capabilities were investigated using a suite of difficult analytical test problems, while its scale independent nature was proven mathematically and verified using a biomechanical test problem. For comparison, all test problems were also solved with three off-the-shelf optimization algorithms a global genetic algorithm (GA) and multi-start gradient-based sequential quadratic programming (SQP) and quasi-Newton (BFGS) algorithms. For the analytical test

problems, only the PSO algorithm was successful on the majority of the problems. When compared to previously published results for the same problems, PSO was more robust than a global simulated annealing algorithm but less robust than a different, more complex genetic algorithm. For the biomechanical test problem, only the PSO algorithm was insensitive to design variable scaling, with the GA algorithm being mildly sensitive and the SQP and BFGS algorithms being highly sensitive. The proposed PSO algorithm (freely available with this article) provides a new off-the-shelf global optimization option for difficult biomechanical problems, especially those utilizing design variables with different length scales or units.

DTIC

*Algorithms; Biodynamics; Optimization*

**20070026760** California Univ., Los Angeles, CA USA

**Direct Numerical Simulation and Experimental Validation of Hypersonic Boundary-Layer Receptivity and Instability**

Zhong, Xiaolin; Mar 28, 2007; 46 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0029

Report No.(s): AD-A467163; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467163>

The objective of this research project is to compare our numerical simulation solutions with available experimental or theoretical results on hypersonic boundary layer receptivity and stability; and to conduct extensive DNS studies on the flow mechanisms of hypersonic boundary layer receptivity and stability. During the three-year period, we have conducted extensive DNS studies on the receptivity of hypersonic boundary layer flows over a sharp wedge, a flat plate, a blunt cone, and the FRESH aeroshell. DNS studies are compared with Stetson's 1984 stability experiment on Mach 7.99 flow over a blunt cone, and Maslov's leading-edge receptivity experiment on Mach 5.92 flow over a flat plate. Our numerical studies have been validated to be of high accuracy and led to further understanding of hypersonic boundary layer receptivity mechanism. Such understanding can lead to better tools for the prediction and control of high-speed boundary layer transition.

DTIC

*Boundary Layer Flow; Boundary Layers; Direct Numerical Simulation; Hypersonic Flow; Hypersonics; Simulation*

**20070026761** Massachusetts Inst. of Tech., Cambridge, MA USA

**Parameter Space: The Final Frontier. Certified Reduced Basis Methods for Real-Time Reliable Solution of Parametrized Partial Differential Equations**

Patera, Anthony T; Mar 12, 2007; 13 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0114

Report No.(s): AD-A467167; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467167>

This project is focused on reduced basis approximation methods, associated rigorous and sharp a posteriori error bounds, and offline-online computational strategies for the rapid and reliable solution of parametrized elliptic, parabolic, and more recently hyperbolic partial differential equations relevant to mechanics from the quantum through the meso-scale to the macro-scale. Typical equations and applications of interest include Density Functional Theory for solid state property calculations, the Boltzmann equation for microscale gas flows, the Navier-Stokes equations for natural convection calculations, elasticity for stress intensity factors/brittle failure, and Helmholtz and the wave equation for acoustic waveguide applications. Of particular interest is real-time and robust parameter estimation with application to detection, nondestructive evaluation, adaptive design/optimization, and control. In the online/deployed stage, we can provide results for key engineering outputs in real-time without loss of accuracy or reliability: the outputs provided - in milliseconds (online) - by our approach are provably indistinguishable from the outputs provided - typically in many minutes or even hours - by classical methods.

DTIC

*Independent Variables; Partial Differential Equations; Real Time Operation*

**20070026860** National Ground Intelligence Center, Charlottesville, VA USA

**Military Information Networks as Complex Adaptive Systems**

Miller, L D; Jun 2001; 16 pp.; In English

Report No.(s): AD-A468189; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468189>

New information technology now permits a vastly increased degree of connectivity in military communication networks. This more connected architecture should result in faster response times and greater efficiencies in military operations. A

potential downside, however, is that highly connected network architectures are more prone to chaotic behaviors. Unfortunately, these behaviors are: nonlinear, frequently counter intuitive, usually manifested only under severe stress, and difficult to discern under the 'artificial' conditions of training exercises. This paper introduces a methodology and a set of tools for the simulation of nonlinear network behaviors. The approach taken is to consider military information networks to be complex adaptive systems made up of autonomous decision nodes (of variable capacity and responsiveness) coupled by information flows (of variable urgencies and multiplicities). A coupled map- lattice approach to the simulation of network dynamic behavior (greatly facilitated via the recursive functions of the Mathematica(TradeMark) software package) is employed. Although simplistic, this approach may possess the appropriate degree of 'essential nonlinearity' for use by network designers seeking to hone their nonlinear intuition. If destructive chaotic behaviors can be thereby anticipated and ameliorated prior to their occurrence in military operations, then the promises of information age technology may be fully realized by our nation's military forces.

DTIC

*Adaptation; Complex Systems; Software Development Tools*

**20070027361** Naval Postgraduate School, Monterey, CA USA

### **Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer**

Mack, Thomas J; Mar 2007; 143 pp.; In English

Report No.(s): AD-A467274; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Certain methods of realizing numeric functions, such as  $\sin(x)$  or square root of  $x$ , in hardware involve a Taylor Series expansion or the CORDIC algorithm. These methods, while precise, are iterative and slow and may take on the order of hundreds to thousands of CPU clock cycles. A faster method involves a piecewise approximation to the function. The function value is computed by reading pre-calculated coefficients (slope and intercept for first order approximations). And then, by multiplying the function argument by the proper slope and adding the proper intercept, a close approximation to the function solution is produced. This thesis shows how this first order approximation technique was implemented on an FPGA-based COTS reconfigurable computer. MATLAB routines were developed to approximate the function as a set of consecutive, linear equations. The MATLAB approximation is combined with other modules designed in VHDL to construct an overall circuit. A pipelined circuit was created on the SRC-6E computer that reduces the latency of the  $\sin(x)$  function by over 88% and produces a result on each clock cycle. The circuit easily implements other functions by simply exchanging the approximation and coefficients. Thus, a user-friendly environment was created for calculating functions at higher speeds than the more popular current methods.

DTIC

*Algebra; Approximation; Function Generators; High Speed; Linear Equations; Linear Systems; Reconfigurable Hardware*

**20070027452** Naval Research Lab., Washington, DC USA

### **Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates**

Amatucci, William E; Schuck, Peter W; Ganguli, Gurudas; Walker, David N; Apr 27, 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-67-3419-17

Report No.(s): AD-A467594; NRL/MR/6750--07-9030; XB-NRL/MR/6750; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Hamiltonian approach in cylindrical coordinates is applied to the motion of charged particles in a uniform axial magnetic field. The method is compared to the traditional approaches of uniform circular motion and Newtonian mechanics. Cylindrical coordinates are preferred in many practical situations such as application to laboratory experiments. The advantage cylindrical coordinates offer is the ability to form a one-dimensional effective potential, which can be used to determine a number of spatial and temporal characteristics of the resulting cyclotron motion without an explicit solution of the equations of motion. This approach provides a different perspective into the dynamics of Larmor motion to complement the traditional approaches.

DTIC

*Charged Particles; Cylindrical Coordinates; Hamiltonian Functions; Magnetic Fields*

**20070027495** Civil Aeromedical Inst., Oklahoma City, OK USA

### **Relationship of Complexity Factor Ratings With Operational Errors**

Pfleiderer, Elaine M; Manning, Carol A; Goldman, Scott M; May 2007; 18 pp.; In English

Report No.(s): AD-A467731; DOT/FAA/AM-07/11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study is an examination of the extent to which objective static sector characteristics and controller ratings of static



and dynamic sector complexity factors contributed to the occurrence of operational errors (OEs) at the Indianapolis air route traffic control center (ZID). A multiple regression model of the relationship between a combination of static sector characteristics (sector altitude strata and sector size) resulted in a modest prediction of the variance in OE incidence ( $R = .70$ ,  $R^2 = .49$ ). Sector size was negatively related to OEs, indicating that smaller sectors were associated with more OEs. Sector strata were positively related to OEs, indicating that higher altitude sectors were associated with more OEs. Principal Components Analysis (PCA) of the complexity ratings produced four components with eigenvalues  $>1.00$ , accounting for 62% of the variance in the data. Components were used as predictors in a multiple regression analysis of the number of OEs in the ZID sectors. Only Component 1 (climbing and descending aircraft in the vicinity of major airports) and Component 2 (services provided to non-towered airports) contributed significantly to the total proportion of variance explained by the model ( $R = .78$ ,  $R^2 = .61$ ). Component 2 shared an inverse relationship with the number of OEs, indicating that the complexity related to providing services to non-towered airports is associated with fewer OEs. These results will be used to guide the choice of objective measures for further analysis of the influence of static and dynamic sector characteristics in the occurrence of OEs.

DTIC

*Air Traffic Control; Error Analysis; Errors; Ratings*

**20070027614** Naval Postgraduate School, Monterey, CA USA

**Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model**

Smith, Kevin B; Wolfson, Michael A; van Leijen, A V; May 4, 2007; 19 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): MIPR-N0001407AF00002

Report No.(s): AD-A467952; NPS-PH-07-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this report is to notify those in the community who have used, or are using, the Monterey-Miami Parabolic Equation (MMPE) Model of an error in previous implementations that affects the computation of volume loss. The error has been corrected and an updated version is now available. Thorough analysis of the results are provided here, including comparison with exact modal attenuation factors for bottom loss parameters, which indicate the model is now performing properly.

DTIC

*Errors; Mathematical Models; Models; Parabolic Differential Equations; Underwater Acoustics*

**20070027644** Texas Univ., Austin, TX USA

**The Role of Continuity in Residual-Based Variational Multiscale Modeling of Turbulence**

Akkerman, I; Bazilevs, Y; Calo, V M; Hughes, T J; Hulshoff, S; May 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-C-0263

Report No.(s): AD-A468018; ICES-07-16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper examines the role of continuity of the basis in the computation of turbulent flows. We compare standard finite elements and NURBS (non-uniform rational B-splines) discretizations that are employed in Isogeometric Analysis. We make use of quadratic discretizations that are  $C_0$ -continuous across element boundaries in standard finite elements, and  $C_1$ -continuous in the case of NURBS. The variational multiscale residual-based method is employed as a turbulence modeling technique. We find that  $C_1$ -continuous discretizations outperform their  $C_0$ -continuous counterparts on a per-degree-of-freedom basis. We also find that the effect of continuity is greater for higher Reynolds number flows.

DTIC

*Models; Turbulence*

**20070027679** Raytheon Co., Tucson, AZ USA

**Integrated Sensing and Processing (ISP) Phase 2: Demonstration and Evaluation for Distributed Sensor Networks and Missile Seeker Systems**

Schmitt, Harry A; May 29, 2007; 69 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-C-0437

Report No.(s): AD-A468089; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary goal of this effort is to bring to maturity a select set of basic algorithms, hardware, and approaches developed under the Integrated Sensing and Processing (ISP) Phase I program, implement them on representative hardware, and demonstrate their performance in a realistic field environment. We have identified a few promising research thrusts

investigated in ISP Phase I where field demonstrations are cost prohibitive but collected data sets are available. Here, we will conduct a thorough performance evaluation.

DTIC

*Algorithms; Detection; Homing Devices; Missile Systems; Networks; Target Acquisition*

**20070027682** Brown Univ., Providence, RI USA

**Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws**

Qiu, Jing-Mei; Shu, Chi-Wang; Jan 2007; 41 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0123

Report No.(s): AD-A468107; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, we consider the issue of convergence toward entropy solutions for high order finite volume weighted essentially non-oscillatory (WENO) scheme and discontinuous Galerkin (DG) finite element method approximating scalar nonconvex conservation laws. Although such high order nonlinearly stable schemes can usually converge to entropy solutions of convex conservation laws, convergence may fail for certain nonconvex conservation laws. We perform a detailed study to demonstrate such convergence issues for a few representative examples, and suggest a modification of the high order schemes based either on first order monotone schemes or a second order entropic projection to achieve convergence toward entropy solutions while maintaining high order accuracy in smooth regions.

DTIC

*Conservation; Conservation Laws; Convergence; Essentially Non-Oscillatory Schemes; Finite Volume Method; Galerkin Method; Oscillations*

**20070027683** Brown Univ., Providence, RI USA

**The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship**

Lu, Yadong; Wong, S C; Zhang, Mengping; Shu, Chi-Wang; Jan 2007; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-1-0291

Report No.(s): AD-A468108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we explicitly construct the entropy solutions for the Lighthill-Whitham-Richards (LWR) traffic flow model with a flow-density relationship which is piecewise quadratic, concave, but not continuous at the junction points where two quadratic polynomials meet, and with piecewise linear initial condition and piecewise constant boundary conditions. The existence and uniqueness of entropy solutions for such conservation laws with discontinuous fluxes are not known mathematically. We have used the approach of explicitly constructing the entropy solutions to a sequence of approximate problems in which the flow-density relationship is continuous but tends to the discontinuous flux when a small parameter in this sequence tends to zero. The limit of the entropy solutions for this sequence is explicitly constructed and is considered to be the entropy solution associated with the discontinuous flux. We apply this entropy solution construction procedure to solve three representative traffic flow cases, compare them with numerical solutions obtained by a high order weighted essentially non-oscillatory (WENO) scheme, and discuss the results from traffic flow perspectives.

DTIC

*Discontinuity; Entropy; Flow; Flux Density; Models; Traffic*

**20070027695** Naval Surface Warfare Center, Bethesda, MD USA

**A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions**

Fu, Thomas C; Fullerton, Anne M; Fu, Thomas K; Rice, James R; Hess, David E; Apr 2007; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468141; NSWCCD-50-TR-2007/028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Limitations in our current knowledge of a ship in extreme wave conditions have been illuminated by the work being done by the US Navy on advanced hull-forms. Stochastic approaches to these phenomena are insufficient, and deterministic testing of these events must be performed if the physics is to be understood. Although modern computer controlled wavemakers provide the ability to generate regular sine waves, long crested multi-spectral waves, mixed seas of almost any sea spectra, and even freak' waves, all of these systems require the wavemakers be tuned to the specific facility and that transfer functions between wavemaker settings and the generated wave be calculated. This tuning is performed to compensate for the facility's

geometry, wave absorbers (beaches), etc, as well as to aid the researcher in using the wavemaker system.

DTIC

*Calibrating; Height; Impact Prediction; Time Series Analysis; Transfer Functions*

**20070027709** London Univ., UK

**Digital Watermarking Using Syndrome Codes**

Cox, Ingemar J; Apr 4, 2005; 11 pp.; In English

Contract(s)/Grant(s): FA8655-03-1-3045

Report No.(s): AD-A468319; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Grantee will conduct research on informed watermarking. Recent analyses proved that the theoretical limit to digital watermarking is much higher than previously believed, however no practical means for accomplishing the theoretical rates are available. As detailed in the technical proposal, the PI will investigate means to achieve increased embedding rates. Specifically, he will: 1. refine the trellis-based coding techniques including (1) studying how variations in the trellis architecture (i.e. number of states and arcs) affect performance and (2) investigating the performance of syndrome coding as a function of the underlying error correction code. 2. investigate approximations to the informed embedding optimizations, including (1) studying how such optimizations can be efficiently computed and (2) examining the choice of symbol alphabet (binary versus n-symbol alphabets) and their corresponding modulation codes. Pending satisfactory results of the initial work and availability of funding, additional research would be performed to: 3. Improve the perceptual modeling required to hide a high data rate embedded signal in a video 4. conduct tests to measure and subsequently model the distortions that occur during the broadcasting of television 5. conduct tests to determine the robustness of our watermarking algorithms to commercial broadcasting.

DTIC

*Algorithms; Coding; Embedding; Error Correcting Codes; Signs and Symptoms*

**20070027735** Northeastern Univ., Boston, MA USA

**Theory and Applications of Computational Time-Reversal Imaging**

Davaney, Anthony J; May 3, 2007; 37 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0187

Report No.(s): AD-A468426; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document constitutes the final project report for Contract # FA9550-04-1-0187 titled Theory and Applications of Computational Time-reversal Imaging. The report summarizes the theoretical development and implementation of time-reversal based imaging and target detection algorithms for locating targets from multistatic data collected from unstructured phased antenna arrays. The report summarizes the main theoretical results obtained in the program and includes both computer simulated examples as well as results from experimental data collected by a research team from Carnegie Mellon University illustrating the use of the algorithms developed in the project. The final section of the report outlines goals for follow-on research in these general areas.

DTIC

*Algorithms; Detection; Imaging Techniques; Target Acquisition; Time*

**20070027749** Air Force Research Lab., Kirkland AFB, NM USA

**Cooperative Solutions in Multi-Person Quadratic Decision Problems: Finite-Horizon and State-Feedback Cost-Cumulant Control Paradigm**

Pham, Khanh D; Jan 2007; 9 pp.; In English

Report No.(s): AD-A468463; AFRL-VS-PS-TP-2007-1019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the cooperative cost-cumulant control regime for the class of multi-person single-objective decision problems characterized by quadratic random costs and state-feedback information structures, individual decision makers share state information with their neighbors and then autonomously determine decision strategies to achieve the desired goal of the group which is a minimization of a finite linear combination of the first k cost cumulants of a finite-horizon integral quadratic cost associated with a linear stochastic system. Since this problem formation is parameterized by the number of cost cumulants, the scalar coefficients in the linear combination and the group of decision makers, it may be viewed both as a generalization of linear-quadratic Gaussian control, when the first cost cumulant is minimized by a single decision maker and of the problem class of linear-quadratic identical-goal stochastic games when the first cost cumulant is minimized by multiple decision

makers. Using a more direct dynamic programming approach to the resultant cost-cumulant initial-cost problem, it is shown that the decision laws associated with multiple persons are linear and are found as the unique solutions of the set of coupled differential matrix Riccati equations, whose solvability guarantees the existence of the closed-loop feedback decision laws for the corresponding multi-person single-objective decision problem.

DTIC

*Decision Making; Feedback; Financial Management; Horizon; Problem Solving; Quadratic Equations*

**20070028426** Missouri Univ., Rolla, MO USA

**Background Modeling and Algorithm Fusion for Airborne Landmine Detection**

Ramachandran, Hariharan; Dec 2005; 104 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAB07-01-D-G601; W15P7T-05-R-B497

Report No.(s): AD-A466482; AMSRD-CER-NV-TR-245; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466482>

Airborne mine and minefield detection has been an active topic of research in recent times. The detection process looks for local anomalies in the acquired mid-wave infrared imagery. An anomaly is any mine size image feature that is different from its immediate surrounds. The so called RX algorithm by Reed and Yu has been used extensively in airborne mine detection systems as the anomaly detector. The RX detector measures the local signal to clutter ratio assuming a zero mean uncorrelated Gaussian background. The airborne minefield detection system is expected to detect possible mines and minefields over various types of terrains, different soil conditions and at different times of the day. For most terrains conditions, the background is often correlated and inhomogeneous. This raises the question as to whether the performance can be made invariant to terrain characteristics. The primary aim behind this thesis is to model the distributions for RX statistics of false alarms under more realistic background conditions. This modeling is expected to facilitate the study of the detectability of mines and minefields in various backgrounds. By modeling various backgrounds, guidelines can be obtained for likely false alarms rates for different backgrounds. Algorithmic fusion is simple but often effective tool to derive optimum performance from multiple detection algorithms. The parameters obtained from background modeling can be use as a catalyst for algorithm fusion and thereby improve detection performance for a given set of detector algorithms.

DTIC

*Aerial Reconnaissance; Algorithms; Mine Detectors; Mines (Ordnance)*

**20070028543** Defence Science and Technology Organisation, Edinburgh, Australia

**Application of the Unscented Transformation to Obtain Target Range, Bearing, Elevation, Range Rate, Speed and Course Estimates and Errors From Tracks Given in Cartesian Coordinates**

Ong, Hwa-Tung; Mar 2007; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467801; DSTO-TN-0745; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The unscented transformation is applied to tracks given in Cartesian coordinates to obtain target range, bearing, elevation, range rate, speed and course estimates, and their associated errors. This approach is attractive because it does not require tedious closed-form mathematical derivations, is not computationally expensive, and does not require a pseudo-random number generator. Example code and results are given to demonstrate the applicability of the approach.

DTIC

*Cartesian Coordinates; Elevation; Estimates; Range Errors; Targets*

**20070028807** Massachusetts Inst. of Tech., Cambridge, MA USA

**New Tools for Hybrid Systems**

Dahleh, Munther A; Megretski, Alexandre; May 2, 2007; 9 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0052; Proj-6895917

Report No.(s): AD-A467021; 6895917-FINAL; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467021>

The ultimate goal of our research is to find a procedure that would enable us to generate, for a class of systems, nominal finite state machine models with guaranteed error bounds that are usable for robust controller synthesis. We consider three notions of stability, input/output stability, external stability and incremental input/output stability, as they apply to deterministic finite state machine systems. We propose LP based algorithms for verifying stability of a system, or lack thereof,

in the input/output and the external sense. We show that for a class of systems, incremental I/O stability and external stability are equivalent notions, stronger than the notion of I/O stability.

DTIC

*Algorithms; Systems Stability; Controllers*

**20070028815** Auburn Univ., AL USA

**Puzzle-Based Storage Systems**

Gue, Kevin R; Feb 6, 2007; 28 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0130

Report No.(s): AD-A466830; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466830>

We introduce and develop models for a physical goods storage system based on the 15-puzzle, a classic children's game in which 15 numbered tiles slide within a 4 x 4 grid. The objective of the game is to arrange the tiles in numerical sequence, starting from a random arrangement. For our purposes, the tiles represent totes, pallets, or even containers that must be stored very densely, and the objective is to maneuver items to an input-output point for retrieval or processing. We develop analytical results for storage configurations having a single empty location (as in the game) and experimental results for configurations with multiple empty locations. Designs with many empty locations can be made to form aisles, allowing us to compare puzzle-based designs with traditional aisle-based designs found in warehousing systems.

DTIC

*Logistics; Storage*

**20070029526** Rutgers - The State Univ., New Brunswick, NJ USA

**Retort Racks for Polymeric Trays in 1400 Style Spray Retorts**

Bruins, Henderikus B; May 2003; 12 pp.; In English

Contract(s)/Grant(s): SP0103-02-D-0024-0005

Report No.(s): AD-A468626; RUTGERS-FTR 202; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468626>

The objective of this project was to design a retort rack that would maximize the retort capacity of a 1400 style spray retort and to select a material that would withstand the harsh retort spray environment. The contract consisted of three phases: 1.) mold design, 2.) mold fabrication, 3.) rack production. Test rack samples were produced at the end of phase II using three different materials. A blend of Polyphenylene (PPE) and Polypropylene (PP) with 15% short glass fiber filling was selected as the preferred material for the production of the final set of racks. Two retort producers were supplied with 100 retort racks each, for testing in a production environment. The racks increased the capacity of the retort with 29-33% and the rack material has withstood the retort environment without any problems after exposure to three-month of production environment.

DTIC

*Rations; Sprayers; Trays*

**20070029603** Teledyne Scientific and Imaging, LLC, Thousand Oaks, CA USA

**Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control**

Malmuth, Norman D; Fedorov, Alexander V; Soloviev, Victor; Apr 2007; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-C-0028

Report No.(s): AD-A468863; SC71234.RFRFTV; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468863>

This report summarizes theoretical and CFD studies related to surface discharge to quench stall-slip departure due to asymmetric vortex shedding on aircraft nose tips, augment directional control/authority agility, and develop tailless capability. This approach offers adaptability in rapidly changing flight and mission conditions, constructional simplicity, massless operation, no changes in aerodynamic shape, no influence on aircraft characteristics when the system is not in use, and low weight and power penalties, and closed loop feedback control. In the first phase of the effort, lower-order theoretical modeling showed that vortex symmetry breakdown strongly depends on the boundary-layer separation locus. The latter can be effectively controlled by a surface discharge located upstream from the separation line. Using spark discharges of relatively

small power (less than 1 kW) it is feasible to shift the separation line toward the windward surface and suppress vortex asymmetry.

DTIC

*Aerodynamic Stalling; Aircraft Spin; Dynamic Models; Fluid Dynamics; Mathematical Models; Plasma Control*

**20070029690** Air Force Research Lab., Hanscom AFB, MA USA

**Proceedings of the Quantum Computation for Physical Modeling Workshop Held in North Falmouth, Massachusetts on October 18-19, 2000**

Yepez, Jeffrey; Boghosian, Bruce; Jan 2002; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAG55-98-1-0376; F49620-01-1-0494; Proj-2304

Report No.(s): AD-A468878; AFRL-VS-HA-TR-2007-1043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468878>

A practical and efficient way to use the power of quantum mechanics (quantum parallelism due to the superposition and entanglement of states) could enormously speed up numerical simulations of interest to computational physicists. The diffusion equation the nonlinear Burgers equations, the turbulent Navier-Stokes equations, and the many-body Schroedinger equation could all be solved much more rapidly if efficient quantum algorithms could be implemented for their solution. The presentations at the conference that are published here review the progress toward these goals.

DTIC

*Algorithms; Conferences; Equations; Quantum Computation; Quantum Theory*

**20070029710** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Learning Robustly From Instructions**

Anderson, John R; Apr 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-2-0014; Proj-COGV

Report No.(s): AD-A468924; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468924>

The goal of the project was to perform a proof of potential by applying ACT-R, a modular architecture, to a challenging learning task. This task involved learning what is traditionally taught as the solution of linear equations in American high schools. This involved giving the system the abilities that a prepared student entering Alebra 1 should have. This included the abilities to perform basic arithmetic and to parse arithmetic Expressions, giving the system a representation of the instructions that appear in a standard algebra Textbook, and having the system learn by feedback on its solution efforts how to solve the class of problems that appear in the textbook.

DTIC

*Algebra; Learning; Linear Equations*

**20070029794** Army Research Lab., Aberdeen Proving Ground, MD USA

**A Multipurpose Projectile for Penetrating Urban Targets**

Phillabaum, II, Robert A; Schraml, Stephen J; Summers, Richard L; Sorensen, Brett R; Moxley, Rayment E; Cargile, James D; Apr 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A469119; ARL-RP-173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469119>

The U.S. Army Research Laboratory at the Aberdeen Proving Ground, MD is interested in developing a thin-walled munition capable of perforating an urban structure and delivering a payload intact to the interior of the structure. One of the most critical design aspects of this munition is the shell casing. Its shape, thickness, and material composition must be selected such that it has sufficient structural integrity to perforate a double-reinforced concrete wall as a rigid body and to deliver a payload to the interior of the structure. A combined experimental-computational approach is being used to evaluate candidate munition configurations. The goal of maximizing the payload mass delivered, with a thin-walled and lightweight casing, must be balanced against the need to retain sufficient structural integrity to survive the breaching of the wall intact. In this study, various casing-wall thicknesses and nose shapes and their effects on the payload volume were considered.

DTIC

*Penetration; Projectiles; Shapes; Simulation; Targets*

**20070029817** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Quick-Turn Finite Element Analysis for Plug-and-Play Satellite Structures**

Naff, Jeffrey E; Mar 2007; 118 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469164; AFIT/GA/ENY/07-M15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469164>

Plug-and-play (PnP) satellite construction is a key component of the US Air Force Operational Responsive Space (ORS) effort. The goal of ORS is to provide mission specific satellite support by configuring and launching a satellite to a selected orbit within days of the request. One major challenge during the time limited process is to accurately predict the response of the satellite to harmonic loads that occur during launch and satellite operation. Given the time limitations, constructing finite element (FE) models by traditional methods is not currently a viable option for the ORS timeline. By implementing an approach for rapid FE model creation, we can significantly reduce the timeline from weeks to hours. The advantages to our approach include simplification of model creation, ease of design modifications, and significant reduction in the FE model creation timeline; all lending this approach for utilization within the ORS acquisition cycle.

DTIC

*Artificial Satellites; Communication Networks; Finite Element Method; Plugs*

65

**STATISTICS AND PROBABILITY**

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

**20070026362** Connecticut Univ., Storrs, CT USA

**Effects-Based Design of Robust Organizations**

Ruan, Sui; Meirina, Candra; Tu, Haiying; Yu, Feili; Pattipati, Krishna R; Jun 2004; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0101

Report No.(s): AD-A466015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466015>

Effects-based design of robust organizations seeks to synthesize an organizational structure and its strategies (resource allocation, task scheduling and coordination), to achieve the desired effect(s) in a dynamically changing mission environment. In this paper, we model the dynamic system associated with the mission environment (e.g., environment faced by a joint task force with a military objective or the competitive environment confronted by a consumer electronic company striving to increase its market share) as a finite-state Markov Decision Process (MDP). Using this model, we determine a near-optimal action strategy that specifies which action to take in each state of the MDP model by Monte Carlo control method. The action strategy determines a range of possible missions the organization may face. The range of missions and platform utilization measures, in turn, are used to synthesize a robust organizational structure.

DTIC

*Markov Processes; Monte Carlo Method; Organizations*

**20070026371** George Mason Univ., Fairfax, VA USA

**An Approximation Technique for Belief Revision in Timed Influence Nets**

Haider, Sajjad; Levis, Alexander; Jun 2004; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0033; F30602-01-C-0065

Report No.(s): AD-A466041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466041>

The paper presents an approach for belief updating in Timed Influence Nets. Influence Nets provide graphical representation of causal or influencing relationships in complex situations. They are used to model and evaluate courses of actions in certain domains and to compare the performance of actions based on the desired outcome. In Timed Influence Nets, the impact or effect of these actions on target variables is not instantaneous. This is modeled by adding communication and processing delays in the model. The paper provides a technique for updating the beliefs of variables in the model over time once new evidence is received about some of the variables in the model. The objective is to assess the behavior of the variables

of interest as a function of both the timing of actions and the receipt of evidence on indicators, thus providing aid to decision makers in the revision of the planned courses of actions.

DTIC

*Approximation; Nets; Probability Theory*

**20070026492** Boston Univ., Boston, MA USA

**Analysis of Origin Destination Flows (Raw Data)**

Lakhina, Anukool; Papagiannaki, Konstantina; Crovella, Mark; Diot, Christophe; Kolaczyk, Eric D; Taft, Nina; Nov 10, 2003; 57 pp.; In English

Contract(s)/Grant(s): N000140310043

Report No.(s): AD-A466318; BUCS-TR-2003-022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466318>

In a recent paper, Structural Analysis of Network Traffic Flows [BUCS-TR-2003-021], we analyzed the set of Origin Destination traffic flows from the Sprint-Europe and Abilene backbone networks. This report presents the complete set of results from analyzing data from both networks. The results in this report are specific to the Sprint-1 and Abilene datasets studied in the above paper.

DTIC

*Network Analysis; Telephones*

**20070026531** Virginia Univ., Charlottesville, VA USA

**An Adaptive Quality of Service Aware Middleware for Replicated Services**

Krishnamurthy, Sudha; Sanders, William H; Cukier, Michel; Nov 2003; 15 pp.; In English

Contract(s)/Grant(s): F30602-98-C-0187

Report No.(s): AD-A466398; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466398>

A dependable middleware should be able to adaptively share the distributed resources it manages in order to meet diverse application requirements, even when the quality of service (QoS) is degraded due to uncertain variations in load and unanticipated failures. In this paper, we have addressed this issue in the context of a dependable middleware that adaptively manages replicated servers to deliver a timely and consistent response to time-sensitive client applications. These applications have specific temporal and consistency requirements, and can tolerate a certain degree of relaxed consistency in exchange for better response time. We propose a flexible QoS model that allows clients to specify their timeliness and consistency constraints. We also propose an adaptive framework that dynamically selects replicas to service a client's request based on the prediction made by probabilistic models. These models use the feedback from online performance monitoring of the replicas to provide probabilistic guarantees for meeting a client's QoS specification. The experimental results we have obtained demonstrate the role of feedback and the efficacy of simple analytical models for adaptively sharing the available replicas among the users under different workload scenarios.

DTIC

*Applications Programs (Computers); Consistency; Replicas*

**20070026541** Florida Univ., Gainesville, FL USA

**Scale-Independent Biomechanical Optimization**

Schutte, J F; Koh, B; Reinbolt, J A; Haftka, R T; George, A; Fregly, B J; Jun 2003; 3 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-09-1-0070

Report No.(s): AD-A466411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466411>

In this paper, the authors present a scale-independent method of optimization with a stochastic global optimization approach introduced by Kennedy and Eberhart: the Particle Swarm Optimizer (PSO). They apply this method to the biomechanical system identification problem of finding positions and orientations of joint axes in body segments through the processing of experimental movement data. They compare its performance to the BFGS optimizer, which falls under a class of optimizers more commonly used for this application. Traditionally, gradient-based methods such as the BFGS algorithm have been used to solve joint parameter identification problems, but major drawbacks to these methods are their sensitivity to problem scaling and algorithm parameter selection. These drawbacks require costly and time-consuming parameter



sensitivity studies to be carried out for a problem before consistently acceptable results can be obtained. In addition, the presence of noise in the data will often cause premature convergence to an incorrect solution. The PSO method has some very desirable qualities that can be exploited in these types of problems. First, because it requires no gradient evaluations and because of the way it is formulated, the algorithm is insensitive to scaling of the design variables. Second, because of the algorithm's simplicity, there are very few parameters to tune, and even these have been shown to be relatively problem independent. Finally, the concurrent nature of the swarm algorithm lends it to parallelization, enabling the solution of problems that are too computationally challenging for single-processor machines. The need for greater computational power is common in the search for more realistic and accurate engineering models that currently can only be addressed by the use of parallel algorithms.

DTIC

*Algorithms; Biodynamics; Kinematics; Optimization; Stochastic Processes*

**20070026636** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Change-Point Methods for Overdispersed Count Data**

Wilken, Brian A; Mar 2007; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466621; AFIT/GOR/ENS/07-26; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466621>

A control chart is often used to detect a change in a process. Following a control chart signal, knowledge of the time and magnitude of the change would simplify the search for and identification of the assignable cause. In this research, emphasis is placed on count processes where overdispersion has occurred. Overdispersion is common in practice and occurs when the observed variance is larger than the theoretical variance of the assumed model. Although the Poisson model is often used to model count data, the two-parameter gamma-Poisson mixture parameterization of the negative binomial distribution is often a more adequate model for overdispersed count data. In this research effort, maximum likelihood estimators for the time of a step change in each of the parameters of the gamma-Poisson mixture model are derived. Monte Carlo simulation is used to evaluate the root mean square error performance of these estimators to determine their utility in estimating the change point, following a control chart signal. Results show that the estimators provide process engineers with accurate and useful estimates for the time of step change. In addition, an approach for estimating a confidence set for the process change point will be presented.

DTIC

*Change Detection; Quality Control*

**20070026644** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Hyperspectral Imagery Target Detection Using Principal Component Analysis**

Reyes, Kevin B; Mar 2007; 100 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466634; AFIT/GOR/ENS/07-22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466634>

The purpose of this research was to improve on the outlier detection methods used in hyperspectral imagery analysis. An algorithm was developed based on Principal Component Analysis (PCA), a classical multivariate technique usually used for data reduction. Using PCA, a score is computed and a test statistic is then used to make outlier declarations. First, four separate PCA test statistics were compared in the algorithm. It was found that Mahalanobis distance performed the best. This test statistic was then compared using the entire data set and a clustered data set. Since it has been shown in the literature that even one outlier can distort the covariance matrix, an iterative approach to the clustered based algorithm was developed. After each iteration, if an outlier(s) is identified, the observation(s) is removed and the algorithm is reapplied. Once no new outliers are identified or one of the stopping conditions is met, the algorithm is reapplied a final time with the new covariance matrix applied to the original data set. Experiments were designed and analyzed using analysis of variance to identify the significant factors and optimal settings to maximize each algorithm's performance.

DTIC

*Algorithms; Detection; Imagery; Principal Components Analysis; Target Acquisition*

**20070026646** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Feasibility Study of Variance Reduction in the Logistics Composite Model**

Cole, III, George P; Mar 2007; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466637; AFIT/GLM/ENS/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466637>

The Logistics Composite Model (LCOM) is a stochastic, discrete-event simulation that relies on probabilities and random

number generators to model scenarios in a maintenance unit and estimate optimal manpower levels through an iterative process. Models such as LCOM involving pseudo-random numbers inevitably have a variance associated with the output of the model for each run, and the output is actually a range of estimates. The reduction of the variance in the results of the model can be costly in the form of time for multiple replications. The alternative is a range of estimates that is too wide to realistically apply to real-world maintenance units. This research explores the application of three different methods for reducing the variance of the output in the Logistics Composite Model. The methods include Common Random Numbers, Control Variates, and Antithetic Variates. The differences in the 95% confidence intervals were compared between the variance reduction techniques and the original model to determine the degree of variance reduction. The result is a successful variance reduction in the primary output statistics of interest using the application of the Control Variates technique, as well as a methodology for the implementation of Control Variates in LCOM.

DTIC

*Analysis of Variance; Feasibility; Logistics; Models*

**20070026669** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Examining Clandestine Social Networks for the Presence of Non-Random Structure**

Seder, Joshua S; Mar 2007; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466683; AFIT/GOR/ENS/07-24; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466683>

This thesis develops a tractable, statistically sound hypothesis testing framework for the detection, characterization, and estimation of non-random structure in clandestine social networks. Network structure is studied via an observed adjacency matrix, which is assumed to be subject to sampling variability. The vertex set of the network is partitioned into  $k$  mutually exclusive and collectively exhaustive subsets, based on available exogenous nodal attribute information. The proposed hypothesis testing framework is employed to statistically quantify a given partition's relativity in explaining the variability in the observed adjacency matrix relative to what can be explained by chance. As a result, valuable insight into the true structure of the network can be obtained. Those partitions that are found to be statistically significant are then used as a basis for estimating the probability that a relationship tie exists between any two vertices in the complete vertex set of the network. The proposed methodology aids in the reduction of the amount of data required for a given network, focusing analyses on those attributes that are most promising. Ample effort is given to both model demonstration and application, including an example using open-source data, illustrating the potential use for the defense community and others.

DTIC

*Hypotheses; Network Analysis; Networks*

**20070026683** Georgia Inst. of Tech., Atlanta, GA USA

**L2 Stability Analysis of the Central Discontinuous Galerkin Method and a Comparison between the Central and Regular Discontinuous Galerkin Methods**

Liu, Yingjie; Shu, Chi-Wang; Tadmor, Eitan; Zhang, Mengping; Jan 2002; 24 pp.; In English

Contract(s)/Grant(s): DMS-0511815

Report No.(s): AD-A466706; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466706>

In this paper we give stability analysis and error estimates for the recently introduced central discontinuous Galerkin method when applied to linear hyperbolic equations. A comparison between the central discontinuous Galerkin method and the regular discontinuous Galerkin method in this context is also made. Numerical experiments are provided to validate the quantitative conclusions from the analysis.

DTIC

*Galerkin Method; Stability; Stability Tests*

**20070026693** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation**

Theocharous, Georgios; Mahadevan, Sridhar; Kaelbling, Leslie P; Sep 27, 2005; 73 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DABT63-99-1-0012; NCC2-1237

Report No.(s): AD-A466737; MIT-CSAIL-TR-2005-058; AIM-2005-027; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466737>

Partially observable Markov decision processes (POMDPs) are a well studied paradigm for programming autonomous

robots, where the robot sequentially chooses actions to achieve long term goals efficiently. Unfortunately, for real world robots and other similar domains, the uncertain outcomes of the actions and the fact that the true world state may not be completely observable make learning of models of the world extremely difficult, and using them algorithmically infeasible. In this paper we show that learning POMDP models and planning with them can become significantly easier when we incorporate into our algorithms the notions of spatial and temporal abstraction. We demonstrate the superiority of our algorithms by comparing them with previous flat approaches for large scale robot navigation.

DTIC

*Autonomous Navigation; Autonomy; Markov Processes; Navigation; Observation; Robots*

**20070026705** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Empirical Effective Dimension and Optimal Rates for Regularized Least Squares Algorithm**

Caponnetto, Andrea; Rosasco, Lorenzo; De Vito, Ernesto; Verri, Alessandro; May 27, 2005; 16 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0915

Report No.(s): AD-A466778; MIT-CSAIL-TR-2005-036; AIM-2005-019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466778>

This paper presents an approach to model selection for regularized least-squares on reproducing kernel Hilbert spaces in the semi-supervised setting. The role of effective dimension was recently shown to be crucial in the definition of a rule for the choice of the regularization parameter, attaining asymptotic optimal performances in a minimax sense. The main goal of the present paper is showing how the effective dimension can be replaced by an empirical counterpart while conserving optimality. The empirical effective dimension can be computed from independent unlabelled samples. This makes the approach particularly appealing in the semi-supervised setting.

DTIC

*Algorithms; Least Squares Method*

**20070026706** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Risk Bounds for Regularized Least-Squares Algorithm with Operator-Value Kernels**

De Vito, Ernesto; Caponnetto, Andrea; May 16, 2005; 20 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0915

Report No.(s): AD-A466779; MIT-CSAIL-TR-2005-031; AIM-2005-015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466779>

We show that recent results in [3] on risk bounds for regularized least-squares on reproducing kernel Hilbert spaces can be straight-forwardly extended to the vector-valued regression setting. We first briefly introduce central concepts on operator-valued kernels, then we show how risk bounds can be expressed in terms of a generalization of effective dimension.

DTIC

*Algorithms; Kernel Functions; Least Squares Method; Risk*

**20070026797** Army Tank-Automotive and Armaments Command, Warren, MI USA

**Techniques for the Statistical Analysis of Observer Data**

Bennett, John G; Mar 28, 2001; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467464; TARDEC-TR-16198; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467464>

For vehicle designers, the main goal of experiments on the observability of combat vehicles is a comparison of the probability of detection for two vehicles as a function of range. This paper addresses the statistical techniques to analyze such data to compare the probability of detection of the two vehicles as a function of range. Two techniques are compared: 1. Fitting logistic curves to the data of the vehicles, and 2. Using the Fisher Exact Test to compare the probability of detection of the two vehicles at each range. The paper discusses the issues of background variability and confidence levels for hypothesis testing. Finally, a recommendation is made on how to write a specification for the detectability of a vehicle.

DTIC

*Combat; Detection; Fitting; Probability Theory; Statistical Analysis*

**20070026868** Naval Surface Warfare Center, Dahlgren, VA USA

**An Inverse of the Generalized Circular Error Function**

Didonato, Armido; Jun 2004; 43 pp.; In English

Report No.(s): AD-A468233; NSWCDD/TR-04/43; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468233>

This report describes an algorithm, INGCE, to evaluate an inverse of the generalized circular error function, GCE, also known as the elliptical normal function. Given a two-dimensional normal distribution function with mean zero and standard deviations  $u, v$  with a circular target  $T$  centered at the mean;  $R$ , the radius of  $T$ , is determined for a specified probability,  $P$ , of a shot falling in  $T$ . A Fortran 77 subroutine, INVGCE, is available that is based on INGCE, which produces  $K$  ( $R=Ku$ ) to eight significant digits for  $10(\exp -8)$  less than or equal to  $P$  less than or equal to  $1 - 10(\exp -8)$  and  $0$  less than or equal to  $c = v/u$  less than or equal to  $1$ . A table of  $K$  versus  $P$  and  $c$  is included. The appendix contains a 22-page table that shows the tabulation of  $K$  as a function of  $P$  and  $c$ .

DTIC

*Accuracy; Algorithms; Error Analysis; Error Functions; FORTRAN; Probability Distribution Functions; Probability Theory; Subroutines; Target Acquisition*

**20070026869** Naval Surface Warfare Center, Dahlgren, VA USA

**An Inverse of the Circular Coverage Function**

Didonato, Armido; Jan 2005; 43 pp.; In English

Report No.(s): AD-A468234; NSWCDD/TR-05/89; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468234>

This report describes an algorithm, INCIR, to evaluate an inverse of the Circular Coverage Function, CIR. Given a two-dimensional normal distribution function with mean zero and equal unit standard deviations and a target located at  $(h, k)$ ;  $R$ , the radius of the circle,  $C$ , with center at  $(h, k)$  is determined for a specified probability of a shot falling within  $C$ . A Fortran 77 subroutine, INVCIR, is available that is based on INCIR, which produces  $R$  to eight significant digits for  $10(\exp -8)$  less than or equal to  $P$  less than or equal to  $1 - 10(\exp -8)$  and  $0$  less than or equal to  $d = (h(\exp 2) + k(\exp 2))^{1/2}$  less than or equal to  $10(\exp 8)$ . The appendix contains a 22-page table that shows the tabulation of  $R$  as a function of  $P$  and  $d$ .

DTIC

*Accuracy; Algorithms; Error Analysis; FORTRAN; Probability Distribution Functions; Probability Theory; Subroutines; Target Acquisition*

**20070026870** Naval Surface Warfare Center, Dahlgren, VA USA

**An Inverse of the Elliptic Coverage Function**

Didonato, Armido; Apr 2005; 63 pp.; In English

Report No.(s): AD-A468235; NSWCDD/TR-05/90; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468235>

This report describes an algorithm, INELP, to evaluate an inverse of the elliptic coverage function, ELP. Given a circular target  $T$  centered at  $(h, k)$ ;  $r$ , the radius of  $T$ , is determined for a specified probability  $P$  of a shot falling in  $T$  under a two-dimensional normal distribution function with mean zero and standard deviations  $u, v$ . A Fortran 77 double-precision subroutine, INVELP, is available that is based on INELP. It produces  $r$  to approximately eight significant digits when  $10(\exp -20)$  is less than or equal to  $P$  less than or equal to  $1 - 10(\exp -11)$ ,  $0$  less than or equal to  $h / u$  less than or equal to  $10(\exp 14)$ , and  $0$  less than or equal to  $k / v$  less than or equal to  $10(\exp 14)$ . Appendixes contain refined limits of integration for  $P$ , Grubbs' approximation for  $r(\text{sub } 0)$ , probability over a square circumscribing a circle, and a 28-page table that shows the tabulation of  $r$  as a function of  $P, h, k, v$  ( $u = 1$ ).

DTIC

*Accuracy; Algorithms; Elliptic Functions; Error Analysis; FORTRAN; Probability Distribution Functions; Probability Theory; Subroutines; Target Acquisition*

**20070027322** Naval Postgraduate School, Monterey, CA USA

**The Potential Impact of an Auction Based Retention Bonus and Other Factors on Continuation Rates of General Dentists Completing Their Initial Obligation**

Anderson, Robert L; Mar 2007; 83 pp.; In English

Report No.(s): AD-A467131; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis seeks to determine the impact of an auction based retention bonus on continuation rates for general dentists

completing their initial obligation. An auction based retention bonus has the potential to improve retention rates. In lieu of actual bids from Navy general dentists, the difference between average civilian dentist salaries and Navy general dentist pay is used to represent theoretical opportunity costs. Inputting opportunity costs into a break-even formula allows approximation of the retention bonus amount needed for a one-year and/or five-year employment agreement with the Navy. A logistic regression retention model is also estimated using data for 516 Navy general dentists commissioned between 1998 and 2001. Model results indicate that accession source significantly affects the decision to continue military service. Officers commissioned as direct accessions and participants in the Dental Student Program are more likely to stay in the navy than participants in the Health Sciences Collegiate Program. Dentists commissioned in 2000-2001 are less likely to stay than those commissioned in 1998-1999. Those commissioned between the ages of 30 and 39 are more likely to continue service beyond their initial obligation than younger dentists. Race and gender do not significantly affect retention.

DTIC

*Dentistry; Manpower; Navy; Regression Analysis*

**20070027326** Naval Postgraduate School, Monterey, CA USA

**The Effect of Graduate Education on the Performance of Air Force Officers**

Pearson, Jeffrey P; Mar 2007; 114 pp.; In English

Report No.(s): AD-A467144; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis investigates the effects of graduate education on the retention and promotion of Line of the Air Force (LAF) officers at the rank of Captain and Major. Logistic regression models are estimated to examine the effects of graduate education on the retention of Captains and Majors and on promotion to Major using data from the Active Duty Military Master File for fiscal years 1992 through 2006. A difference-in-difference estimator is incorporated into the promotion model to evaluate the effects of an Air Force policy change intended to eliminate any bias towards advanced education at promotion boards. Besides graduate education, explanatory variables include basic demographic traits and professional characteristics. Results indicate that graduate education has a positive effect on retention of LAF officers at the rank of Captain and Major. Findings from the promotion model indicate that graduate education also has a positive effect on promotion but results for the change in policy (masking education information for promotion) are inconclusive. In addition, race and career field are shown to influence both retention behavior and promotion while gender significantly affects retention but not promotion.

DTIC

*Armed Forces (United States); Education; Military Personnel; Personnel; Regression Analysis*

**20070027331** Naval Postgraduate School, Monterey, CA USA

**Reducing the 'Gap of Pain': A Strategy for Optimizing Federal Resource Availability in Response to Major Incidents**

Heidtke, Curtis L; Mar 2007; 105 pp.; In English

Report No.(s): AD-A467162; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In large-scale domestic disasters, a temporal gap frequently develops between the exhaustion of state and local resources and the arrival of federal resources. To date, strategies for reducing this so-called gap of pain have not been based upon scientific methodology. This thesis reviews four alternatives for ensuring continuous availability of critical commodities: pre-positioning, pre-emptive federal action, time-phased deployment, and surge transportation. For a given scenario, the optimum approach is likely to be some combination of these alternatives. Stochastic modeling using optimization techniques holds great promise for producing efficient and effective strategic solutions. This thesis evaluates one such model using two notional scenarios affecting the Washington, D.C. metropolitan area: a Category 4 hurricane and a one-kiloton nuclear explosion near the city center. The results reinforce the validity of using this method to generate viable strategic alternatives for consideration by senior decision-makers. With additional development and testing, the model may be productively applied to a range of natural and man-made incidents, in disparate locations.

DTIC

*Deployment; Logistics; Stochastic Processes; Surges; Transportation*

**20070027356** Naval Postgraduate School, Monterey, CA USA

**High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations**

Dea, John R; Giraldo, Francis X; Neta, Beny; Apr 2007; 17 pp.; In English

Report No.(s): AD-A467252; NPS-MA-07-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this report we document the implementation of high-order Higdon nonreflecting boundary conditions. We suggest a way to choose the parameters and demonstrate numerically the efficiency of our choice. The model we used is the linearized

2-D Euler equations with zero advection. These equations are solved by the finite difference method. We close with a list of topics for research.

DTIC

*Algebra; Boundary Conditions; Differential Equations; Linear Equations; Reflection*

**20070027660** Logistics Management Inst., McLean, VA USA

**Stochastic Lanchester Air-To-Air Campaign Model: Methods Used to Generate Model Outputs and a User's Guide: 2007**

Hemm, Robert V; Lee, David A; Eckhause, Jeremy M; Dukovich, John A; May 2007; 128 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): GS-00F-0026M

Report No.(s): AD-A468049; LMI-PA603T2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The report describes latest version of the Stochastic Lanchester Air-to-Air Campaign Model (SLAACM). The report has two major sections and appendices. The first section includes several chapters that describe the mathematics and analysis methods used for engagement modeling, bomb damage calculations, campaign planning, and integer program optimization. The second section is a user's guide for the latest SLAACM release. The appendices describe the unique and efficient engagement algorithm used in SLAACM, supporting Markov analysis tools, mathematics to support additional combat scenarios, and results of supplemental analyses.

DTIC

*Models; Stochastic Processes; Warfare*

**20070027677** Maryland Univ., College Park, MD USA

**A Strong Zero-One Law for Connectivity in One-Dimensional Geometric Random Graphs With Non-Vanishing Densities**

Han, Guang; Makowski, Armand M; Apr 30, 2007; 22 pp.; In English

Contract(s)/Grant(s): DAAD19-01-2-0011

Report No.(s): AD-A468079; ISR-TR-2007-8; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We consider the geometric random graph where  $n$  points are distributed independently on the unit interval  $[0, 1]$  according to some probability distribution function  $F$ . Two nodes communicate with each other if their distance is less than some transmission range. When  $F$  admits a continuous density  $f$  which is strictly positive on  $[0, 1]$ , we show that the property of graph connectivity exhibits a strong critical threshold and we identify it. This is achieved by generalizing a limit result on maximal spacings due to Levy for the uniform distribution.

DTIC

*Communication Networks; Graph Theory; Laws; Models*

**20070027767** Army Research Lab., Aberdeen Proving Ground, MD USA

**Design of Experiments Study of the Initial Extended Area Protection and Survivability (EAPS) Projectile System**

Chen, Michael M; May 2007; 38 pp.; In English

Contract(s)/Grant(s): Proj-622618.H80

Report No.(s): AD-A468505; ARL-TR-4109; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A novel approach is proposed for assessing the effects of gun barrel centerline variations on Extended Area Protection and Survivability (EAPS) projectile launch dynamics. The technique of experiment design was adopted to simulate an array of deformed gun tubes representing reasonable manufacturing tolerance. Subsequently, in-bore structural analysis of the EAPS projectile system subject to the simulated gun barrels was performed. The projectile responses, including transitional and rotational velocities at the muzzle, were obtained. The analysis of variance method was then used to identify the sources of variability and to determine the significance of each gun shape. Based on the response statistics, no erratic launch conditions should be expected for the EAPS projectile because of normal barrel centerline variations.

DTIC

*Experiment Design; Projectiles; Protection*

**20070028440** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Patterns of War Termination: A Statistical Approach**

Robinson, II, Paul D; Mar 2007; 151 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466619; AFIT/GOR/ENS/07-23; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466619>

This research uses an advanced statistical technique to expand upon the current understanding of war termination. Specifically, this thesis addressed questions concerning the most relevant factors toward predicting both the outcomes of interstate wars and the winners of intrastate and extra-systemic wars, within the limitations of the available data. Open-source war data from the Correlates of War Project was analyzed using both binary and multinomial logistic regression techniques. While the Correlates of War Project did not necessarily focus its data collection efforts on those variables historically associated with war termination, it did provide a sufficient number of variables with which to demonstrate the applicability of logistic regression techniques to war termination analyses. As a consequence, every significant logistic regression model contains a single relevant variable. For both intrastate and extra-systemic wars, the duration of the conflict was found to be most relevant to predicting the winner. In contrast, the proportion of total casualties borne by a nation in an interstate war was most relevant to predicting the manner in which an interstate war ends. Conclusions drawn from this research and suggestions for future statistical applications to war termination studies were also discussed.

DTIC

*Statistical Analysis; Warfare*

**20070028818** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Classifying Failing States**

Nysether, Nathan E; Mar. 2007; 150 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466620; AFIT/GOR/ENS/07-19; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466620>

The US is heavily involved in the first major war of the 21st Century -- The Global War on Terror (GWOT). As with any militant group, the foundation of the enemy's force is their people. There are two primary strategies for defeating the terrorists and achieving victory in the GWOT. First, we must root out terrorists where they live, train, plan, and recruit and attack them militarily. Second, we must suffocate them by cutting off the supply of new soldiers willing to choose aggression or even death over their current life. This thesis helps to achieve these objectives by applying Multivariate Analysis techniques to identify the states most likely to provide asylum for terrorists. Weak and Failed States are attractive to terrorist groups looking for safe haven and recruits. Governments in these states are often unable to prevent illegal activity, and are vulnerable to corruption or takeover. Citizens of failing states often experience poverty, disease, and unemployment, and may see little hope for improvement. Terrorists can meet these disenfranchised people's basic needs and promise brighter futures for families of those willing to fight and perhaps die for the cause. Current published efforts to identify failing states primarily use Ordinary Least Squares Regression, which requires the analyst to predefine the degree to which a state is likely to fail. This thesis uses a Factor Analysis approach to identify the key indicators of state failure, and Discriminant Analysis to classify states as Stable, Borderline, or Failing based on these indicators. Furthermore, each nation's discriminant function scores are used to determine their degree of instability. The methodology is applied to 200 countries for which open source data was available on 167 variables. Results of the classification are compared with subject matter experts in the field of state failure.

DTIC

*Terrorism; Failure Analysis; Classifications*

**20070029728** Advanced Optical Technologies, Inc., Albuquerque, NM USA

**Coherence Solution for Bidirectional Reflectance of Surfaces with Wavelength-Scale Statistics (Postprint)**

Hoover, Brian G; Gamiz, Victor L; Feb 2006; 17 pp.; In English

Contract(s)/Grant(s): FA9451-04-C-0353

Report No.(s): AD-A468980; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468980>

The scalar bidirectional reflectance distribution function (BRDF) due to a perfectly conducting surface with roughness and autocorrelation width comparable with the illumination wavelength is derived from coherence theory on the assumption of a random reflective phase screen and an expansion valid for large effective roughness. A general quadratic expansion of the two-dimensional isotropic surface autocorrelation function near the origin yields representative Cauchy and Gaussian BRDF solutions and an intermediate general solution as the sum of an incoherent component and a nonspecular coherent component proportional to an integral of the plasma dispersion function in the complex plane. Plots illustrate agreement of the derived

general solution with original bistatic BRDF data due to a machined aluminum surface, and comparisons are drawn with previously published data in the examination of variations with incident angle, roughness, illumination wavelength, and autocorrelation coefficients in the bistatic and monostatic geometries. The general quadratic autocorrelation expansion provides a BRDF solution that smoothly interpolates between the well-known results of the linear and parabolic approximations.

DTIC

*Bidirectional Reflectance; Reflectance*

**20070029990** NASA Johnson Space Center, Houston, TX, USA

**Risk Assessment: Evidence Base**

Johnson-Throop, Kathy A.; October 25, 2007; 17 pp.; In English; Medical Informatics and Technology Working Group, 23-27 Oct. 2006, Cologne, Germany; Original contains color and black and white illustrations; No Copyright; Avail.: CASI:

A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070029990>

Human systems PRA (Probabilistic Risk Assessment: a) Provides quantitative measures of probability, consequence, and uncertainty; and b) Communicates risk and informs decision-making. Human health risks rated highest in ISS PRA are based on 1997 assessment of clinical events in analog operational settings. Much work remains to analyze remaining human health risks identified in Bioastronautics Roadmap.

Derived from text

*Probability Theory; Decision Making; Health; Risk*

66

**SYSTEMS ANALYSIS AND OPERATIONS RESEARCH**

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

**20070026376** Naval Undersea Warfare Center, Newport, RI USA

**Analysis of Network-Enabled ASW Concepts of Operation**

Klingbeil, Ralph; Shannon, John; Galdorisi, George; Jun 2004; 61 pp.; In English; Original contains color illustrations Report No.(s): AD-A466050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466050>

This report describes an analysis of two selected concepts for improving Anti-Submarine Warfare (ASW) performance and effectiveness by means of network-enabled sharing of information during ASW operations. These concepts are identified as Shared Situational Awareness (SSA) and Collaborative Information Environment (CIE). It is shown that the application of queueing theory models provide useful tools for quantitatively estimating the value-added of implementing these concepts. In addition, queueing theory can be used to examine the tradeoffs between information systems and shooters. In general, queueing theory can support analysis whenever military operations, such as ASW, can be characterized as demand for service processes. For the SSA and CIE concepts, an ASW tactical situation (TACSIT) is described and then metrics are defined and quantified by means of queueing models. Insights, conclusions and recommendations are then developed from the parametric quantitative results about the potential improvements to ASW performance and effectiveness achievable through implementation of these network-enabled concepts.

DTIC

*Antisubmarine Warfare; Quantitative Analysis; Situational Awareness*

**20070026423** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**The Hybrid Tree: An Index Structure for High Dimensional Feature Spaces (Preprint)**

Chakrabarti, Kaushik; Mehrotra, Sharad; Jan 1999; 9 pp.; In English

Contract(s)/Grant(s): DAAL01-96-2-0003

Report No.(s): AD-A466131; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466131>

Feature based similarity search is emerging as an important search paradigm in database systems. The technique used is to map the data items as points into a high dimensional feature space which is indexed using a multidimensional data structure. Similarity search then corresponds to a range search over the data structure. Although several data structures have been proposed for feature indexing, none of them is known to scale beyond 10-15 dimensional spaces. This paper introduces the



hybrid tree a multidimensional data structure for indexing high dimensional feature spaces. Unlike other multidimensional data structures, the hybrid tree cannot be classified as either a pure data partitioning (DP) index structure (e.g., R-tree, SS-tree, SRtree) or a pure space partitioning (SP) one (e.g., KDB-tree, hBtree); rather, it combines positive aspects of the two types of index structures a single data structure to achieve search performance more scalable to high dimensionalities than either of the above techniques (hence, the name hybrid ). Furthermore, unlike many data structures (e.g., distance based index structures like SS-tree, SR-tree), the hybrid tree can support queries based on arbitrary distance functions. Our experiments on real high dimensional large size feature databases demonstrate that the hybrid tree scales well to high dimensionality and large database sizes. It significantly outperforms both purely DP-based and SP-based index mechanisms as well as linear scan at all dimensionalities for large sized databases.

DTIC

*Data Management; Hybrid Structures; Information Retrieval*

**20070026425** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

### **Integration of SATURN System and VGIS**

Yu, Hu; Mehrotra, Sharad; Winkler, Robert; Ho, Sean S; Gregory, Timothy C; Allen, Swati D; Jan 1999; 7 pp.; In English  
Contract(s)/Grant(s): DAAL01-96-2-0003

Report No.(s): AD-A466133; UCI-TR-DB-99-09; UCI-TR-MARS-99-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466133>

This paper reports on the integration of the SpAtio-Temporal Uncertainty ReasoNing (SATURN) system being developed in our group with the Virtual GIS (VGIS) system in order to improve its performance and scalability to complex dynamic environments as well as to enhance its functionality as a collaborative planning tool. To achieve this we added three new components to VGIS: a spatiotemporal object manager, a performance monitor, and a task database. The spatio-temporal object manager uses SATURN techniques for indexing dynamic multidimensional (spatio-temporal) objects to support effective and efficient object traversal during visualization. The performance monitor adjusts the resource allocation between VGIS components and adaptively adjusts image quality to guarantee bounded visualization performance. The task database extends VGIS as a tool for collaborative planning. Performance results illustrate that the SATURN techniques for object management and the performance monitor significantly improve VGIS performance allowing it to scale to complex scenarios with a large number of dynamic objects.

DTIC

*Data Management; Geographic Information Systems*

**20070026426** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

### **An Approach to Integrating Query Refinement in SQL**

Ortega-Binderberger, Michael; Chakrabarti, Kaushik; Mehrotra, Sharad; Jan 2002; 19 pp.; In English

Contract(s)/Grant(s): DAAL01-96-2-0003

Report No.(s): AD-A466134; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466134>

With the emergence of applications that require content based similarity retrieval, techniques to support such a retrieval paradigm over database systems have emerged as a critical area of research. User subjectivity is an important aspect of such queries, i.e., which objects are relevant to the user and which are not depends on the perception of the user. Query refinement is used to handle user subjectivity in similarity search systems. This paper explores how to enhance database systems with query refinement for content-based (similarity) searches in object-relational databases. Query refinement is achieved through relevance feedback where the user judges individual result tuples and the system adapts and restructures the query to better reflect the users information need. We present a query refinement framework and an array of strategies for refinement that address different aspects of the problem. Our experiments demonstrate the effectiveness of the query refinement techniques proposed in this paper.

DTIC

*Feedback; Information Retrieval*

**20070026427** Florida State Univ., Tallahassee, FL USA

**Knowledge Tracing and Prediction of Future Trainee Performance**

Jastrzembski, Tiffany S; Gluck, Kevin A; Gunzelmann, Glenn; Jun 2006; 15 pp.; In English

Contract(s)/Grant(s): Proj-2313

Report No.(s): AD-A466136; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466136>

Intelligent tutoring systems seek to optimize instruction and training by adapting and individualizing the learning experience on the basis of a student model (Shute, 1995). This model represents the system's estimate of the student's current knowledge or skill level, established from a performance history. Knowledge tracing (Alevan & Koedinger, 2002; Anderson, Conrad, & Corbett, 1989) is a dynamic, Bayesian approach to updating the estimates of probability of skill mastery in the student model. A fundamental shortcoming of this approach is that it does not include a representation of memory decay during periods of non-practice. As a result, traditional student modeling approaches are unable to make predictions regarding knowledge and skill changes under various future training schedules or to prescribe how much training will be required to achieve specific levels of readiness at a specific future time. In this paper, we propose a new knowledge tracing equation, computationally inspired by the learning and forgetting equations in the ACT-R cognitive architecture (Anderson et al., 2004), which uses performance history to baseline student model parameters and then extrapolates knowledge state transformation to predict future performance. We explore practical issues concerning predictive models of future trainee performance and the prescription of frequency and timing of optimal learning with training systems. For instance, we investigate how much data from the training history are necessary to achieve reasonable predictive validity, and we describe the impact of data granularity through a quantitative assessment of how adequately the model can fit and predict human performance curves across aggregate-level, team-level, and individual-level resolutions. The paper ends with a discussion of the implications of this research for the future of training and education

DTIC

*Education; Mathematical Models; Performance Prediction; Students*

**20070026489** Center for Army Analysis, Fort Belvoir, VA USA

**Optimizing the Allocation of Sensor Assets for the Unit of Action**

Tutton, Stephanie J; Sep 2004; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466312; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466312>

The U.S. Army's Objective (Future) Force is being developed as a faster, lighter, more rapidly deployable alternative to the current force structure. The development of a strategy for the allocation of the Unit of Action's organic sensing assets is necessary to achieve the maximum situational awareness and information dominance required for successful combat operations on the future battlefield. This paper presents a methodology for finding an appropriate mix and allocation strategy for organic Unit of Action sensors in a given scenario. Specifically, the author developed a mathematical programming model to analyze the mix and allocation of organic sensor assets using an optimization-based approach. The model requires the following inputs: an inventory of sensors and platforms, a list of asset configurations known as packages, and an intelligence-based clustering of targets. The model then creates operationally feasible assignments of packages to target clusters, maximizing the weighted number of targets detected. Stochastic optimization and mixed integer linear programming were used to accomplish this goal. Two optimization models were developed: (1) a Sensor Mix Model that, given a fixed mix or inventory, allocates assets to target areas on the battlefield; and (2) a Sensor Mix Model that suggests an organic mix of sensors for consideration in developing the Objective Force structure. These models have the potential to be used as operational decision support tools for the unit commander. The notional data set used for model development included 10 platform types, 10 target clusters, 10 target categories, 4 enemy orders of battle, and 4 outcomes. However, these inputs could be easily modified based on the requirements of the user or analyst.

DTIC

*Allocations; Decision Support Systems; Detection; Detectors; Mathematical Models; Mathematical Programming; Target Acquisition*

**20070026503** Synergia, Redwood City, CA USA

**Risk Advised Course of Action (COA) Analysis**

Courand, Gregg; Liu, Wanderley; Mar 2007; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0196; Proj-459S

Report No.(s): AD-A466339; AFRL-IF-RS-TR-2007-84; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466339>

The purpose of this project is to demonstrate the feasibility and value of Synergia's experimental 'Risk-Advised Planning' (RAP) technology. This technology embodies an analytical tool called 'Value of Informed Control over Events' (VOICE). VOICE manages simulation-based analysis for COA development and assessment. RAP integrates human systems modeling tools to develop causal conditions and trajectories for projected COA execution, with VOICE decision-theoretic tools to assess and comparatively evaluate candidate COAs. The results of VOICE guide COA design/redesign, and circumscribe whatever information gathering and human systems modeling may be required. The value of the experimental VOICE technology was successfully demonstrated as a formal mechanism for managing the potentially unbounded combinatory complexity of simulation-based planning. VOICE clearly identifies the most important causal variables in a COA. It sharply circumscribes the simulation studies that are required to establish the kinds and frequency of outcomes pertinent to COA evaluation and redesign. The authors illustrate RAP's operation on a simulation scenario -- the Jakarta scenario -- that was developed under the Joint Semi-Automated Forces (JSAF) environment. The Jakarta scenario consists of a series of events following the assassination of the Indonesian president and key government leaders that ultimately leads to a military intervention of the Australian forces (blue forces) on Indonesia (red forces.) First, they describe their revised version of the Jakarta scenario and use it as background to illustrate the complexities associated with the development of plans and the design of simulation studies. Then, they summarize the technology and methods employed in this demonstration, including the VOICE technology and the H-RAP method. Next, they present the demonstration itself; they describe each step of their hierarchical planning approach as they apply it to the Jakarta scenario.

DTIC

*Computerized Simulation; Management Planning; Military Operations; Planning; Risk; Simulation*

**20070026524** Air Warfare Centre RAF, Lincoln, UK

**Further Evidence of the Effects of Wind Turbine Farms on AD Radar**

Aug 12, 2005; 57 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466373; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466373>

The Government is supporting the introduction of wind turbine farms within the UK as part of its renewable energy strategy. As a result of the Government's policy, there has been a rapid increase in the number of planning applications for wind turbine farms, including offshore developments. Prior to conducting live flight trials in 2004, the MoD scrutinised planning applications for wind turbine farm developments within 74 km and Line of Sight (LoS) of a primary Air Defence (AD) surveillance radar. However, following those trials, the resultant Trial Report recommended that the MoD scrutinise wind turbine farm planning applications within LoS of AD radars, regardless of range. As a result of this recommendation, the MoD temporarily removed the 74 km range limit. There remains a requirement for MoD to provide more robust and substantiated evidence in support of this policy change. Consequently, the Directorate of Counter Terrorism and UK Operations (D CT&UK Ops) tasked the Air Warfare Centre (AWC) (Air Command and Control Operational Evaluation Unit (Air C2 OEU)) with gathering further evidence on the effects of wind turbines on AD radar performance. This task was conducted as a live flight trial during the period 29 Mar 8 Apr 05.

DTIC

*Policies; Search Radar; System Effectiveness; Wind Effects; Wind Turbines*

**20070026530** Center for Army Analysis, Fort Belvoir, VA USA

**Value Added Analysis - VAAFY03**

Heck, John G; May 2003; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466392; CAA-R-03-14; XA-DCSG8/DC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466392>

This project was requested by the Office of the Deputy Chief of Staff, G8, Force Development. The purpose of the project was to evaluate the costs and benefits of selected weapon systems and to develop and evaluate alternative weapon system

modernization programs. Value Added Analysis (VAA) analyzes benefits and costs among different weapon systems and munitions.

DTIC

*Combat; Cost Analysis; Cost Effectiveness; Optimization; Weapon Systems*

**20070026544** Florida Univ., Gainesville, FL USA

**A Parallel Particle Swarm Optimizer**

Schutte, J F; Fregly, B J; Haftka, R T; George, A D; Jan 2003; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-09-1-0070; R03-LM07332-01

Report No.(s): AD-A466417; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466417>

Time requirements for the solving of complex large-scale engineering problems can be substantially reduced by using parallel computation. Motivated by a computationally demanding biomechanical system identification problem, we introduce a parallel implementation of a stochastic population based global optimizer, the Particle Swarm Algorithm, as a means of obtaining increased computational throughput. The Particle Swarm requires very few algorithmic parameters to define convergence behavior due to its simplicity, and, as a population based optimization method it is a natural candidate for concurrent computation. The parallelization of the Particle Swarm Optimization (PSO) algorithm is detailed and its performance and characteristics demonstrated for the biomechanical system identification problem as example.

DTIC

*Algorithms; Computation; Optimization; Parallel Processing (Computers)*

**20070026557** Florida Univ., Gainesville, FL USA

**Parallel Global Optimization with the Particle Swarm Algorithm (Preprint)**

Schutte, J F; Reinbolt, J A; Fregly, B J; Haftka, R T; George, A D; Dec 2004; 34 pp.; In English

Contract(s)/Grant(s): F49620-09-1-0070

Report No.(s): AD-A466447; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466447>

Present day engineering optimization problems often impose large computational demands, resulting in long solution times even on a modern high-end processor. To obtain enhanced computational throughput and global search capability, we detail the coarse-grained parallelization of an increasingly popular global search method, the Particle Swarm Optimization (PSO) algorithm. Parallel PSO performance was evaluated using two categories of optimization problems possessing multiple local minima - large-scale analytical test problems with computationally cheap function evaluations and medium-scale biomechanical system identification problems with computationally expensive function evaluations. For load-balanced analytical test problems formulated using 128 design variables, speedup was close to ideal and parallel efficiency above 95% for up to 32 nodes on a Beowulf cluster. In contrast, for load-imbalanced biomechanical system identification problems with 12 design variables, speedup plateaued and parallel efficiency decreased almost linearly with increasing number of nodes. The primary factor affecting parallel performance was the synchronization requirement of the parallel algorithm, which dictated that each iteration must wait for completion of the slowest fitness evaluation. When the analytical problems were solved using a fixed number of swarm iterations, a single population of 128 particles produced a better convergence rate than did multiple independent runs performed using sub-populations (8 runs with 16 particles, 4 runs with 32 particles, or 2 runs with 64 particles). These results suggest that 1) parallel PSO exhibits excellent parallel performance under load-balanced conditions, 2) an asynchronous implementation would be valuable for real-life problems subject to load imbalance, and 3) larger population sizes should be considered when multiple processors are available.

DTIC

*Algorithms; Optimization*

**20070026559** Virginia Univ., Charlottesville, VA USA

**Real-Time Communication and Coordination in Embedded Sensor Networks**

Stankovic, John A; Abdelzaher, Tarek F; Lu, Chenyang; Sha, Lui; Hou, Jennifer C; Jul 2003; 22 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0576

Report No.(s): AD-A466459; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466459>

Sensor networks can be considered distributed computing platforms with many severe constraints, including limited CPU

speed, memory size, power, and bandwidth. Individual nodes in sensor networks are typically unreliable and the network topology dynamically changes, possibly frequently. Sensor networks also differ because of their tight interaction with the physical environment via sensors and actuators. Because of this interaction, we find that sensor networks are very data-centric. Due to all of these differences, many solutions developed for general distributed computing platforms and for ad-hoc networks cannot be applied to sensor networks. After discussing several motivating applications, this paper first discusses the state of the art with respect to general research challenges, then focuses on more specific research challenges that appear in the networking, operating system, and middleware layers. For some of the research challenges, initial solutions or approaches are identified.

DTIC

*Communication Networks; Coordination; Embedding; Real Time Operation; Topology*

**20070026631** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Updating Optimal Decisions Using Game Theory and Exploring Risk Behavior Through Response Surface Methodology**

Jordan, Jeremy D; Mar 2007; 157 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466605; AFIT/GOR/ENS/07-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466605>

This thesis utilizes game theory within a framework for updating optimal decisions based on new information as it becomes available. Methodology is developed that allows a decision maker to change his perceived optimal policy based on available knowledge of the opponents strategy, where the opponent is a rational decision maker or a random component nature. Utility theory is applied to account for the different risk preferences of the decision makers. Furthermore, response surface methodology is used to explore good risk strategies for the decision maker to approach each situation with. The techniques are applied to a combat scenario, a football game, and a terrorist resource allocation problem, providing a decision maker with the best possible strategy given the information available to him. The results are intuitive and exemplify the benefits of using the methods.

DTIC

*Game Theory; Risk*

**20070026634** Michigan State Univ., East Lansing, MI USA

**Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Postprint)**

Zeng, Zhiwei; Liu, Xin; Deng, Yiming; Udpa, Lalita; Knopp, Jeremy S; Steffes, Gary; Mar 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4349

Report No.(s): AD-A466615; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466615>

A new formulation using the reduced magnetic vector potential and the electric scalar potential is proposed for modeling of eddy current (EC) problems using finite element analysis. The major advantage of the proposed formulation is that it eliminates the need for meshing the current source. In EC nondestructive testing the probe coil scans across the sample which involves motion of the coil. Simulation of EC scans in conventional finite element models requires considerable re-meshing. In the proposed formulation, the mesh and system matrix remain unchanged with different coil positions. The incomplete factorization of the system matrix as pre-conditioner is performed only once during the entire scan, which results in a significant reduction of computation time.

DTIC

*Eddy Currents; Electric Potential; Finite Element Method; Scalars*

**20070026675** Paine Coll., Augusta, GA USA

**A Quantum Approach to Multi-Agent Systems (MAS), Organizations, and Control**

Lawless, W F; Jun 2003; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466693; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466693>

In some rapidly approaching future, on a battlefield, deep-space or planetary mission, teams of agents will be confronted with a problem beyond their computational capability, putting missions at risk. This risk arises from a lack of social theory based on first principles for decision-making in the face of ill-defined problems (IDPs). Also, no first principles exist to address

the downside of cooperation (e.g., terrorist cells, corruption, and, regarding agents, reductions in computational power from communication costs when an increasing number of agents cooperates interactively). These problems make traditional social models impractical for a multiple-agent system to solve IDPs. In contrast to logical positivist models, such as command or consensus decision models, quantizing the pro-con positions in decision-making may produce a robust model that increases in computational power with 'N.' Previously, optimum solutions of IDPs were found to occur when incommensurable beliefs interacting before neutral decision makers generated sufficient emotion to process information, 'I,' but insufficient to impair the interaction, producing more trust compared to cooperation. This model has been extended to the first quantum information density functional theory of groups, especially mergers between organizations. The author now begins to integrate his model with Markovian models. Twenty-nine briefing charts summarize the presentation.

DTIC

*Decision Making; Group Dynamics; Mathematical Models; Organizations; Problem Solving; Quantum Theory*

**20070026691** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Collective Choice with Uncertain Domain Models**

Richards, Whitman; Aug 16, 2005; 20 pp.; In English

Contract(s)/Grant(s): 6894705

Report No.(s): AD-A466728; MIT-CSAIL-TR-2005-054; AIM-2005-024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466728>

When groups of individuals make choices among several alternatives, the most compelling social outcome is the Condorcet winner, namely the alternative beating all others in a pair-wise contest. Obviously the Condorcet winner cannot be overturned if one sub-group proposes another alternative it happens to favor. However, in some cases, and especially with haphazard voting, there will be no clear unique winner, with the outcome consisting of a triple of pair-wise winners that each beat different subsets of the alternatives (i.e. a 'top-cycle'.) We explore the sensitivity of Condorcet winners to various perturbations in the voting process that lead to top-cycles. Surprisingly, variations in the number of votes for each alternative is much less important than consistency in a voter's view of how alternatives are related. As more and more voter's preference orderings on alternatives depart from a shared model of the domain, then unique Condorcet outcomes become increasingly unlikely.

DTIC

*Models; Selection; Voting*

**20070026699** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Autonomous Virtual Mobile Nodes**

Dolev, Shlomi; Gilbert, Seth; Schiller, Elad; Shvartsman, Alex; Jun 15, 2005; 13 pp.; In English

Contract(s)/Grant(s): CCR-0098305; 0121277

Report No.(s): AD-A466762; MIT-CSAIL-TR-2005-043; MIT-LCS-TR-992; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466762>

This paper presents a new abstraction for virtual infrastructure in mobile ad hoc networks. An Autonomous Virtual Mobile Node (AVMN) is a robust and reliable entity that is designed to cope with the inherent difficulties caused by processors arriving, leaving, and moving according to their own agendas, as well as with failures and energy limitations. There are many types of applications that may make use of the AVMN infrastructure: tracking, supporting mobile users, or searching for energy sources. The AVMN extends the focal point abstraction in and the virtual mobile node abstraction in. The new abstraction is that of a virtual general-purpose computing entity, an automaton that can make autonomous on-line decisions concerning its own movement. We describe a self-stabilizing implementation of this new abstraction that is resilient to the chaotic behavior of the physical processors and provides automatic recovery from any corrupted state of the system.

DTIC

*Autonomy; Extremely Low Frequencies; Networks; Stabilization*

**20070026718** Rensselaer Polytechnic Inst., Troy, NY USA

**Supporting Effects-Based Operations with Information Technology Tools: Examining Underlying Assumptions of EBO Tool Development Practices**

Wales, William J; Triscari, Thomas; Sep 2004; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466810; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466810>

Throughout the course of history, great leaps in progress and understanding have been facilitated through the questioning of basic assumptions. In an effort to uncover critical opportunities and vulnerabilities within effect-based operations (EBO), similar questions must be posed to our current assumptions underlying EBO tool development practices. Required for these assumptions to be examined is a shared understanding of strategy formulation as an intensely human process. The breadth of approaches used in recent years to help commanders formulate effects-based courses of action (CoA) is quite diverse including expert systems, Bayesian networks, and scenario analysis. All of these approaches represent best guess assumptions of how to codify aspects of the strategy development process, often with out regard for the principles of automation. The adverse unintended consequences made possible from this neglect are wide ranging, including the potential to inadvertently foster convergent vs. divergent thinking, conditioning commanders and policy makers to accept a dangerously limited view as an accurate model of real world threats. Imperative to avoiding this conceivable eventuality is a strategic perspective on EBO tool development practices. Identified in this paper are four major paradigms or schools of thought of strategic decision support: autonomous, directive, predictive, and emergent. The proposed paradigms are offered to illustrate how recent EBO tool development approaches may be classified and subsequently characterized based upon their inherent gravitation to a particular decision support paradigm.

DTIC

*Decision Support Systems; Information Systems; Procedures*

**20070026756** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Virtual Stationary Automata for Mobile Networks**

Dolev, Shlomi; Gilbert, Seth; Lahiani, Limor; Lynch, Nancy; Nolte, Tina; Jan 21, 2005; 18 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0121; F33615-01-C-1896

Report No.(s): AD-A467098; MIT-CSAIL-TR-2005-004; MIT-LCS-TR-979; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467098>

We define a programming abstraction for mobile networks called the Virtual Stationary Automata programming layer, consisting of real mobile clients, virtual timed I/O automata called virtual stationary automata (VSAs), and a communication service connecting VSAs and client nodes. The VSAs are located at pre-specified regions that tile the plane, defining a static virtual infrastructure. We present a self-stabilizing algorithm to emulate a VSA using the real mobile nodes that are currently residing in the VSA's region. We also describe several examples of applications whose implementations benefit from the simplicity obtained through use of the VSA abstraction.

DTIC

*Algorithms; Automata Theory*

**20070026757** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**Simultaneous Localization, Calibration, and Tracking in an ad Hoc Sensor Network**

Taylor, Christopher; Rahimi, Ali; Bachrach, Jonathan; Shrobe, Howard; Apr 26, 2005; 19 pp.; In English

Contract(s)/Grant(s): F33615-01-C-1896

Report No.(s): AD-A467100; MIT-CSAIL-TR-2005-029; AIM-2005-016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467100>

We introduce Simultaneous Localization and Tracking (SLAT), the problem of tracking a target in a sensor network while simultaneously localizing and calibrating the nodes of the network. Our proposed solution, LaSLAT, is a Bayesian filter providing on-line probabilistic estimates of sensor locations and target tracks. It does not require globally accessible beacon signals or accurate ranging between the nodes. When applied to a network of 27 sensor nodes, our algorithm can localize the nodes to within one or two centimeters.

DTIC

*Calibrating; Position (Location); Targets*

**20070026766** Center for Naval Analyses, Alexandria, VA USA

**Using Gaming and Agent Technology to Explore C2**

Perla, Peter P; Loughran, Julia; Jun 2003; 68 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467258; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA467258>

Traditional command and control research occurs at two extremes of the cost and fidelity spectrums. At one end, low cost seminar games and simple abstractions, like chess, offer insights, but lack rigorous scientific techniques for analysis. On the other hand, highly detailed simulations, like those conducted for the US Navy's Global War Game, cost time and money, and offer little in support of developing scientific proofs. This paper details the methodology of employing two complementary concepts to the field of C2 research: game-based experimentation using distillation games, and agentbased methods. These approaches fall midway on the cost and fidelity spectrums. The game distillation, SCUDHunt, has proven to be successful in providing a rigorous scientific and statistical approach for experimentation. The results of SCUDHunt experiments offer insights into team behavior, shared situational awareness, and team performance. To complement this human-player environment, we created SCUDHunt computer agents. This agent-based approach provides an exploratory environment complementary to the human-based game. This paper provides an overview of the work we, and others, have done in these areas to date, and proposes some future directions to develop the promise of this approach.

DTIC

*Command and Control; Game Theory*

**20070026774** Aptima, Inc., Woburn, MA USA

**Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts)**

Kleinman, David L; Levchuck, Georgiy M; Hutchins, Susan G; Kemple, William G; Jun 2003; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467391; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA467391>

No abstract available

*Charts; Congruences; Organizations; Reverse Engineering*

**20070026777** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Realistic and Affordable Cyberware Opponents for the Information Warfare Battlespace**

Stytz, Martin R; Banks, Sheila B; Young, Michael J; Jun 2003; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467405; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA467405>

As military environments increase in the complexity, fidelity, scope, and number of participants, the reliance of the military upon information superiority to facilitate successful operations increases. In conjunction with this increase upon accurate and timely information the vulnerability of military forces to information attack also increases. Additionally, information management capability improvements inevitably increase the value of the information management networks and software; thereby, directly increasing the incentive for attacking or pirating the network and software capabilities. Therefore, as the information management capabilities of military forces increase, there is a corresponding need for improved security for the software and network systems and this need for improved security will increase as the value of the software and network systems increases. This improvement in information management capabilities must be accompanied by a corresponding increase in the ability to manage the protection of military information systems, which is a topic that has received scant attention.

DTIC

*Security; Warfare*

**20070026780** Icosystem Corp., Cambridge, MA USA

**Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms**

Bonabeau, Eric; Hunt, Carl W; Gaudio, Paolo; Jun 2003; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467426; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA467426>

Agent-based modeling (ABM) is a recent simulation modeling technique that consists of modeling a system from the bottom up, capturing the interactions taking place between the system's constituent units. Such a bottom up approach enables



users to describe and predict emergent phenomena. These include aggregate, system-level behaviors that can be counter-intuitive. Because decentralized command and control (DC2) paradigms can sometimes lead to counter-intuitive phenomena, ABM is the tool of choice to test DC2 and can provide significant insight into the design of DC2 approaches.  
DTIC

*Adaptation; Algorithms; Apogee Boost Motors; Command and Control; Models; Simulation*

**20070026783** Air Force Research Lab., Wright-Patterson AFB, OH USA

**IEIST Technologies Enabling TCT Prosecution**

Satterwaite, Charles P; Corman, David E; Herm, Thomas S; Jun 2003; 32 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467431; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467431>

Twelve years after Desert Storm, conduct of Time Critical Target (TCT) operations remains one of the most difficult challenges facing US military forces. While a variety of DoD and DARPA programs are addressing technologies to locate and identify TCTs, finding the target candidate is only one part of the problem. Success will only occur when we shorten the entire 'kill chain', and operate within the enemy's maneuver timeline. The automated exchange and processing of battlefield information is critical to achieving viable decision timelines in this arena. The situation demands a secure, robust network backbone supporting automated decision aids designed to execute commander's guidance. Critical decision aids include the ability to monitor and exchange critical tactical information, to evaluate real-time intelligence and generate actionable Target Evidence Files and to re-assign en-route tactical and support assets to higher value tasks. The Air Force Research Laboratory (AFRL), with support of The Boeing Company, is executing several research initiatives targeted at these information exchange shortfalls. AFRL is developing the Joint Battlespace Infosphere (JBI) as a means to realize information dominance. In effect, the JBI can be viewed as a tactical Internet that provides unprecedented access to data sources. Through this wide-area network connectivity, the JBI can be accessed, searched, and manipulated to create new products. This paper will discuss the Insertion of Embedded Infosphere Support Technology (IEIST) research in which the Guardian Agent (GA) will be embedded within the Force Template (FT) and transmitted to the appropriate C2 node(s) over Link 16. The demonstration C2 node is planned to be the Advanced AWACS Prototype Software, which will host the transmitted GAs as well as the TCT Evidence File Generation Agents, and the Real-time Battle Management system that will match tactical assets to selected TCTs.

DTIC

*AWACS Aircraft; Data Processing; Data Systems; Decision Support Systems; Probability Theory; Prototypes; Targets; Time Dependence*

**20070026791** Department of National Defence, Ottawa, Ontario Canada

**A Woven Web of Guesses**

Giffin, Ralph E; Reid, Darryn J; Jun 2003; 68 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467454; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467454>

A WOVEN WEB of GUESSES -- Canto One: Network Centric Warfare and the Myth of the New Economy. -- Canto Two: Network Centric Warfare and the Myth of Inductivism. -- Canto Three: Network Centric Warfare and the Virtuous Revolution. INTRODUCTION -- Canto One: The NCW business analogy is highly problematic. Important and often adverse insight have been ignored. -- Canto Two: The NCW thesis perpetuates a discredited theory of knowledge and knowledge development, known as naive inductivism, that has long exerted powerful influence over the military. -- Canto Three: Exciting opportunities exist if we replace inductivism with critical rationalism. Unlike inductivism, critical rationalism is consistent with profound insights into the nature of logic, information, knowledge and reasoning. In short, the prerequisite to a revolution in military affairs is a revolution in the way we think about thinking.

DTIC

*Communication Networks; Warfare*

**20070026793** Maryland Univ., College Park, MD USA

**The GeoGraph 3D Computational Laboratory**

Dibble, Catherine; Feldman, Philip G; Jun 2003; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467457; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467457>

Human interactions of all kinds, both friendly and unfriendly, are increasingly structured by networks of transportation

and communication spatial technologies. Yet our tools to model, understand, and predict dynamic human interactions and behavior on spatial networks and geographic landscapes have lagged far behind. Even recent progress in social network modeling has not yet offered us any capability to model dynamic processes among mobile agents who interact at all scales on small-world and scale-free geographic networks. Computational laboratory modeling of dynamic human interactions on richly structured landscapes is important for understanding the sometimes counter-intuitive dynamics of such loosely coupled systems of non-linear interactions. Deeper understanding is more important than ever not only because the stakes are so much higher, but because we now have greater strategic control over the structural design and therefore the effects of our networks of organizational and spatial technologies.

DTIC

*Mathematical Models; Simulation*

**20070026813** Army Research Lab., Aberdeen Proving Ground, MD USA

**Time-Base Tree Graphs for Stabilized Force Structure Representations**

Chamberlain, Sam; Leeds, Chris; Jun 2003; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467517; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467517>

A basic, and often key, component of any battlefield representation is the forces involved. Obtaining high-resolution force structure data has always been a major task. This is true whether the representation is for simulated or actual operations. However, the problem extends far beyond simply obtaining a single force structure snapshot. The real challenge is maintaining the data, especially when numerous other programs are creating and linking their data to the force structure. This paper describes an approach for maintaining consistency in a high-resolution database of Army units that is undergoing continual change due to force modification. The use of time-based tree graphs is proposed as a technique for providing stability and maximizing the retention of existing entities to minimize the effect to systems that use the data. In a network-centric context, an easily accessible repository called the Army Organization Server (AOS) is under development that will contain the evolving, default force structure of the Army.

DTIC

*Organizations; Topology*

**20070026829** Department of National Defence, Ottawa, Ontario Canada

**Workforce Configuration of a Canadian Forces Geomatics Division**

Ng, Kevin Y; Ghanmi, Ahmed; Mitchell, Roy; Lam, M N; Sep 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467627; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467627>

This paper addresses some of the pertinent issues related to the workforce configuration of a C2 organization within the Canadian Forces. The mission of the latter is to produce Geomatics Information supporting US National Imaging and Mapping Agency's (NIMA) Foundation Based Operations (FBO). Initially, the open queueing network representation of the Geomatics division (where each node or station is governed by a GI/G/s queue) is examined and its complexity analyzed. The Geomatics network belongs to the class of queueing network with signals. An alternate network architecture is proposed and the intent of which is to provide a simplified network whereby the theory of product-form solutions can be employed to evaluate the workforce configuration. The equivalence of the L norm on the waiting times between the original and the revised network is demonstrated. A nonlinear integer programming model to minimize the L norm on the waiting times for the revised network is formulated. The solution procedure involves transforming the nonlinear problem into a linear problem using approximation techniques. Fictitious data are used to illustrate the methodology.

DTIC

*Approximation; Canada; Command and Control; Mathematical Models; Network Analysis; Queueing Theory*

**20070026840** Strategic Perspectives, Inc., McLean, VA USA

**Assessing C3I in Support of Dismounted Operations in Complex Terrain**

Brady, Edward; Starr, Stuart; Jun 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467715; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467715>

The assessment of dismounted operations in complex terrain remains one of the most challenging problems for the military analysis community. Recently, a study was performed by the US Army Science Board to identify the operational

capabilities that were needed to enhance the effectiveness of these operations, with emphasis on C3I. To establish a context for the study, an extensive data mining activity was undertaken to identify the key issues and to formulate preliminary insights. This activity focused on 'lessons learned' reports from actual operations and after action reports from recent experiments. In the former category, C3I lessons recorded (if not learned) were identified in the Handbook for Joint Urban Operations (reference 1). As an illustration, based on an assessment of the Russian experience in Chechnya, it was concluded that 'The command and control structure needs to be able to adapt to the urban environment where communication may be difficult.' Similarly, in the area of experimentation, the USMC's experiences in Project Metropolis (reference 2) revealed shortfalls in communications at the lowest tactical levels (e.g., platoon commander and squad leader). Based on the results of this data mining, several vignettes were selected that spanned an interesting set of levels of conflict and environmental conditions. Three of these vignettes were selected to illuminate selected C3I issues: a reverse slope, treeline attack against a well-protected squad in rugged terrain; floor clearing operations in a building; and humanitarian assistance in a small village.

DTIC

*Data Mining; Terrain*

**20070027294** Naval Postgraduate School, Monterey, CA USA

### **Simulation of Coherent Signals with Forward Error Correction Coding**

Kong, Der-Hung; Mar 2007; 67 pp.; In English

Report No.(s): AD-A467078; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis focuses on the modeling and simulation of the performance of M-ary modulation techniques. In addition to the most popular used coherent modulation schemes, forward error correction (FEC) coded signals, and fading channels are also considered. The channel is modeled for the two cases of fading and no fading, both with additive white Gaussian noise (AWGN). The effect of barrage noise interference is also considered. Binary phase-shift keying (BPSK), 16-PSK, and 16-QAM (quadrature amplitude modulation) communication systems are simulated and analyzed. For BPSK, both hard decision decoding (HDD) and soft decision decoding (SDD) are considered. For 16-PSK and 16-QAM, only HDD is examined. Simulation results and analytical results are compared. The results show that the modeling and simulation in SystemView, are in excellent agreement with the analytical results.

DTIC

*Coding; Error Analysis; Error Correcting Codes; Phase Shift; Random Noise; Simulation*

**20070027304** Naval Postgraduate School, Monterey, CA USA

### **Polarimetric Thermal Imaging**

Loo, Fook L; Mar 2007; 121 pp.; In English

Report No.(s): AD-A467102; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Passive infrared (IR) imagers, using intensity contrast for target detection, are often limited by low target-background contrast. Detecting stationary targets against cluttered backgrounds presents an even bigger challenge. Polarized signatures can be used as an additional discriminator, to improve target detection probability and reduce false alarm rate. In this research, a polarimetric thermal imager, operating in the mid wave infrared (3-5  $\mu$ m), was set up using the Merlin InSb camera with three internal wire grid polarizers. Non uniformity correction and radiometric calibration were performed to compensate for differences in detector response and polarizer's transmittance. The scene consisted of a heated aluminum plate in front of a large area blackbody as background. The viewing angle, defined as the angle between surface normal and camera line of sight, was varied by rotating the plate about its vertical axis. Stokes parameters were computed from the irradiance images. Images of intensity, degree of polarization and polarization angle were derived from the Stokes parameters. The dependence of these polarization characteristics on viewing angle was investigated. While intensity increased slightly with viewing angle, degree of polarization increased rapidly when the viewing angle was increased from 20c to 80c. The polarization angle increased with viewing angle and became constant at 150c for viewing angle greater than 60c. Target to background contrast based on degree of polarization increased with viewing angle and was higher than intensity contrast for viewing angle greater than 20c. Image processing algorithms were developed to segment the target plate from its background. The target similarity metric used was the texture-based Fisher distance, which enabled the fusion of one or more data type.

DTIC

*Image Processing; Infrared Imagery; Polarimetry; Thermal Mapping*

**20070027335** Naval Postgraduate School, Monterey, CA USA

**Particle Filter Based Tracking in a Detection Sparse Discrete Event Simulation Environment**

Borovies, Drew A; Mar 2007; 135 pp.; In English

Report No.(s): AD-A467179; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One of the key abilities of agents in military simulations is to react to both detections of and counter-detections by other agents in the environment. While methods have been developed to model these detections and counter-detections, the majority of these methods model detection and counter-detection as an all or nothing prospect in which an un-detected entity at some point crosses an arbitrary threshold of observability and becomes fully detected. In actuality, even extremely uncertain or incomplete detections and counter-detections of opposing entities can provide enough data for entities to make reasonably intelligent decisions on the virtual battlefield. Recent developments in commercial gaming artificial intelligence suggest that particle-based tracking techniques can provide accurate and computationally efficient state estimation of opposing agents within virtual environments. In this work several particle-based methods for obtaining and tracking contacts are explored to determine the feasibility of their use as a general purpose tracking technique in military simulations.

DTIC

*Combat; Detection; Simulation*

**20070027363** Naval Postgraduate School, Monterey, CA USA

**An Analysis of Small Navy Tactics Using a Modified Hughes' Salvo Model**

Tiah, Yao M; Mar 2007; 112 pp.; In English

Report No.(s): AD-A467282; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis develops a modified version of Hughes' Salvo Model and employs it to analyze the tactical disposition (concentration or dispersion) of a small, but modern, navy whose adversary is numerically superior but technologically inferior. It also identifies tactical factors and develops insights that are critical to the success of small navies when fighting outnumbered. Quantitative results indicate that the smaller navy must fight dispersed and win by outscouting the enemy and attacking him effectively first. This requires a superior scouting capability, effective command, control, and communications (C3), and the ability to deliver sufficient striking power. To ensure the delivery of sufficient striking power, a small navy must put greater emphasis on offensive firepower to compensate for small force size. To be successful in battle, small navies must show initiative, and be willing to implement bold tactics. These attributes have been demonstrated by small, but successful, naval forces in the history of naval warfare. In addition, innovative tactical thinking can allow small navies to take advantage of useful tactical phenomenon like the 'missile- sump effect' and to design the most appropriate type of combat craft for their respective operating environments.

DTIC

*Mathematical Models; Military Operations; Navy; Tactics; Warfare*

**20070027382** Naval Postgraduate School, Monterey, CA USA

**A System of Systems Interface Hazard Analysis Technique**

Redmond, Patrick; Mar 2007; 151 pp.; In English

Report No.(s): AD-A467343; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The next generation of military capabilities will hinge on systems of systems technologies, entailing the integration of numerous large scale systems into a complex system of systems whose capability exceeds the capabilities of the individual systems. The increase in capability is due to the emergent properties of the system of systems. However, these emergent properties also introduce hazards that must be adequately dealt with before the system of systems can be employed. The current state of hazard analysis processes is insufficient to deal with the complexity and size of a system of systems. This thesis aims to define the nature and types of hazards associated with systems of systems and to define a technique for identifying specific hazards within a system of systems. In addition to developing a theoretical process, this thesis applies it to a real world case study, the Ballistic Missile Defense System. A software application was developed to prove the concept of the hazard analysis technique. The technique has been designed from the top down to be compatible with current system safety processes and as such, is directly compatible with systems of systems currently in development and familiar to practicing system safety engineers.

DTIC

*Antimissile Defense; Hazards; Safety Factors; Systems Analysis; Systems Engineering*

**20070027465** Space and Naval Warfare Systems Center, San Diego, CA USA

**Multipurpose Activity Definitions and Interfaces to Support Operational Needs (MADISON)**

Vineberg, Maniel; Sep 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467634; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Multipurpose Activity Definitions and Interfaces to Support Operational Needs (MADISON) is a proposed operator-oriented approach to Battle-Management/ Command and Control, Communications, Computing, Intelligence, Surveillance, and Reconnaissance/Navigation (BM/C4ISR/N). MADISON responds to several challenges within this broad domain: coordinating independent, in-service systems to support complex operations; interoperability; operator training and operational effectiveness; and, efficient resource allocation. MADISON is neither platform-centric nor network-centric; it is operator-centric, intended to position the operator to fight the battle rather than fight the system.

DTIC

*Command and Control; Interoperability; System Effectiveness*

**20070027581** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**A Heuristic Design Information Sharing Framework for Hard Discrete Optimization Problems**

Jacobson, Sheldon H; Mar 1, 2007; 48 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0110; 6RNM25; Proj-FQ867100400698

Report No.(s): AD-A467897; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project studied and developed simultaneous generalized hill climbing (SGHC) algorithms as an algorithmic framework for information sharing in discrete optimization problems. This framework has been used to gain new insights into neighborhood structure designs that allow different neighborhood functions to share information when using the same heuristic applied to the same problem. The results reported from this project introduce the SGHC algorithm framework for information sharing across sets of related discrete optimization problems, provide guidelines on how to use and to design neighborhood functions that results in effective performance of local search algorithms, and describe how tabu search can be effectively used to improve the performance of generalized hill climbing algorithms. Extensive computationally results are reported on a large variety of test bed, large-scale, real-world discrete optimization problems. The primary application for this research were a military combat search and rescue problems, where several possible search and rescue strategies must be considered to determine the optimal strategy, and a homeland security aviation security baggage screening problems, where several different baggage screening strategies at a set of airports must be considered to determine the optimal strategy for the entire system. Both these problems are intractable due, in part, to the exponentially large number of possible solutions that exist and must be evaluated to identify those that are optimal.

DTIC

*Algorithms; Design Optimization; Heuristic Methods; Optimization*

**20070027624** Software and Engineering Associates, Inc., Carson City, NV USA

**IHRPPT Improvements to the Solid Performance Program (SPP)**

Coats, D E; Berker, D R; Hylin, E C; Dunn, S S; Babbitt, D P; Tullos, J A; Mar 19, 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9300-05-C-0011; Proj-492204JJ

Report No.(s): AD-A467974; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The JANNAF Solid Performance Program (SPP) is being upgraded as part of the Air Force Research Laboratory's IHRPPT Modeling and Simulation effort. This paper describes the improvements to the nozzle performance modules within the SPP. Both full and parabolized Navier-Stokes solvers have been added to the code and are described in this paper along with a comparison of results.

DTIC

*Computational Fluid Dynamics; Gas Flow; Nozzle Flow; Solid Propellant Rocket Engines; Three Dimensional Flow*

**20070027632** Defence Science and Technology Organisation, Edgecliff, Australia

**System Instantiation Comparison Method: A Technique for Comparing Military Headquarters**

Rees, Leanne M; Bowden, Fred D; Feb 2007; 51 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467992; DSTO-RR-0322; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document provides a generic, efficient and cost-effective method of comparing system instantiations. It gives a unique view of a complex system by considering how well the system supports the overarching aim. The method proposed

was developed from a requirement to undertake evaluations of complex military systems, in particular those associated with command and control. To illustrate the generic nature of the method, it is introduced using three very different systems. A military headquarters is then used as a more comprehensive example of how the method can be applied.

DTIC

*Organizations; Systems Analysis*

**20070027707** Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA

**A Study of Autonomous Micro-Robots and Their Application to Complex Environments, Volume 1**

Niles, Christopher; Tran, Thehue; May 2000; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468316; ARFSD-TR-00001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report identifies and surveys the state of the art in enabling technologies supporting the major components of autonomous mobile robot design. The object of this effort is to determine to what extent ongoing industry and university programs can support the development of 'lobster-sized,' land based autonomous robots capable of traversing terrain consisting of vertical obstacles, canyons, and diverse surface textures in all-weather conditions. Particular attention is placed on path planning with limited a priori knowledge and primitive sensors. Ideas on how to conduct 3D path planning of complex outdoor environments are discussed. Following the evaluation and survey, the report recommends areas requiring further research.

DTIC

*Autonomous Navigation; Autonomy; Intelligence; Robots*

**20070027738** Naval Academy, Annapolis, MD USA

**Problem representation and variation in the forecasts of 'political experts'**

Purkitt, Helen E; Jun 2001; 21 pp.; In English

Report No.(s): AD-A468436; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Forecasts often involve judgments about 'ill-structured' problems that lack an optimal solution or agreement about boundary conditions. This paper describes how the degree of structure of the problem and the forecasting time frame can be used to form a classification scheme of different types of forecasting problems. This scheme can be used as a guide for choosing the most appropriate approach and methods to use in analyses and predictions. The paper next describes a method for summarizing how individuals or groups of problem solvers analyze 'ill-structured' social and political problems. Examples of this method, based on the construction of free-hand causal diagrams of novice and expert political forecasters, are presented. Experience to date using these schematic summaries indicate that such summaries are useful for understanding the reasoning processes of clients and to check the reasoning process used by experts from different backgrounds and experiences in making forecasts.

DTIC

*Forecasting; Problem Solving*

**20070028439** Engineer Research and Development Center, Alexandria, VA USA

**Using a Shortest Path Algorithm for Identifying Areas of Interest in An Area of Operations**

Charbonneau, Steven; Stein, Michael; Jun 2003; 53 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466746; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466746>

Sensor coverage of a unit's area of operations will be critical to maintaining situational awareness for interim and objective force ground units. As such, sensor deployment plans that offer a high probability of covering lines of communication (LOC's) and avenues of approach (AA) while limiting the number of sensors employed will become an important part of the Intelligence Preparation of the Battlefield. Manual methods for determining these LOC's and AA's can be time consuming when applied over large areas of terrain. We propose a method that combines mathematical morphology and a greedy heuristic (single source shortest path algorithm) in order to identify channeling terrain along likely routes of enemy movement. The results of the analysis can then be graphically reviewed for quality and used as necessary in the Intelligence Preparation of the Battlefield (IPB) process.

DTIC

*Algorithms; Detectors; Identifying*

**20070028522** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Filtered Rayleigh Scattering Measurements in a Buoyant Flowfield**

McGaha, Christopher C; Mar 2007; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468305; AFIT/GAE/ENY/07-M18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Filtered Rayleigh Scattering (FRS) is a non-intrusive technique for studying flowfields. Molecular scattering provides the signal to the camera, and the difference in molecular cross section can be used to discriminate between unmixed gaseous components. The focus of this research is to document the behavior of a horizontal buoyant jet using FRS. A helium jet of precisely controlled mass flow rate is injected into a standard room temperature environment, and FRS provides the means to measure its core trajectory and mixing rate. Trajectory analysis, conducted with consideration of the Reynolds number and Grashof number, can be used to compare these results to the literature. A significant portion of the study was dedicated to measuring the rate at which FRS data can be acquired with a continuous wave laser. Additionally, mixing patterns for the buoyant jet were collected and indicate that core low-density fluid is expelled into the ambient region in a striking manner under certain conditions. Although such an expulsion of core low-density fluid has been noted in the literature, it has generally been associated only with an upward direction. This was observed at a Reynolds number of 238. However, at a Reynolds number of 667, the jet appears to take on features of jets subjected to an exaggerated form of helical mode excitation. The physics behind this phenomena requires additional study.

DTIC

*Buoyancy; Flow Distribution; Rayleigh Scattering; Reynolds Number*

**20070028613** Air Force Research Lab., Kirkland AFB, NM USA

**Multi-Cumulant and Non-Inferior Strategies for Multi-Player Pursuit-Evasion (PREPRINT)**

Pham, Khan D; Lacy, Seth; Robertson, Lawrence; Jan 2007; 9 pp.; In English

Contract(s)/Grant(s): LRI; 00VS17C0R

Report No.(s): AD-A468453; AFRL-VS-PS-TP-2007-1018; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The paper presents an extension of cost-cumulant control theory over a finite horizon for a class of two-team pursuit-evasion games wherein the evolution of the states of the game in response to decision strategies selected by pursuit and evasion teams from non-inferior sets of admissible controls is described by stochastic linear differential equations and integral quadratic cost. Since the sum of the aggregate cost functions of two teams is equal to zero, the amount that one team gains is equal to the amount of the other team loses. Both cooperation within each team and competition between the teams presumably exist. A direct dynamic programming approach for the Mayer optimization problem is used to solve for a multi-cumulant non-inferior based solution when the members in each team measure the states and minimize the first  $k$  cumulants of the standard integral-quadratic cost associated with this special class of multi-player pursuit-evasion games.

DTIC

*Dynamic Programming; Pursuit-Evasion Games; Strategy*

**20070028784** Pittsburgh Univ., PA USA

**Organizational Fragility Curves: Sensemaking under Stress**

Comfort, Louise K; Oct 23, 2001; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467779; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Fragility in organizational context is the point at which the capacity for collective action collapses in the social environment. Complex adaptive systems demonstrate the capacity to reallocate resources and action in response to new demands.

DTIC

*Complex Systems; Adaptive Control*

**20070029514** Carnegie-Mellon Univ., Pittsburgh, PA USA

**An Examination of a Structural Modeling Risk Probe Technique**

Anderson, William; Boxer, Phillip; Brownsword, Lisa; Oct 2006; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468603; CMU/SEI-2006-SR-017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468603>

The integration of demand dynamics into a structural model is a key conceptual shift for software engineering. This report

examines the utility and transition characteristics of a structural dynamic analysis modeling technique called Protective ANalysis (PAN) that was used on an interoperability technical probe of a North Atlantic Treaty Organization (NATO) modernization program. The report focuses on the process rather than the findings of the probe. Organizational entities are referred to generically and in some instances aggregated. The probe involved workshops and interviews conducted over a two-week period with more than 25 people followed by analysis of the data gathered. PAN was used to model the NATO program as a system of systems. The model is a rapid assessment based on the subjective understanding of the interviewed subject matter experts. It is a snapshot in time; while dynamic stocks and feedback loops are represented their temporal characteristics are not. From the model five perspectives were analyzed for different forms of interoperability- risk. These analyses produced three-dimensional projections that depict clusters of shared interfaces. The separation between these clusters identifies the interoperability risks. The report notes that the PAN technique starts from a client-driven context and builds visual representations that are easily understood by and bring immediate value to the client. Further the report observes that the modeler is critical to this technique and must possess expert skills in the Microsoft Visio application as well as an ability to quickly grasp and characterize the constructs and objects revealed through dialog-based inquiry. The report concludes that PAN appears to offer a fresh approach new insights and appropriate mechanisms to study complexity in systems of systems. The potential for applying and amplifying this technique appears to be significant.

DTIC

*Interoperability; Models; Risk*

**20070029515** Carnegie-Mellon Univ., Pittsburgh, PA USA

**A Practical Example of Applying Application-Driven Design (ADD), Version 2.0**

Wood, William G; Feb 2007; 59 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A468604; CMU/SEI-2007-TR-005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468604>

This report describes an example application of the Attribute-Driven Design (ADD) method developed by the Carnegie Mellon Software Engineering Institute. The ADD method is an approach to defining a software architecture in which the design process is based on the quality attribute requirements the software must fulfill. ADD follows a recursive process that decomposes a system or system element by applying architectural tactics and patterns that satisfy its driving quality attribute requirements. The example in this report shows a practical application of the ADD method to a client-server system. In particular this example focuses on selecting patterns to satisfy typical availability requirements for fault tolerance. The design concerns and patterns presented in this report-as well as the models used to determine whether the architecture satisfies the architectural drivers-can be applied in general to include fault tolerance in a system. Most of the reasoning used throughout the design process is pragmatic and models how an experienced architect works.

DTIC

*Computer Programming; Fault Tolerance; Software Engineering*

**20070029528** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Executive Overview of SEI MOSAIC: Managing for Success Using a Risk-Based Approach**

Alberts, Christopher; Dorofee, Audrey; Marino, Lisa; Mar 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A468631; CMU/SEI-2007-TN-008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468631>

In today's business environment, multiple organizations routinely work collaboratively in pursuit of a single mission. These separate efforts result in process and programmatic complexity that is difficult to manage effectively. Mission success in these complex settings demands a collaborative management approach that effectively coordinates task execution and decision-making activities among all participating groups. Managing for mission success requires establishing and maintaining a reasonable degree of confidence that a mission's objectives will be successfully achieved. Confidence at the mission level requires establishing and maintaining a corresponding level of confidence in the people, processes, and technologies used to achieve a mission. The Software Engineering Institute (SEI) is currently developing the Mission-Oriented Success Analysis and Improvement Criteria (MOSAIC) a suite of advanced, risk-based analysis methods for assessing



complex, distributed programs, processes, and information-technology systems. With SEI MOSAIC methods, management can establish and maintain confidence in success throughout the life cycle and help provide assurance at the mission, system, and program levels. This technical note provides an executive overview of the concepts and foundations of SEI MOSAIC.

DTIC

*Complex Systems; Risk*

**20070029564** Army Center of Military History, Washington, DC USA

**History of Operations Research in the USA Army, Volume 1: 1942-1962**

Shrader, Charles R; Nov 8, 2006; 223 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DASW01-02-D-0016

Report No.(s): AD-A468757; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468757>

Operations research (OR) emerged during World War II as an important means of assisting civilian and military leaders in making scientifically sound improvements in the design and performance of weapons and equipment. OR techniques were soon extended to address questions of tactics and strategy during the war and, after the war, to matters of high-level political and economic policy. Until now, the story of why and how the U.S. Army used OR has remained relatively obscure, surviving only in a few scattered official documents, in the memories of those who participated, and in a number of notes and articles that have been published about selected topics on military operations research. However, none of those materials amounts to a comprehensive, coherent history. In this, the first of three planned volumes, Dr. Charles R. Shrader has for the first time drawn together the scattered threads and woven them into a well-focused historical narrative that describes the evolution of OR in the U.S. Army, from its origins in World War II to the early 1960s. He has done an admirable job of ferreting out the surviving evidence, shaping it into an understandable narrative, and placing it within the context of the overall development of American military institutions. Often working with only sparse and incomplete materials, he has managed to provide a comprehensive history of OR in the U.S. Army that offers important insights into the natural tension between military leaders and civilian scientists, the establishment and growth of Army OR organizations, the use (and abuse) of OR techniques, and, of course, the many important contributions that OR managers and analysts have made to the growth and improvement of the Army since 1942.

DTIC

*Military Operations; Operations Research; United States*

**20070029765** Air Force Research Lab., Tyndall AFB, FL USA

**Design and Implementation of a Modular Manipulator Architecture**

Sosa, Ognjen; Dec 2004; 226 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F08637-00-C6008

Report No.(s): AD-A469060; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469060>

The Joint Architecture for Unmanned Systems (JAUS) has successfully established a well-defined component interface for unmanned mobile systems, but has yet to address the implications of such systems requiring an on-board robot manipulator. This configuration is seen in many applications including planetary exploration, hazardous materials removal, and marine research and is frequently referred to as the vehicle-manipulator system. The purpose of our study was to develop and implement a set of JAUS components that will allow for tele-operational (teleop) and autonomous control of a vehicle-manipulator platform. Teleop control is the control of a system by the direct input of a human or a computer. Autonomous control is a cooperative mode between the vehicle and the manipulator. Testing and implementation of these components was performed on a 6-degree-of-freedom (6-DOF) Puma 762 robot manipulator (Unimation Westinghouse, Danbury, Connecticut) outfitted with a commercially available Galil motion controller (Galil Motion Control, Inc, Rocklin, California). Successful completion and adequate compatibility to the outlined JAUS performance specifications would ensure the inception of the above mentioned components to the latest version of the document's Reference Architecture. Even though this modular manipulator architecture is suitable for both autonomous and teleop control, testing and results were based solely on the input provided using a graphical user interface on a computer.

DTIC

*Computer Programming; Man Machine Systems; Manipulators; Robots; Software Engineering*

**20070029767** Florida Univ., Gainesville, FL USA

**A Modular, Scalable, Architecture for Unmanned Vehicles**

Armstrong, David G; Crane, Carl D; Novick, David; Wit, Jeffrey; English, Ralph; Adsit, Phillip; Shahady, David; Jul 2000; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469064; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469064>

A modular, scalable architecture for use on unmanned vehicles has been developed at the Center for Intelligent Machines and Robotics under the direction of the Air Force Research Laboratory at Tyndall Air Force Base, FL. This state of the art architecture isolates five functionally cohesive sub-tasks into self-contained modules with well defined interfaces. The architecture consists of a Mobility Control Unit (MCU), Path Planner (PLN), Position System (POS), Detection and Mapping System (DMS), and a Primitive Driver (PD). The design considerations for the development of this architecture included sub-system modularity, implementation independent software interfaces, ability to expand system functionality through continued addition of modules (scale), and the goal of moving toward a standard architecture for autonomous systems. The focus of this paper is to present a modular architecture that addresses the above design considerations.

DTIC

*Architecture (Computers); Autonomous Navigation*

**20070029787** Army War Coll., Carlisle Barracks, PA USA

**Knowledge Management in an Information Age Army**

Fountain, Darrell D; Mar 30, 2007; 21 pp.; In English

Report No.(s): AD-A469106; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469106>

The widespread application of advanced information technologies has dramatically affected USA fighting forces. Senior leaders at all levels that came of age as principals before the technological revolution of the 90's have struggled to take full advantage of modern information technology. Information technology exploitation strategies have been further complicated by the now omnipresent Joint and Combined nature of our operations. Key leaders need to more fully embrace the comprehensive strategy already available to take full advantage of this explosion in capability. This work examines the Army's current knowledge management strategy and suggests that a consistent construct is required at the CORPS and Division level to fully exploit current information technology capabilities in a joint and combined environment. This construct is required to move our fighting forces beyond the simplistic incorporation of the latest information technology hardware and software to a more deliberate knowledge management strategy: the logical extension of the information age technology and network-centric operations to effective Knowledge Management. This organizational construct should be disciplined enough to resist the latest hardware/software solution of the day and agile enough to readily adopt innovative information technology solutions addressing critical organizational information sharing and knowledge management challenges.

DTIC

*Information Management; Management Information Systems; Warfare*

67

**THEORETICAL MATHEMATICS**

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

**20070026595** Seoul National Univ., Korea, Republic of

**Quantum Algorithms and Initialization**

Chi, Dong-Pyo; Aug 31, 2006; 21 pp.; In English

Contract(s)/Grant(s): FA5209-04-P-0228

Report No.(s): AD-A466534; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466534>

We are going to show that whether or not a function is evenly distributed can be determined in quantum polynomial time without initialization. We will also show that the functional evaluation oracle and the functional phase transform are equivalent. To solve the first conjecture, we will construct a quantum algorithm to solve the reduced problem to determine whether or not a function is evenly balanced and then extend this result by employing our initialization-free quantum functional evaluation oracle. For the second conjecture, we will construct the quantum functional evaluation oracle from the quantum functional phase transform. For this purpose, we will localize the both operators on the auxiliary register and then

build a quantum circuit that can transform both localized operators to each other. We will extend the domain of the functional phase transform to the Hilbert space, which is the domain of a function evaluation oracle, so that the relative phase changes in the functional phase transform can be encoded into the control register. The limitation on the size of quantum computers makes it important to reuse qubits for auxiliary registers. Our initialization-free algorithm will greatly reduce the size of quantum computers since independent computational processes can share auxiliary registers. Furthermore, our algorithm can be useful in symmetric cryptography, because to design secure block ciphers it is essential to find evenly distributed functions. Moreover, until now it is not known how to implement functional evaluation on a quantum computer. Also which one is easy or possible to implement on a quantum computer among the functional phase transform and the functional evaluation oracle has not been answered yet. Thus our result can give a flexibility to the realization of functional evaluation on quantum computers.

DTIC

*Algorithms*

**20070026736** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**Fundamental Study on Quantum Nanojets**

Chiu, Huei-huang; Aug 2004; 173 pp.; In English

Contract(s)/Grant(s): F62562-03-P-0460

Report No.(s): AD-A466948; AOARD-03-4039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466948>

The contractor shall investigate quantum fluid mechanics. Technical work plan: Analytical formulations and exact solutions of planar and axi-symmetric nanojets of Schrodinger's fluid in QM formalism. (QM-QDFD equivalence) Numerical simulation of planar and axi-symmetric nanojets of Schrodinger's fluid in QDFD formalism. (QDFD-QM equivalence) Analytical formulations of planar and cylindrical shaped nanojets injector in QDFD formalism. Conservation equations of QDFD Canonical theoretic formulation of the axiomatic solutions of nanojet flows in an injector of planar and cylindrical configurations. Two types of axiomatic representations, dilatation based and diffusion kinetic energy based will be carried out to facilitate the prediction of nano-jet flows in injectors. Overall flow structures of nanojets will examine the overall nanojet flow configuration to assess the following characteristics: Exterior flow characteristics and their dependence on the injection conditions, Interior flow characteristics and their effects on the exterior jet configuration, Collective quantum behaviors on the spreading of the jets, particle separation, local flow rates, and jet penetration.

DTIC

*Numerical Analysis; Quantum Theory*

**20070027488** Naval Postgraduate School, Monterey, CA USA

**Ukraine's Search for its Place in Europe: The East or the West?**

Yakovenko, Andriy; Mar 2007; 96 pp.; In English

Report No.(s): AD-A467712; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The pace of democratic political and economic reforms in Ukraine has been slower than that of some other democracies of post-communist Eastern and Central Europe. Ukraine is still uncertain of its future development orientation. The reasons for this uncertainty involve internal factors such as the historically diverse political, cultural and ethnic affiliations of Ukraine's population. At the same time, the impact of external factors, especially Russian and Western geo-strategic interests relating to the future of Ukraine, also contribute to the current crisis. The thesis examines the historically-based geopolitical and cultural attachments of the Ukrainian people in relation to the nation-formation process in independent Ukraine. The absence of a common national identity in Ukraine is one of the obstacles to successful national development. In the case of Ukraine, a sense of national identity cannot be based purely on ethno-cultural and regional bonds. On the contrary, the emphasis on the rise of civic consciousness among all strata of Ukrainian society seems crucial. The successful integration of major democratic values might afford a clear direction for the country's future development, and help define its place in Europe in a way that would be acceptable to a majority of the Ukrainian people.

DTIC

*Identities; International Relations; Ukraine*

**20070027685** Brown Univ., Providence, RI USA

**A High Order WENO Scheme for a Hierarchical Size-Structured Model**

Shen, Jun; Shu, Chi-Wang; Zhang, Mengping; Jan 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-1-0291

Report No.(s): AD-A468112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we develop a high order explicit finite difference weighted essentially non-oscillatory (WENO) scheme for solving a hierarchical size-structured population model with nonlinear growth, mortality and reproduction rates. The main technical complication is the existence of global terms in the coefficient and boundary condition for this model. We carefully design approximations to these global terms and boundary conditions to ensure high order accuracy. Comparing with the first order monotone and second order total variation bounded schemes for the same model, the high WENO scheme is more efficient and can produce accurate results with far fewer grid points. Numerical examples including one in computational biology for the evolution of the population of *Gambusia affinis*, are presented to illustrate the good performance of the high order WENO scheme.

DTIC

*Essentially Non-Oscillatory Schemes; Hierarchies; Models; Oscillations*

**20070027717** Institute of Medical Cybernetics, Inc., Alexandria, VA USA

**Towards Dominant Battlespace Comprehension in Network Centric Warfare**

Yufik, Y M; Cunningham, W B; Jun 2001; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DASG60-97-C-0019; N00014-99-1-0999

Report No.(s): AD-A468373; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wars in the XXIst century will place unprecedented demands on the commander's ability to make critical decisions under volatile conditions and extreme time pressure. Advances in information technology and cognitive science have made possible new types of decision aids that can help commanders to meet those demands. Design of commander decision aids for Network Centric Warfare is in the focus of this paper. The first section treats command and control in terms of dynamic asset allocation and considers the cognitive complexity of allocation decisions under shifting constraints and priorities. The next section compares two decision strategies: 1) template-matching and 2) creative utilization of past experiences under conditions that are rapidly changing and have no exact precedents. We argue that creative and efficient application of rules and past experiences requires battle space comprehension and suggest that current decision technologies do not recognize the role of comprehension and thus overlook a fundamental prerequisite for efficient command and control. The third section outlines a model of expert commander decision processes, and defines a new approach to the design of decision aids that facilitate commander's comprehension of the battle space and help to increase the speed of control and self-synchronization in highly mobile and geographically dispersed forces.

DTIC

*Decision Making; Warfare*

**20070029716** State Univ. of New York, Utica, NY USA

**Eigenvector Analysis for Multipath**

Rusjan, Edmond; Apr 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-1-0226; Proj-558B

Report No.(s): AD-A468948; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468948>

This research analyzes the properties of singular vectors of circulant matrices. In particular, it proves that the singular values of circulant matrices are doubly degenerate. This results in a V pattern in the Fourier transform of the singular vectors. An additional structure in the Fourier space is observed and proven. These results provide a rigorous and firm foundation for the use of the Fourier space structures in the analysis of multipath.

DTIC

*Eigenvectors; Multipath Transmission; Vector Analysis*

**20070029763** Florida Univ., Gainesville, FL USA

**Design and Implementation of an Intelligent Primitive Driver**

Vinch, Jr, Peter M; Jan 2003; 85 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F08637-00-C-6008

Report No.(s): AD-A469052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469052>

An Intelligent Primitive Driver (IPD) was designed to supplement the control of a Primitive Driver component that is defined in the Department of Defense Joint Architecture for Unmanned Systems (JAUS). Whereas the Primitive Driver component accepts and blindly executes wrench commands, the IPD uses various subsystems to provide it with the necessary information to make low-level decisions concerning vehicle control. The IPD is accessible by either an onboard autonomous control system; or by a tele-operational control system. Tele-operational control (teleop) is characterized by the direct control of a platform by a human operator. For the case of an autonomous control system, the IPD reduces high-level control responsibilities; and therefore reduces processor demands. In the case of teleop control, the IPD serves to ease operator burden by automating intensive operator-controlled processes. The test platform for the functionality of the Intelligent Primitive Driver was a Remotec ANDROS robot. In the case of the ANDROS robot, the IPD automates the process of maneuvering up or down a flight of stairs.

DTIC

*Man Machine Systems; Remote Control*

**20070029807** Das (Digendra K.), Sauquoit, NY USA

**Enhancement of the Computational Efficiency of Membrane Computing Models**

Das, Digendra K; Apr 2007; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-2-0043; Proj-NBGQ

Report No.(s): AD-A469153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469153>

Part I: The researchers developed a comprehensive transitional P-system Membrane Computing model. Membrane computing consists of cell-like membranes placed inside a unique skin membrane. In regions delimited by a membrane structure, cells are placed in multisets of objects which evolve according to evolution rules associated with the regions. The researchers considered multi-sets of objects, usually multi-sets of symbols, objects and a set of evolution rules, which are placed inside regions delimited by membranes. The evolution between system configurations is completed non-deterministically by applying rules synchronously in a maximum parallel manner. Part II: The researchers applied the P system constructs described in Part I to provide end-to-end secure mobile ad hoc networks as Distributed P systems consisting of migrating membrane agents. Membrane networks were modeled, with migration components and a guardian membrane that regulates interactions between the processing component and the external environment. Membranes act as filters that control access to the associated site and rely on the established notion of trust between sites. The researchers developed steps necessary to control the actions of incoming agents and encompass complex policies, wherein the number of actions a membrane agent is allowed to perform and the order of actions are prioritized.

DTIC

*Augmentation; Computer Aided Tomography; Mathematical Models; Membranes*

**70**

**PHYSICS (GENERAL)**

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics, or 92 Solar Physics*.

**20070026402** Air Force Research Lab., Wright-Patterson AFB, OH USA

**A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint)**

Behbahani, Al; Jordan, Eric A; Millar, Richard; Dec 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-3066

Report No.(s): AD-A466102; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466102>

Turbine engine controllers are typically designed and operated to meet required or desired performance criterion within

stability margins, while maximizing fuel efficiency. The U.S. Air Force turbine engine research program is seeking to incorporate sustainable cost reduction into this approach, by considering a life-cycle design objective if the life of the engine is considered as an objective during the design of the engine controller. Specifically during aircraft takeoff, the turbine engines are subject to high temperature variations that aggravate the stress of the material used in their construction and thus a negative effect in their life spans. Therefore, the control strategy needs to be re-evaluated to include operating cost, and extending the life of the engine is one way to reduce that. Life-Extending Control (LEC) is an area that deals with control action, engine component life usage, and designing an intelligent control algorithm embedded in the FADEC. This paper evaluates the LEC, based on critical components research, to demonstrate how an intelligent engine control algorithm can drastically reduce the engine life usage, with minimum sacrifice in performance. Finally, a generic turbine engine is extensively simulated using a sophisticated non-linear model of the turbine engine. The paper concludes that LEC is worth consideration and further research should include development of the damage models for turbine engines, and experimental research that could correlate the damage models to actual damage for turbine engines. This could lead to implementation of online damage models in real-time that will allow for more robust damage prevention.

DTIC

*Algorithms; Control; Engine Parts; Feasibility; Life (Durability); Stability; Turbine Engines*

**20070026519** Naval Research Lab., Washington, DC USA

**On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe**

Walker, D N; Fernsler, R F; Blackwell, D D; Amatucci, W E; Apr 20, 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-67-3419-17

Report No.(s): AD-A466367; NRL/MR/6750-07-9033; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466367>

A new method of determining probe/antenna plasma sheath parameters has been developed. For low neutral pressure environments in the absence of a magnetic field, the method provides these quantities from a probe/antenna surface through the sheath, pre-sheath, and into the bulk plasma. For high pressure environments, where conventional resonances are strongly damped, it can determine bulk plasma density. The paper cites commonly used methods of finding electron density/temperature and points out the inadequacy of each to make sheath measurements in the general case. The primary advantage of the method lies in the fact that a non-perturbative rf signal is applied to the probe/antenna for the determination and this makes the measurement independent of complicating influences such as secondary electron emission, surface conditions, and ion mass. Because of this, the ac impedance depends on frequency but not on the dc voltage unlike a typical Langmuir probe. In this paper, we concentrate on the low pressure regime.

DTIC

*Electron Density (Concentration); Electron Probes; Inspection; Nonintrusive Measurement; Plasma Sheaths; Sheaths*

**20070026533** Florida Univ., Gainesville, FL USA

**Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators**

Gallas, Quentin; Mathew, Jose; Kasyap, Anurag; Holman, Ryan; Nishida, Toshikazu; Carroll, Bruce; Sheplak, Mark; Cattafesta, Louis; Jan 2002; 11 pp.; In English

Report No.(s): AD-A466402; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466402>

This paper presents a lumped element model of a piezoelectric-driven synthetic jet actuator. A synthetic jet, also known as a zero net mass-flux device, uses a vibrating diaphragm to generate an oscillatory flow through a small orifice or slot. In lumped element modeling (LEM), the individual components of a synthetic jet are modeled as elements of an equivalent electrical circuit using conjugate power variables. The frequency response function of the circuit is derived to obtain an expression for  $Q(\text{sub out})/V(\text{sub AC})$ , the volume flow rate per applied voltage. The circuit is analyzed to provide physical insight into the dependence of the device behavior on geometry and material properties. Methods to estimate the model parameters are discussed, and experimental verification is presented. In addition, the model is used to estimate the performance of two prototypical synthetic jets, and the results are compared with experiment.

DTIC

*Actuators; Models; Piezoelectricity*

**20070026566** Akron Univ., Akron, OH USA

**On the Correlation Between the Self-Organized Island Pattern and Substrate Elastic Anisotropy**

Pan, Ernian; Zhu, Richard; Chung, Peter W.; Apr 2007; 12 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466483; ARL-RP-168; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA466483>

Self-organized quantum dots pattern depends strongly on the elastic strain energy of the substrate. It is well-known experimentally that for the elastic substrate with a high degree of anisotropy, the epitaxially grown island patterns are different for different growth orientations. In this report, by incorporating the anisotropic strain energy field into a kinetic Monte Carlo algorithm for adatom diffusion, we show that the self-organized island pattern on the surface of an anisotropic substrate is closely correlated to the elastic energy distribution on the surface. The anisotropic substrates studied are GaAs with different growth orientations (001), (111), and (113). An isotropic substrate Iso (001), reduced from GaAs, is also investigated for the purpose of comparison. The island patterns on these substrates with and without elastic strain energy are presented. Besides the effect of substrate anisotropy, different growth parameters, including temperature, coverage, and interruption time, are further investigated to identify the optimal growth values. It is observed that the strain energy field in the substrate is the key factor that controls the island pattern, and that the latter is closely correlated to the substrate orientation (anisotropy). Our simulated patterns are also in qualitative agreement with recent experimental growth results.

DTIC

*Elastic Anisotropy; Elastic Properties; Substrates*

**20070026572** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Estimating Runflat Stiffness**

Bylsma, Wesley; Gunter, Dave; Feb 2007; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466491; TARDEC-TR-16996; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA466491>

This report documents a method to estimate runflat stiffness using the bulk modulus of the runflat material. For the example dimensions and material properties given, the runflat stiffness is estimated to be approximately 6,000 pounds per inch and will be contacted after 4.53 inches of tire deflection. The report describes example runflat technology and dimensions, discusses bulk modulus and appropriate values for it, details the calculation for determining compression of the runflat, describes the method used to estimate the runflat force upon impact and its stiffness rate at various tire deflections, determines the amount of tire deflection at which runflat contact begins, and summarizes the results.

DTIC

*Bulk Modulus; Estimating; Stiffness; Tires*

**20070026581** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**Synthesis of One-dimensional Nano-sized Defects in High Tc Superconductor**

Chen, In-Gann; Wu, Maw-Kuen; Chen, Shih-Yun; Jul 31, 2006; 13 pp.; In English  
Contract(s)/Grant(s): FA5209-05-P-0501  
Report No.(s): AD-A466509; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA466509>

This work showed that a high aspect ratio nano-scale hollow tube can be produced in a Y-Ba-Cu-O surface by focused ion beam (FIB) etching methods. However, production of matrices of deep hollow tubes on an individual basis would require long FIB operating times and would be costly. Cost and time limitations prevented the measuring of the superconducting properties of these materials.

DTIC

*Current Density; Defects; High Temperature Superconductors; Nanorods; Superconductivity*

**20070026722** Raytheon Missile Systems Co., Tucson, AZ USA

**Control of Spinning Symmetric Airframes**

Mracek, Curtis P; Stafford, Max; Unger, Mike; Nov 14, 2006; 24 pp.; In English  
Report No.(s): AD-A466818; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA466818>

Several missiles and projectiles have periods during their flight where the body is spinning and must be controlled. It has been stated that a roll stabilized autopilot may be more appropriate during this phase of the flight. This paper first examines

the full nonlinear equations of motion in both the roll stabilized frame and the body axis system assuming a rigid axially symmetric body. Two and three loop autopilots are developed using an optimal control approach for a non-rolling airframe. These autopilots are examined to determine how well they are able to follow inertial commands. An extremely simplified example is presented so that the basic characteristics of the closed loop system can be examined. The results are presented and conclusions drawn. Effects of different acceleration levels, including the axial moment of inertia and very high roll rates are examined.

DTIC

*Airframes; Symmetry*

**20070027270** Air Force Research Lab., Kirkland AFB, NM USA

**On the Importance of Atomic Packing in Determining Dielectric Permittivities**

Edwards, A H; Busani, T; Devine, R A; Pineda, A; Jan 2006; 15 pp.; In English

Contract(s)/Grant(s): F29601-01-C-0241; Proj-4846

Report No.(s): AD-A466915; AFRL-VS-PS-TN-2007-1001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The role of the network structure in determining the dielectric constant of binary and ternary oxide insulators is outlined. Seemingly anomalous behavior observed in rare-earth sesquioxides, Ta<sub>2</sub>O<sub>5</sub>-TiO<sub>2</sub> mixed oxides, lanthanum aluminate and dilute Zr(x)Si(y)O<sub>2</sub> is discussed in terms of the atomic structure. Physical examination of the relevant properties of these materials should lead to an understanding of how to engineer the dielectric constant.

DTIC

*Atomic Structure; Atoms; Dielectrics; Packing Density; Permittivity*

**20070027272** Michigan State Univ., East Lansing, MI USA

**Designing of Bulk Nano-Structures With Enhanced Thermoelectric Properties**

Kanatzidis, Mercouri G; Apr 23, 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0867

Report No.(s): AD-A466951; 4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We discovered a grand homologous series which may help in the future to systematically identify thermoelectric materials with high performance. Namely, the series  $A_m[Ml+1Se2+1]2m[M21+nSe2+31+n]$  ( $A$  = alkali metal,  $M$  = Pb, Bi) has structure-predicting properties. The modular construction of these structures from evolving building blocks permits many of the criteria necessary for good thermoelectrics to be met. K<sub>2</sub>Bi<sub>8</sub>Se<sub>13</sub> is a member of this series and was found to be a promising thermoelectric. The charge transport properties were studied under pressure, where a significant increase in the power factor was observed. Several other promising materials were also discovered. In another part of this project we prepared nanocrystals of thermoelectric semiconductors and studied their properties. We investigated the assembly of nanocrystal components into well-organized arrays. The goal was to utilize quantum dot building blocks of desired thermal and electronic properties to design composite materials with improved power generation, thermoelectric characteristics. We devised new ways to prepare nanocrystals of PbTe, AgSbTe<sub>2</sub> and AgPb<sub>2</sub>SbTe<sub>4</sub>.

DTIC

*Nanostructure (Characteristics); Nanostructures (Devices); Thermodynamic Properties; Thermoelectricity*

**20070027292** Naval Postgraduate School, Monterey, CA USA

**Through-the-Wall Imaging from Electromagnetic Scattered Field Measurements**

Kim, Jerry; Mar 1, 2007; 125 pp.; In English

Report No.(s): AD-A467076; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We investigate an inverse imaging problem for TWI (Through-the-wall Imaging) using frequencies between 500 GHz and 1 THz. Starting from first principles, this thesis uses Maxwells equations to develop a model for the transmission Greens function. This simplified model is then used in a Lippman-Schwinger integral equation to predict the scattered field associated with interrogating THz waves. We investigate the effects of wave propagation through isotropic media, and present methods for creating images from the scattered field. These methods are examined using simulated data.

DTIC

*Electromagnetic Fields; Electromagnetic Scattering; Imaging Techniques; Inversions; Walls*



**20070027321** Naval Postgraduate School, Monterey, CA USA

**Simulation of Radiowave Propagation in a Dense Urban Environment**

Chung, Chris V; Mar 2007; 65 pp.; In English

Report No.(s): AD-A467130; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One objective of this thesis was to investigate the effect of details, such as the windows of high-rise buildings, on the radio wave propagation in the dense urban environment through modeling and simulations. If adding windows does not significantly change the signal distribution on average, it may not be necessary to build such a detailed model. Simulations are performed using several levels of detail and the results compared to estimate the impact of the fine details on the signal level. A second issue is base station antenna coverage. The antenna gain, half power beamwidth (HPBW), location, and pointing angle should be chosen to give the maximum coverage over a specified sector. Simulations can be used to select the optimum set of base station properties. Specifically this research looks at the coverage from the two sectored antennas versus a single one over a quadrant.

DTIC

*Cities; Electromagnetic Wave Transmission; Radio Transmission; Radio Waves; Simulation*

**20070027347** Naval Postgraduate School, Monterey, CA USA

**Optical and Radio Frequency Refractivity Fluctuations from High Resolution Point Sensors: Sea Breezes and Other Observations**

MacPherson, Douglas A; Mar 2007; 55 pp.; In English

Report No.(s): AD-A467200; No Copyright; Avail.: Defense Technical Information Center (DTIC)

High bandwidth communications and optical/RF weapons systems are being developed that are limited by atmospheric absorption and accumulated phase distortions. The need and ability to mitigate these effects depends on their magnitudes. It is difficult to numerically model the magnitudes of Cn2 numerically and results are frequently off by an order of magnitude or more. To refine models or conduct climatologically studies for Cn2 requires direct measurements to identify the underlying factors and provide a clear understanding of the phenomena. In situ measurements of Cn2 are extremely sparse at RF wavelengths. This thesis utilized high speed measurements of the humidity, temperature and wind speed collected on a 10 m tower at a coastal location to simultaneously examine the optical and RF Cn2. The humidity data were collected with a high-speed infrared humidity sensor. A three axis sonic anemometer provided wind data and a fine wire temperature sensor as well as the sonic anemometer provided temperature data. All the data were sampled at 20 Hz. This study examined a subset of 251 days of data collected at Marina, California to investigate the relative variations of optical and RF magnitudes of Cn2 and the underlying atmospheric phenomena.

DTIC

*Detectors; High Resolution; Radio Frequencies; Refractivity; Sea Breeze*

**20070027476** Library of Congress, Washington, DC USA

**High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments**

Wilson, Clay; Aug 20, 2004; 18 pp.; In English

Report No.(s): AD-A467679; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Electromagnetic Pulse (EMP) is an intense energy field that can instantly overload or disrupt numerous electrical circuits at a distance. Modern high technology microcircuits are especially sensitive to power surges, and the possible vulnerability of U.S. civilian computer systems to the effects of EMP has been discussed in the media. EMP can be produced on a large scale using a single nuclear explosion, and on a smaller, non-nuclear scale using a device with batteries or chemical explosives. Several nations, including reported sponsors of terrorism, may currently have a capability to use EMP as a weapon for cyber warfare or cyber terrorism, to disrupt computers, communications systems, or parts of the U.S. critical infrastructure. The threat of an attack against the USA involving EMP is hard to assess, but some observers indicate that it is growing along with worldwide access to newer technologies and the proliferation of nuclear weapons. In the past, the threat of mutually assured destruction provided a lasting deterrent against the exchange of multiple high-yield nuclear warheads. However, now a single, specially-designed low-yield nuclear explosion high above the USA, or over a battlefield, can produce an EMP effect that results in a widespread loss of electronics, but no direct fatalities, and may not necessarily evoke a large nuclear retaliatory strike by the U.S. military. This, coupled with the possible vulnerability of U.S. commercial electronics and U.S. military battlefield equipment to the effects of EMP, may create a new incentive for other countries to develop or acquire a nuclear capability.

DTIC

*Electromagnetic Pulses; High Altitude; Microwaves*

**20070027520** Wisconsin Univ., Madison, WI USA

**Report on the Wisconsin-Stanford-Kansas-Davis-Florida State MURI on Scientific Challenges of Coated Conductors**

Larbalestier, David C; Mar 30, 2007; 6 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0464

Report No.(s): AD-A467782; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Coordinated, multi-institutional research (University of Wisconsin, Stanford University, the University of Kansas, the University of California-Davis, and Florida State University) is addressing key underlying scientific and engineering issues of Generation II Coated Conductors, and is fabricating and acquiring through collaborations forefront CC samples, developing new tools for their understanding and characterizing them so as to resolve key performance issues. Areas of concentration include substrates, buffer layers, the superconducting overlayer, their complex interactions, and the underlying physical mechanisms that determine conductor performance. Our thrusts have covered study of grain boundaries, electromagnetic characterization, fabrication of model samples relevant to coated conductors, nanoscale characterization by scanning probe and scanning transmission electron microscopies, and the formulation of detailed models of how and why low angle grain boundaries and other macroscopic obstacles become barriers to current flow. We consider the way in which epitaxy develops through from an IBC or deformation-textured substrate, the choice of oxide buffer layer and the influence of the buffer layer formation method. Strong interactions with leading companies, the DOE laboratories and AFRL and other universities are in place.

DTIC

*Coatings; Conductors; Electric Conductors*

**20070027673** Wright State Univ., Dayton, OH USA

**3-Dimensional Crack Growth Behavior of Turbine Engine Materials (Preprint)**

Esperanza, Christine; Jan 31, 2007; 13 pp.; In English

Contract(s)/Grant(s): F33615-02-2-5800; Proj-4349

Report No.(s): AD-A468074; WSU-MME-138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of '3-Dimensional Crack Growth Behavior of Turbine Engine Materials' is to evaluate 2-dimensional and 3-dimensional crack growth and material mechanics in turbine engine components and its corresponding lab specimens under thermomechanical loading configurations. In particular, experiments are conducted on titanium and nickel-base super alloys under simulated engine loading conditions. The resulting residual stresses, the deformation and displacement of the geometry, and the initiation and growth of cracks are analyzed. Such experiments are simulated in finite element analysis (FEA) computer programs. Previous geometries analyzed in this project include turbine disk blades, horseshoe-shaped beams, and dog bone specimens.

DTIC

*Crack Propagation; Engine Parts; Turbine Engines*

**20070027806** AETC, Inc., Arlington, VA USA

**Adaptive and Iterative Processing Techniques for Overlapping Signatures**

Bell, Tom; Mar 2006; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W912HQ-04-C-0017; Proj-MM-0415

Report No.(s): AD-A468558; VA-118-001-06-TR; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A primary goal of the UXO research community is to develop technologies that detect and localize buried UXO, and that discriminate them from clutter. Electromagnetic sensors such as EMI systems operate by detecting the presence of an anomalous electromagnetic field that could be caused by buried UXO. Physics-based modeling and analysis procedures, developed under previous SERDP and ESTCP funding for electromagnetic induction and magnetometer sensor data of isolated targets, have been shown to discriminate UXO from clutter based on the derived source parameters for spatially discrete target signatures. However, many real world UXO remediation sites contain highly-contaminated regions with high density of anomalies, both UXO and clutter. In these cases, where the signatures from multiple targets overlap, whether or not they are UXO, the standard procedures do not work well. The primary problem with overlapping signatures is that conventional inversion procedures assume a single source whose signature is spatially separated from other signatures. Currently, analysts attempt to isolate anomalies by carefully selecting the data to be inverted (usually by manually inspecting a two dimensional plot of the anomaly and carving out two separate regions of data) and assuming that the selected data reflect the signature caused by a single source. The goal of this project was to develop advanced iterative techniques for inverting magnetic and electromagnetic data for situations in which the signatures from two targets overlap. After developing the methodology, the algorithm(s) would be tested first on synthetic data without any added noise. The synthetic data would be used to

systematically vary the parameters of the two targets by changing their depths, the distance between them and their relative orientations. Later, controlled test data would be used to further validate and test the algorithms in real-life situations.

DTIC

*Ammunition; Explosives Detection; Magnetic Induction; Ordnance; Signatures; Targets*

**20070028421** Stanford Linear Accelerator Center, CA, USA

**Physical Renormalization of Quantum Field Theories**

Binger, M. W.; January 2006; 202 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-899841; SLAC-R-854; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available

*Quantum Theory; Field Theory (Physics)*

**20070028423** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA; Stanford Linear Accelerator Center, CA, USA

**Closed Orbit Distortion and the Beam-Beam Interaction**

Furman, M.; Chin, Y. H.; Eden, J.; Kozanecki, W.; Tennyson, J.; Jun. 01, 1992; 15 pp.; In English

Contract(s)/Grant(s): DE-AC03-76SF00098; DE-AC03-76SF00515

Report No.(s): DE2007-899839; LBL-32435-FINAL; SLAC-R-855; No Copyright; Avail.: Department of Energy Information Bridge

We study the applicability of beam-beam deflection techniques as a tuning tool for the SLAC/LBL/LLNL B factory, PEP-II. Assuming that the closed orbits of the two beams are separated vertically at the interaction point by a local orbit bump that is nominally closed, we calculate the residual beam orbit distortions due to the beam-beam interaction. Difference orbit measurements, performed at points conveniently distant from the IP, provide distinct coordinate- or frequency-space signatures that can be used to maintain the beams in collision and perform detailed optical diagnostics at the IP. A proposal to test this method experimentally at the TRISTAN ring is briefly discussed.

NTIS

*Beam Interactions; Deflection; Distortion; Industrial Plants; Mesons*

**20070028592** Pennsylvania Univ., Philadelphia, PA, USA

**Spatially Resolved Electromagnetic Property Measurement**

Bonnell, D. A., Inventor; Kalinin, S. V., Inventor; Alvarez, R. A., Inventor; 4 Mar 05; 22 pp.; In English

Contract(s)/Grant(s): NSF-DMR-79909

Patent Info.: Filed Filed 4 Mar 05; US-Patent-Appl-SN-11-072-914

Report No.(s): PB2007-104590; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A scanning probe detects phase changes of a cantilevered tip proximate to a sample, the oscillations of the cantilevered tip are induced by a lateral bias applied to the sample to quantify the local impedance of the interface normal to the surface of the sample. An ac voltage having a frequency is applied to the sample. The sample is placed at a fixed distance from the cantilevered tip and a phase angle of the cantilevered tip is measured. The position of the cantilevered tip is changed relative to the sample and another phase angle is measured. A phase shift of the deflection of the cantilevered tip is determined based on the phase angles. The impedance of the grain boundary, specifically interface capacitance and resistance, is calculated based on the phase shift and the frequency of the ac voltage. Magnetic properties are measured by applying a dc bias to the tip that cancels electrostatic forces, thereby providing direct measurement of magnetic forces.

NTIS

*Electrical Measurement; Electromagnetic Measurement; Electromagnetism*

**20070028602** Chicago Univ., Chicago, IL USA

**High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses**

Smither, R. K., Inventor; 10 Feb 04; 23 pp.; In English

Contract(s)/Grant(s): DE-W-31-109-ENG-38

Patent Info.: Filed Filed 10 Feb 04; US-Patent-Appl-SN-10-775-789

Report No.(s): PB2007-104587; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for high spatial resolution imaging of a plurality of sources of x-ray and gamma-ray radiation is provided. High

quality diffracting crystals of 1 mm width are used for focussing the radiation and directing the radiation to an array of detectors which is used for analyzing their addition to collect data as to the location of the source of radiation. A computer is used for converting the data to an image. The invention also provides for the use of a multi-component high resolution detector array and for narrow source and detector apertures.

NTIS

*Crystals; Diffraction; Gamma Rays; High Resolution; Imaging Techniques; Lenses; Patent Applications; Spatial Resolution; X Ray Imagery; X Ray Sources*

**20070028608** Delhi Univ., India

**SOME ASPECTS OF HADRON HADRON COLLISIONS IN HIGH ENERGY INTERACTIONS (B(O)(S) MIXING OSCILLATIONS IN SEMILEPTONIC DECAY AT D0 EXPERIMENT)**

Naimuddin, M.; January 2006; 186 pp.; In English

Report No.(s): DE2007-899991; No Copyright; Avail.: National Technical Information Service (NTIS)

From the very beginning of their existence, human beings have tried to understand and explore the things surrounding them. This is the unique feature of human beings which makes them an altogether completely different and superior species. In order to understand any natural phenomenon, a systematic study is needed. As an example, If we are trying to understand the cause of a certain problem in the human body then a systematic study of the human body is required. Similarly if we are trying to understand the nature and surroundings around us then we need to explore it right at its roots. This is what we do at a high energy physics lab like Fermilab. Aided with big machines and state of the art technology we try to understand fundamental questions: How did the Universe came to its present form. What happened at the time of Big Bang. Where has all the anti-matter has gone.

NTIS

*Collisions; Hadrons; High Energy Interactions; Oscillations; Particle Decay*

**20070028610** Fermi National Accelerator Lab., Batavia, IL, USA

**8 GeV BEAM LINE OPTICS OPTIMIZATION FOR THE RAPID ANTIPROTON TRANSFERS AT FERMILAB**

Magaslaev, V.; Lebedev, V.; Morgan, J.; Meulen, D. V.; January 2007; 3 pp.; In English

Report No.(s): DE2007-899989; FERMILAB-CONF-07-020-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

Tevatron Run-II upgrade requires a significant increase of the efficiency and speed of the antiproton transfers from the Accumulator to the Recycler. The goal for the total transfer time is challenging a reduction from 1 hour down to a few minutes. Here we discuss the beam line optics aspects of this project. Results of lattice measurements and optimization are analyzed in terms of transport efficiency and stability.

NTIS

*Antiprotons; Particle Accelerators; Accumulators*

**20070028615** Universidad Autonoma de San Luis Potosi, Mexico; Fermi National Accelerator Lab., Batavia, IL, USA

**SELEX: RECENT PROGRESS IN THE ANALYSIS OF CHARM-STRANGE AND DOUBLE-CHARM BARYONS**

Engelfried, J.; January 2007; 9 pp.; In English

Report No.(s): DE2007-899996; FERMILAB-CONF-07/029-E; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

NTIS

*Baryons; Charm (Particle Physics)*

**20070028617** Columbia Univ., New York, NY, USA

**COMBINED MUON-NEUTRINO AND ELECTRON-NEUTRINO OSCILLATION SEARCH AT MINIBOONE**

Monroe, J. R.; January 2006; 422 pp.; In English

Report No.(s): DE2007-899985; No Copyright; Avail.: National Technical Information Service (NTIS)

MiniBooNE seeks to corroborate or refute the unconfirmed oscillation result from the LSND experiment. If correct, the result implies that a new kind of massive neutrino, with no weak interactions, participates in neutrino oscillations. This work focuses on the estimation of systematic errors associated with the neutrino flux and neutrino interaction cross section

predictions, and in particular, on constraining these uncertainties using in-situ MiniBooNE (nu(sub mu))charged current quasielastic (CCQE) scattering data.

NTIS

*High Energy Interactions; Neutrinos; Oscillations*

**20070028618** Fermi National Accelerator Lab., Batavia, IL, USA; State Univ. of New York, Stony Brook, NY, USA; Northern Illinois Univ., De Kalb, IL, USA; Notre Dame Univ., IN, USA

**Performance Measurement of the Upgraded D0 Central Track Trigger**

Mommsen, R. K.; January 2007; 6 pp.; In English

Report No.(s): DE2007-899992; FERMILAB-CONF-06-441-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The DO experiment was upgraded in spring 2006 to harvest the full physics potential of the Tevatron accelerator at Fermi National Accelerator Laboratory, Batavia, Illinois, USA. It is expected that the peak luminosity delivered by the accelerator will increase to over 3000E1030 cm-2s-1. One of the upgraded systems is the Central Track Trigger (CTT). The CTT uses the Central Fiber Tracker (CFT) and Preshower detectors to identify central tracks with  $p_T > 1.5\text{GeV}$  at the first trigger level. Track candidates are formed by comparing fiber hits to predefined track equations. In order to minimize latency, this operation is performed in parallel using combinatorial logic implemented in FPGAs. Limited hardware resources prevented the use of the full granularity of the CFT. This leads to a high fake track rate as the occupancy increases. In order to mitigate the problem, new trackfinding hardware was designed and commissioned. We report on the upgrade and the improved performance of the CTT system.

NTIS

*Actuators; Evaluation; Particle Accelerators; Performance Tests*

**20070028624** Fermi National Accelerator Lab., Batavia, IL, USA

**Characteristics of Round and Extracted Strands of Nb(3)Al Rutherford Cable**

Kikuchi, A.; Yamada, R.; Ambrosio, G.; Andreev, N.; Barazi, E.; January 2007; 5 pp.; In English

Report No.(s): DE2007-899983; FERMILAB-CONF-06-295-TD; No Copyright; Avail.: Department of Energy Information Bridge

Long Nb3Al strands with copper stabilizer are promising for future high field accelerator magnets. A 1.2 kilometer Nb3Al strand with Cu stabilizer was fabricated at the National Institute for Materials Science in Japan. Using this strand a 30 meter Cu stabilized Nb3Al Rutherford cable was made for the first time by a collaboration of NIMS and Fermilab. The Nb3Al strands extracted from cable with a relatively low packing factor showed almost no Jc degradation. But the extracted strands from the highly compacted cable showed some degradation in both Jc and n value, which may be caused by local separation of the copper stabilizer. Still, its Jc degradation is lower than that of typical Nb3Sn strands. The current limit due to magnetic instability in low field is about 500 A at 4.2 K. The magnetization of the strands, which was measured with balanced coils at 4.2 K, showed large flux jumps, usually around 1.5 T. This value is much larger than the Bc2 (4.2 K) of the Nb matrix, which is around 0.4 Tesla. The magnetic instability of the Nb3Al strand at low field is not completely understood, but it might be explained by the superconducting coupling current through the Nb matrix.

NTIS

*Aluminides; Niobium; Particle Accelerators; Strands*

**20070028676** National Center for Atmospheric Research, Boulder, CO USA

**Hao Spectral Diagnostic Package for Emitted Radiation (Haos-Diper) Reference Guide. Version 1.0**

Judge, P. G.; May 2007; 82 pp.; In English

Report No.(s): PB2007-109948; NCAR/TN-473-STR; No Copyright; Avail.: CASI: [A05](#), Hardcopy

This document is a reference guide for HAOS-DIPER, an IDL-based database and software system for working with data from atoms and atomic ions. HAOS-DIPER grew out of a need to work with and manipulate data for neutral atoms and atomic ions to understand radiation emitted by some space plasmas, notably the solar atmosphere and stellar atmospheres. An early version was described by Judge and Meisner (1994). Since then, other packages have become available which substantively perform many of the tasks originally intended for HAOS-DIPER. These include CHIANTI (Dere et al. 1997, Landi et al. 2006, and references therein), and ADAS (Summers 2003, Badnell et al. 2003).

NTIS

*Data Bases; Emittance; Programming Languages; Spectra*

**20070028733** Fermi National Accelerator Lab., Batavia, IL, USA

**Results on QCD Physics from the CDF-II Experiment**

January 2006; 10 pp.; In English

Report No.(s): DE2007-899351; No Copyright; Avail.: National Technical Information Service (NTIS)

The Quantum Chromo Dynamics (QCD) processes provide signals to test theoretical calculations and models and contribute major backgrounds to many other searches or measurements. Thus, their detailed understanding and modelling is of crucial importance. In particular, the current QCD physics program, at Tevatron, includes studies of jets with the goal of performing precision measurements to test and further constrain the validity of the Standard Model (SM). Jets can be defined as collimated sprays of particles originating, all in one point, from the fragmentation of a parton. The ability in reconstructing the jets allows to characterize and measure the energy of the parent partons. As jet calculations, at leading order and at higher orders, can vary the definition of a jet it is therefore important in order to compute the jet energy beyond the leading order.

NTIS

*Quantum Chromodynamics; Particle Accelerators; Mathematical Models*

**20070028875** Lawrence Livermore National Lab., Livermore, CA USA

**Collaborations in Nuclear Reactors**

Bringa, E.; Caro, A.; Barton, N.; Marian, J.; Vulatov, V.; Jan. 01, 2007; 152 pp.; In English

Report No.(s): DE2007-902252; UCRL-PROC-227349; No Copyright; Avail.: National Technical Information Service (NTIS)

This document presents an outline on (1) eV ion bombardment: tokamak erosion; (2) keV ion bombardment: bombardment of nanocrystals; and (3) MeV-GeV in bombardment: track models and amorphization of complex materials.

NTIS

*Nuclear Reactors; Nanocrystals; Ion Irradiation; Amorphous Materials*

**20070028879** Lawrence Livermore National Lab., Livermore, CA USA

**HEND: A Database for High Energy Nuclear Data**

Brown, D.; Vogt, R.; Nov. 2006; 7 pp.; In English

Report No.(s): DE2007-902246; UCRL-PROC-228275; No Copyright; Avail.: Department of Energy Information Bridge

We propose to develop a high-energy heavy-ion experimental database and make it accessible to the scientific community through an on-line interface. The database will be searchable and cross-indexed with relevant publications, including published detector descriptions. It should eventually contain all published data from older heavy-ion programs such as the Bevalac, AGS, SPS and FNAL fixed-target programs, as well as published data from current programs at RHIC and new facilities at GSI (FAIR), KEK/Tsukuba and the LHC collider. This data includes all proton-proton, proton-nucleus to nucleus-nucleus collisions as well as other relevant systems and all measured observables. Such a database would have tremendous scientific payoff as it makes systematic studies easier and allows simpler benchmarking of theoretical models to a broad range of experiments. To enhance the utility of the database, we propose periodic data evaluations and topical reviews. These reviews would provide an alternative and impartial mechanism to resolve discrepancies between published data from rival experiments and between theory and experiment. Since this database will be a community resource, it requires the high-energy nuclear physics community's financial and manpower support.

NTIS

*Data Bases; High Energy Interactions*

**20070028881** Lawrence Livermore National Lab., Livermore, CA USA

**Overview of Theory and Simulations in the Heavy Ion Fusion Science Virtual National Laboratory**

Friedman, A.; January 2006; 16 pp.; In English

Report No.(s): DE2007-901241; No Copyright; Avail.: National Technical Information Service (NTIS)

The Heavy Ion Fusion Science Virtual National Laboratory (HIFS-VNL) is a collaboration of Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, and Princeton Plasma Physics Laboratory. These laboratories, in cooperation with researchers at other institutions, are carrying out a coordinated effort to apply intense ion beams as drivers for studies of the physics of matter at extreme conditions, and ultimately for inertial fusion energy. Progress on this endeavor depends upon coordinated application of experiments, theory, and simulations. This paper describes the state of the art, with

an emphasis on the coordination of modeling and experiment; developments in the simulation tools, and in the methods that underly them, are also treated.

NTIS

*Particle Accelerators; Simulation*

**20070028883** California Univ., Berkeley, CA USA

**Potential Applications of Microtesla Resonance Imaging Detected Using a Superconducting Quantum Interference Device**

Myers, W. R.; January 2006; 205 pp.; In English

Report No.(s): DE2007-901227; No Copyright; Avail.: National Technical Information Service (NTIS)

This dissertation describes magnetic resonance imaging (MRI) of protons performed in a precession field of 132 iT. In order to increase the signal-to-noise ratio (SNR), a pulsed 40-300 mT magnetic field prepolarizes the sample spins and an untuned second-order superconducting gradiometer coupled to a low transition temperature superconducting quantum interference device (SQUID) detects the subsequent 5.6-kHz spin precession. Imaging sequences including multiple echoes and partial Fourier reconstruction are developed. Calculating the SNR of prepolarized SQUID-detected MRI shows that threedimensional Fourier imaging yields higher SNR than slice-selection imaging. An experimentally demonstrated field-cycling pulse sequence and post-processing algorithm mitigate image artifacts caused by concomitant gradients in low-field MRI. The magnetic field noise of SQUID untuned detection is compared to the noise of SQUID tuned detection, conventional Faraday detection, and the Nyquist noise generated by conducting biological samples.

NTIS

*Imaging Techniques; Magnetic Resonance; Protons; SQUID (Detectors)*

**20070028891** Notre Dame Univ., IN, USA

**Inclusive high-p(T)b anti-b Cross Section Measurement at  $s^{**} (1/2)$  Equals 1.96 TeV**

Galyaev, E.; Nov. 2006; 220 pp.; In English

Report No.(s): DE2007-901121; No Copyright; Avail.: National Technical Information Service (NTIS)

The Run II physics program at the Tevatron started in the spring of 2001 with protons and antiprotons colliding at an energy of  $(\text{square root } s) = 1.96 \text{ TeV}$ , and is continuing with about 1.2 fb(-1) of data currently collected by the CDF and DA experiments. A measurement of the b-jet cross section as function of jet transverse momentum p has been performed using 312 pb(-1) of DA data. The results for this measurement were obtained and are presented herein. A neural network algorithm was used to identify b jets.

NTIS

*Particle Accelerators; Neural Nets; Transverse Momentum*

**20070028892** Fermi National Accelerator Lab., Batavia, IL, USA; Institute for Theoretical and Experimental Physics, Moscow, Russian Federation

**Searching for new Physics at CDF**

Shreyber, I.; Mar. 04, 2007; 9 pp.; In English

Report No.(s): DE2007-901119; FERMILAB-CONF-06-410-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The search for physics beyond the Standard Model is one of the primary motivations of the Run II at the Tevatron. The CDF collaboration has been very active in this field by searching in a variety of final states for signals of new physics processes. The observation of no significant deviation from the Standard Model has led to limits on the cross-sections of the considered processes, which, in turn, have been used to constrain several models that predict such new physics scenarios.

NTIS

*Particle Accelerators; Motivation*

**20070028893** Lawrence Livermore National Lab., Livermore, CA USA

**BlueGene/L Supercomputer and Quantum Chromodynamics**

Vranas, P.; Soltz, R.; Oct. 20, 2006; 5 pp.; In English

Report No.(s): DE2007-902256; UCRL-TR-225442; No Copyright; Avail.: National Technical Information Service (NTIS)

In summary our update contains: (1) Perfect speedup sustaining 19.3% of peak for the Wilson D-slash Dirac operator. (2) Measurements of the full Conjugate Gradient (CG) inverter that inverts the Dirac operator. The CG inverter contains two

global sums over the entire machine. Nevertheless, our measurements retain perfect speedup scaling demonstrating the robustness of our methods. (3) We ran on the largest BG/L system, the LLNL 64 rack BG/L supercomputer, and obtained a sustained speed of 59.1 TFlops. Furthermore, the speedup scaling of the Dirac operator and of the CG inverter are perfect all the way up to the full size of the machine, 131,072 cores. The local lattice is rather small (4x4x4x16) while the total lattice has been a lattice QCD vision for thermodynamic studies (a total of 128x128x256x32 lattice sites). This speed is about five times larger compared to the speed we quoted in our submission. As we have pointed out in our paper QCD is notoriously sensitive to network and memory latencies, has a relatively high communication to computation ratio which can not be overlapped in BGL in virtual node mode, and as an application is in a class of its own. The above results are thrilling to us and a 30 year long dream for lattice QCD.

NTIS

*Quantum Chromodynamics; Supercomputers*

**20070028894** Lawrence Livermore National Lab., Livermore, CA USA

**Thermal Diffusivity and Conductivity Measurements in Diamond Anvil Cells**

Antonangeli, D.; Farber, D. L.; Feb. 26, 2007; 7 pp.; In English

Report No.(s): DE2007-902295; UCRL-TR-228329; No Copyright; Avail.: Department of Energy Information Bridge

We have undertaken a study of the feasibility of an innovative method for the determination of thermal properties of materials at extreme conditions. Our approach is essentially an extension of the flash method to the geometry of the diamond-anvil cell and our ultimate goal is to greatly enlarge the pressure and temperature range over which thermal properties can be investigated. More specifically, we have performed test experiments to establish a technique for probing thermal diffusivity on samples of dimensions compatible with the physical constraints of the diamond anvil cell.

NTIS

*Diamonds; Thermal Conductivity; Thermal Diffusivity*

**20070028897** Lawrence Livermore National Lab., Livermore, CA USA

**Final Task Report on NRF Measurements of Photon Scattering Resonances in Plutonium at the High Voltage Research Laboratory of MIT**

Johnson, M. S.; McNabb, D. P.; Norman, E. B.; Feb. 27, 2007; 8 pp.; In English

Report No.(s): DE2007-902291; UCRL-TR-228387; No Copyright; Avail.: National Technical Information Service (NTIS)

The bremsstrahlung experiments were conducted at the 3-MV Van de Graaff electron accelerator at the High Voltage Research Laboratory (HVRL) at the Massachusetts Institute of Technology (MIT). Bremsstrahlung photons were produced by impinging an electron beam onto a 'radiator' with 102-micron Au backed by 1-cm Cu (used for cooling and electron cleanup). The radiator was electrically isolated and the average current was recorded for analysis. The bremsstrahlung photons then pass through a 20-cm long collimator with a 2.5 degrees half-angle, conic opening. The photon beam was aligned by steering the electron beam on the radiator and observing the tune of the beam with an x-ray imager downstream of the target.

NTIS

*High Voltages; Photons; Plutonium; Scattering*

**20070028900** Lawrence Livermore National Lab., Livermore, CA USA

**Particle Splitting for Monte-Carlo Simulation of the National Ignition Facility**

Dauffy, L. S.; Latkowski, J. F.; Nov. 15, 2006; 7 pp.; In English

Report No.(s): DE2007-902288; UCRL-CONF-226129; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is scheduled for completion in 2009. Thereafter, experiments will commence in which capsules of DT will be imploded, generating neutrons, gammas, x-rays, and other reaction products that will interact in the facility's structure. In order to understand and minimize the exposure of workers within the facility to prompt and delayed (activation) dose, we have developed a model for the facility using the three-dimensional Monte Carlo particle transport code, TART. To obtain acceptable statistics in a reasonable amount of time, biasing techniques are employed. In an effort to improve efficiency, we are studying the optimization of particle splitting using geometrically similar, but much simpler models. We are discussing our techniques and results.

NTIS

*Computerized Simulation; Ignition; Monte Carlo Method; Particle Motion*



**20070028905** Lawrence Livermore National Lab., Livermore, CA USA

**Code Verification Results of an LLNL ASC Code on Some Tri-Lab Verification Test Suite Problems**

Anderson, S. R.; Bihari, B. L.; Salari, K.; Woodward, C. S.; Jan. 03, 2007; 19 pp.; In English

Report No.(s): DE2007-902278; UCRL-CONF-227042; No Copyright; Avail.: National Technical Information Service (NTIS)

As scientific codes become more complex and involve larger numbers of developers and algorithms, chances for algorithmic implementation mistakes increase. In this environment, code verification becomes essential to building confidence in the code implementation. This paper will present first results of a new code verification effort within LLNLs B Division. In particular, we will show results of code verification of the LLNL ASC ARES code on the test problems: Su Olson non-equilibrium radiation diffusion, Sod shock tube, Sedov point blast modeled with shock hydrodynamics, and Noh implosion.

NTIS

*Proving; Algorithms*

**20070028909** Lawrence Livermore National Lab., Livermore, CA USA

**Radiation Damage Effects on the Magnetic Properties of Pu(1-x)Am(x) (x=0.224)**

McCall, S. K.; Fluss, M. J.; Chung, B. W.; Elfresh, M. W.; Haire, R. G.; Dec. 19, 2006; 7 pp.; In English

Report No.(s): DE2007-902266; UCRL-PROC-226893; No Copyright; Avail.: National Technical Information Service (NTIS)

Plutonium-ameridium alloys present an interesting material for the study of 5f electron systems, as the two metals form a single stable fcc phase over a wide range of compositions, with the lattice parameter increasing with Am concentration, showing a positive deviation from Vegard's law. Previous work on radiation damage in PuAm alloys has investigated the consequence of damage accumulation on magnetic susceptibility where the damage was accumulated near room temperature. Recent work on isochronal annealing of PuAm alloys accumulated damage at low temperature with the total number of decays per atom approximately 20 times smaller than the room temperature work but the accumulated damage (surviving atomic displacements) was much greater. The isochronal annealing study finds that room temperature is very close to the annealing stage where small vacancy clusters are unstable, removing the last magnetically observable indication of radiation damage. Therefore, damage accumulated for extended periods of time at room temperature is not simply the very dilute remnant evolution of the vacancy and interstitial displacements and their diffusion history, but likely reflects also the presence of the helium and daughter products of the nuclear decay itself.

NTIS

*Magnetic Properties; Plutonium; Radiation Damage*

**20070028910** Lawrence Livermore National Lab., Livermore, CA USA

**POINT 2007: A Temperature Dependent ENDF/B-VII.0 Data Cross Section Library**

Cullen, D. E.; Feb. 14, 2007; 27 pp.; In English

Report No.(s): DE2007-902265; UCRL-TR-228089; No Copyright; Avail.: National Technical Information Service (NTIS)

This report is one in the series of POINT reports that over the years have presented temperature dependent cross sections for the then current version of ENDF/B. In each case the author has used publicly available nuclear data (the current ENDF/B data, available online at the National Nuclear Data Center, Brookhaven National Laboratory <http://www.nndc.bnl.gov/>) and publicly available computer codes (the current PREPRO codes, available on-line at the Nuclear Data Section, IAEA, Vienna, Austria <http://www.nds.iaea.org/ndspub/endl/prepro/>). The author has used these in combination to produce the temperature dependent cross sections used in applications and presented in this report.

NTIS

*Data Acquisition; Libraries; Temperature Dependence; Cross Sections*

**20070029221** Lawrence Livermore National Lab., Livermore, CA USA

**Nuclear Photo-Science and Applications with T-Rex Sources**

Hartemann, F.; Anderson, S.; Betts, S.; Gibson, D.; Hartouni, E.; Aug. 30, 2006; 35 pp.; In English

Report No.(s): DE2007-902285; UCRL-PROC-224082; No Copyright; Avail.: National Technical Information Service (NTIS)

This document presents information on the motivation; the nuclear resonance fluorescence; the Compton scattering; the

electron beam technology; the laser technology; LLNL's T-REX source; and the nuclear applications.

NTIS

*Nuclear Physics; X Ray Sources; X Rays*

**20070029225** Lawrence Livermore National Lab., Livermore, CA USA

**LDRD Final Report: Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057)**

Escher, J. E.; Bernstein, L. A.; Bleuel, D.; Burke, J.; Church, J. A.; Feb. 27, 2007; 39 pp.; In English

Report No.(s): DE2007-902261; UCRL-TR-228366; No Copyright; Avail.: National Technical Information Service (NTIS)

Research carried out in the framework of the LDRD project Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057) is summarized. The project was designed to address the challenge of determining cross sections for nuclear reactions involving unstable targets, with a particular emphasis on reactions that play a key role in the production of the elements between Iron and Uranium. This report reviews the motivation for the research, introduces the approach employed to address the problem, and summarizes the resulting scientific insights, technical findings, and related accomplishments.

NTIS

*Heavy Elements; Nuclear Reactions*

**20070029239** Fermi National Accelerator Lab., Batavia, IL, USA

**Weak Mixing and Rare Decays in the Littlest Higgs Model**

Bardeen, W. A.; Mar. 15, 2007; 7 pp.; In English

Report No.(s): DE2007-901117; FERMILB-CONF-07-50-T; No Copyright; Avail.: Department of Energy Information Bridge

Little Higgs models have been introduced to resolve the fine-tuning problems associated with the stability of the electroweak scale and the constraints imposed by the precision electroweak analysis of experiments testing the Standard Model of particle physics. Flavor physics provides a sensitive probe of the new physics contained in these models at next-to-leading order.

NTIS

*Standard Model (Particle Physics); Stability; Higgs Bosons*

**20070029246** Lawrence Livermore National Lab., Livermore, CA USA

**LCLS XTOD Tunnel Vacuum Transport System (XVTS) Final Design Report**

Shen, S.; Oct. 23, 2006; 98 pp.; In English

Report No.(s): DE2007-900856; UCRL-TR-225467; No Copyright; Avail.: National Technical Information Service (NTIS)

The design of the X-Ray Vacuum Transport System (XVTS) for the Linac Coherent Light Source (LCLS) X-ray Transport, Optics and Diagnostics (XTOD) system has been analyzed and configured by the Lawrence Livermore National Laboratory's New Technologies Engineering Division (NTED) as requested by the SLAC/LCLS program. A preliminary design review was held on 11/14/05 (1)(2). This FDR (Final Design Report) presents system configuration, detailed analyses and selection of the mechanical and electrical components for the XTOD tunnel section, as well as the response to all issues raised in the review committee report. Also included are the plans for procurement, mechanical integration, schedule and the cost estimates. It should be noticed that, after the XVTS PDR, LCLS management has decided to lower the number of beamlines from three to one, and shorten the tunnel length from 212 m to 184 m. (3)(4).

NTIS

*Diagnosis; Systems Engineering; Vacuum Systems; X Rays*

**20070029250** Abilene Christian Univ., TX, USA; Colorado Univ., Boulder, CO USA

**Proposal to Upgrade the MIPP Experiment**

Peterson, R. J.; Gutbrod, H.; Peters, K.; Feldman, G.; January 2006; 93 pp.; In English

Report No.(s): DE2007-900842; FERMILAB-P-960; No Copyright; Avail.: National Technical Information Service (NTIS)

The upgraded MIPP physics results are needed for the support of NuMI projects, atmospheric cosmic ray and neutrino programs worldwide and will permit a systematic study of non-perturbative QCD interactions. The MIPP TPC is the largest contributor to the MIPP event size by far. Its readout system and electronics were designed in the 1990s and limit it to a readout rate of 60 Hz in simple events and 20 Hz in complicated events. With the readout chips designed for the ALICE collaboration at the LHC, we propose a low cost scheme of upgrading the MIPP data acquisition speed to 3000 Hz. This will also enable

us to measure the medium energy nuclei target to be used for the NO.A/MINER.A experiments. We outline the capabilities of the upgraded MIPP detector to obtain high statistics particle production data on a number of nuclei that will help towards the understanding and simulation of hadronic showers in matter. Measurements of nitrogen cross sections will permit a better understanding of cosmic ray shower systematics in the atmosphere. In addition, we explore the possibilities of providing tagged neutral beams using the MIPP spectrometer that may be crucial for validating the Particle Flow Algorithm proposed for calorimeters for the International Linear Collider detectors. Lastly, we outline the physics potential of such a detector in understanding non-perturbative QCD processes.

NTIS

*Data Acquisition; Nucleons; Cosmic Rays; Neutrinos*

**20070029251** Fermi National Accelerator Lab., Batavia, IL, USA

**Search for Higgs at CDF**

Yu, S. S.; January 2007; 4 pp.; In English

Report No.(s): DE2007-900841; FERMILAB-CONF-06-382-E; No Copyright; Avail.: National Technical Information Service (NTIS)

We present the results on the searches for the SM and the non-SM Higgs boson production in p p collisions at  $\sqrt{s} = 1.96$  TeV with the CDF detector at the Fermilab Tevatron. Using data corresponding to 300-700 pb<sup>-1</sup>, we search for the Higgs boson in various production and decay channels. No signal is observed, therefore, we set upper limits on the production cross-section times branching fraction as a function of the Higgs boson mass.

NTIS

*Higgs Bosons; Particle Production*

**20070029252** Fermi National Accelerator Lab., Batavia, IL, USA; Istituto Nazionale di Fisica Nucleare, Pisa, Italy; Pennsylvania Univ., Philadelphia, PA, USA

**Measurements of Top Quark Properties at CDF**

January 2007; 4 pp.; In English

Report No.(s): DE2007-900840; FERMILAB-CONF-06-418-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The top quark with its mass of about 172 GeV/c<sup>2</sup> is the most massive fundamental particle observed by experiment. In this talk the author highlights the most recent measurements of several top quark properties performed with the CDF detector based on data samples corresponding to integrated luminosities up to 1 fb<sup>-1</sup>. These results include a search for top quark pair production via new massive resonances, measurements of the helicity of W boson from top-quark decay, and a direct limit on the lifetime of the top quark.

NTIS

*Elementary Particles; Quarks*

**20070029253** Fermi National Accelerator Lab., Batavia, IL, USA

**Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab**

Rakho, I.; Nov. 20, 2006; 10 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-900838; FERMILAB-TM-2367-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

The results of Monte Carlo radiation shielding study performed with the MARS15 code for the final design of the vertical test cryostat facility to be installed in the Industrial Building 1 at Fermilab are presented and discussed.

NTIS

*Cavities; Particle Accelerators; Radiation Shielding; Radio Frequencies; Superconducting Cavity Resonators; Superconductivity; Test Facilities*

**20070029258** Lawrence Livermore National Lab., Livermore, CA USA

**Superconducting High Resolution Fast-Neutron Spectrometers**

Hau, I. D.; May 26, 2006; 157 pp.; In English

Report No.(s): DE2007-900877; UCRL-TH-221650; No Copyright; Avail.: National Technical Information Service (NTIS)

Superconducting high resolution fast-neutron calorimetric spectrometers based on (sup 6) LiF and TiB2 absorbers have

been developed. These novel cryogenic spectrometers measure the temperature rise produced in exothermal reactions with fast neutrons in (sup 6) Li and (sup 10) B-loaded materials with heat capacity C operating at temperatures T close to 0.1 K. Temperature variations on the order of 0.5 mK are measured with a Mo/Cu thin film multilayer operated in the transition region between its superconducting and its normal state. The advantage of calorimetry for high resolution spectroscopy is due to the small phonon excitation energies  $kBT$  on the order of microeV that serve as signal carriers, resulting in an energy resolution, which can be well below 10 keV. An energy resolution of 5.5 keV has been obtained with a Mo/Cu superconducting sensor and a TiB<sub>2</sub> absorber using thermal neutrons from a <sup>252</sup>Cf neutron source. This resolution is sufficient to observe the effect of recoil nuclei broadening in neutron spectra, which has been related to the lifetime of the first excited state in <sup>7</sup>Li. Fast-neutron spectra obtained with a <sup>6</sup>Li-enriched LiF absorber show an energy resolution of 16 keV FWHM, and a response in agreement with the <sup>6</sup>Li <sup>3</sup>H reaction cross section and Monte Carlo simulations for energies up to several MeV. The energy resolution of order of a few keV makes this novel instrument applicable to fast-neutron transmission spectroscopy based on the unique elemental signature provided by the neutron absorption and scattering resonances. The optimization of the energy resolution based on analytical and numerical models of the detector response is discussed in the context of these applications.

NTIS

*Calorimeters; Fast Neutrons; High Resolution; Neutron Spectrometers; Neutrons; Spectrometers; Superconductivity; Superconductors (Materials)*

**20070029259** Fermi National Accelerator Lab., Batavia, IL, USA

**Eddy Current Scanning of Niobium for SRF Cavities at Fermilab**

Borro, C.; Bauer, P.; Foley, M.; Antoine, C.; Cooper, C.; January 2006; 4 pp.; In English

Report No.(s): DE2007-901116; FERMILAB-CONF-06-286-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

In the framework of SRF cavity development, Fermilab is creating the infrastructure needed for the characterization of the material used in the cavity fabrication. An important step in the characterization of as received niobium sheets is eddy current scanning. Eddy current scanning is a nondestructive technique first adopted and further developed by DESY with the purpose of checking the cavity material for subsurface defects and inclusions. Fermilab has received and further upgraded a commercial eddy current scanner previously used for the SNS project. This scanner is now used daily to scan the niobium sheets for the Fermilab third harmonic, the ILC, and the Proton Driver cavities. After optical inspection, more than 400 squares and disks have been scanned and when necessary checked at the optical and electron microscopes, anodized, or measured with profilometers looking for surface imperfections that might limit the performance of the cavities. This paper gives a status report on the scanning results obtained so far, including a discussion of the classification of signals being detected.

NTIS

*Cavities; Eddy Currents; Niobium; Particle Accelerators*

**20070029261** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Studies of a Gas-Filled Helical Muon Beam Cooling Channel**

Yonehara, K.; Derbenev, Y.; Johnson, R. P.; January 2006; 3 pp.; In English

Contract(s)/Grant(s): DE-FG02-02ER86145

Report No.(s): DE2007-901112; FERMILAB-CONF-06-197-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

A helical cooling channel (HCC) can quickly reduce the six dimensional phase space of muon beams for muon colliders, neutrino factories, and intense muon sources. The HCC is composed of solenoidal, helical dipole, and helical quadrupole magnetic fields to provide the focusing and dispersion needed for emittance exchange as the beam follows an equilibrium helical orbit through a continuous homogeneous absorber. The beam dynamics of a gas-filled helical muon beam cooling channel is studied by using Monte Carlo simulations. The results verify the cooling theory (1) of the helical magnet. The cooling performance has been improved by correcting chromatic aberration and the non-linear effects caused by the ionization energy loss process. With these improvements, a simulated cooling channel of 160 meters length has achieved a reduction of 6-dimensional (6D) phase space by a factor of 50,000.

NTIS

*Cavities; Cooling; Muons*

**20070029262** Fermi National Accelerator Lab., Batavia, IL, USA

**Preliminary Study of Using 'Pipetron'-Type Magnets for a Pre-Accelerator for the LHC**

de Rijk, G.; Rossi, L.; Piekarz, H.; January 2006; 3 pp.; In English

Report No.(s): DE2007-901111; FERMILAB-CONF-06-192-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

One of the luminosity limitations of the LHC is the rather low injection energy (0.45 TeV) with respect to the collision energy (7 TeV). The magnetic multipoles in the main dipoles at low field and their dynamic behaviour are considered to limit the achievable bunch intensity and emittance. We report on a preliminary study to increase the injection energy to 1.5 TeV using a two-beam pre-accelerator (LER) in the LHC tunnel. The LER is based on Pipetron magnets as originally proposed for the VLHC. The aim of the study is to assess the feasibility and to identify the critical processes or systems that need to be investigated and developed to render such a machine possible.

NTIS

*Hadrons; Injection; Magnets; Particle Accelerators*

**20070029277** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Neutron Generators Developed at LBNL for Homeland Security and Imaging Applications**

Reigonen, J.; January 2006; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-05CH11231

Report No.(s): DE2007-900949; No Copyright; Avail.: Department of Energy Information Bridge

The Plasma and Ion Source Technology Group at Lawrence Berkeley National Laboratory has developed various types of advanced D-D (neutron energy 2.5 MeV), D-T (14 MeV) and T-T (09 MeV) neutron generators for wide range of applications. These applications include medical (Boron Neutron Capture Therapy), homeland security (Prompt Gamma Activation Analysis, Fast Neutron Activation Analysis and Pulsed Fast Neutron Transmission Spectroscopy) and planetary exploration with a sub-surface material characterization on Mars. These neutron generators utilize RF induction discharge to ionize the deuterium/tritium gas. This discharge method provides high plasma density for high output current, high atomic species from molecular gases, long life operation and versatility for various discharge chamber geometries. Four main neutron generator developments are discussed here: high neutron output co-axial neutron generator for BNCT applications, point neutron generator for security applications, compact and sub-compact axial neutron generator for elemental analysis applications. Current status of the neutron generator development with experimental data will be presented.

NTIS

*Imaging Techniques; Neutrons; Radio Frequencies; Security*

**20070029288** Stanford Linear Accelerator Center, Stanford, CA, USA

**Searching for Double Beta Decay with the Enriched Xenon Observatory**

Hall, C.; Mar. 2007; 4 pp.; In English

Report No.(s): DE2007-900996; SLAC-PUB-12399; No Copyright; Avail.: Department of Energy Information Bridge

The Enriched Xenon Observatory (EXO) Collaboration is building a series of experiments to search for the neutrinoless double beta decay of  $^{136}\text{Xe}$ . The first experiment, known as EXO-200, will utilize 200 kg of xenon enriched to 80% in the isotope of interest, making it the largest double beta decay experiment to date by one order of magnitude. This experiment is rapidly being constructed, and will begin data taking in 2007. The EXO collaboration is also developing a technique to identify on an event-by-event basis the daughter barium ion of the double beta decay. If successful, this method would eliminate all conventional radioactive backgrounds to the decay, resulting in an ideal experiment. We summarize here the current status of EXO-200 construction and the barium tag R&D program.

NTIS

*Barium; Beta Particles; Construction; Observatories; Radioactive Decay; Xenon; Xenon Isotopes*

**20070029289** Stanford Linear Accelerator Center, Stanford, CA, USA

**Injector Test Facility for the LCLS. Executive Summary**

Mar. 2007; 34 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-900991; SLAC-TN-07-005; No Copyright; Avail.: National Technical Information Service (NTIS)

SLAC is in the privileged position of being the site for the worlds first 4th generation light source as well as having a premier accelerator research staff and facilities. Operation of the worlds first x-ray free electron laser (FEL) facility will require

innovations in electron injectors to provide electron beams of unprecedented quality. Upgrades to provide ever shorter wavelength x-ray beams of increasing intensity will require significant advances in the state-of-the-art. The BESAC 20-Year Facilities Roadmap identifies the electron gun as the critical enabling technology to advance linac-based light sources and recognizes that the sources for next-generation light sources are the highest-leveraged technology, and that BES should strongly support and coordinate research and development in this unique and critical technology. This white paper presents an R&D plan and a description of a facility for developing the knowledge and technology required to successfully achieve these upgrades, and to coordinate efforts on short-pulse source development for linac-based light sources.

NTIS

*Electron Beams; Free Electron Lasers; Injectors; Linear Accelerators; Particle Accelerators; Test Facilities; X Ray Lasers*

**20070029290** Stanford Linear Accelerator Center, Stanford, CA, USA; Princeton Univ., NJ, USA

**B0 to K0K0bar and Other Hadronic b to d Decays**

Biesiada, J.; Mar. 2007; 4 pp.; In English

Report No.(s): DE2007-900989; SLAC-PUB-12390; No Copyright; Avail.: National Technical Information Service (NTIS)

The b yields d penguin-dominated modes B yields KK have been observed at the B factories. In addition, the BABAR collaboration has reported the first time-dependent CP-violation measurement in B0 yields K0K0.

NTIS

*Hadrons; Particle Decay*

**20070029291** Stanford Linear Accelerator Center, Stanford, CA, USA; European Organization for Nuclear Research, Geneva, Switzerland

**First NNLL Prediction of B(right arrow Xs gamma)**

Hurth, T.; Mar. 2007; 5 pp.; In English

Report No.(s): DE2007-900988; SLAC-PUB-12395; No Copyright; Avail.: National Technical Information Service (NTIS)

We discuss the first NNLL prediction of the B right arrow Xs branching ratio, including important additional subtleties due to non-perturbative corrections and logarithmically-enhanced cut effects.

NTIS

*High Energy Interactions; Branching (Physics); Correction; Decay*

**20070029296** Lawrence Livermore National Lab., Livermore, CA USA

**High-Energy Neutron Imaging Development at LLNL**

Hall, J. M.; Rusnak, B.; Fitsos, P. J.; Dec. 06, 2006; 15 pp.; In English

Report No.(s): DE2007-900879; UCRL-TR-226786; No Copyright; Avail.: National Technical Information Service (NTIS)

We are proceeding with the development of a high-energy (10 MeV) neutron imaging system for use as an inspection tool in nuclear stockpile stewardship applications. Our goal is to develop and deploy an imaging system capable of detecting cubic-mm-scale voids, cracks or other significant structural defects in heavily-shielded low-Z materials within nuclear device components. The final production-line system will be relatively compact (suitable for use in existing or proposed facilities within the DOE complex) and capable of acquiring both radiographic and tomographic (CT) images. In this report, we will review our programmatic accomplishments to date, highlighting recent (FY06) progress on engineering and technology development issues related to the proposed imaging system. We will also discuss our preliminary project plan for FY07, including engineering initiatives, proposed radiation damage experiments (neutrons and x rays) and potential options for conducting classified neutron imaging experiments at LLNL.

NTIS

*Imaging Techniques; Neutron Radiography; Neutrons; Particle Accelerators*

**20070029297** Lawrence Livermore National Lab., Livermore, CA USA

**Systematic Procedure for Assigning Uncertainties to Data Evaluations**

Younes, W.; Feb. 23, 2007; 8 pp.; In English

Report No.(s): DE2007-902296; UCRL-TR-228283; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report, an algorithm that automatically constructs an uncertainty band around any evaluation curve is described. Given an evaluation curve and a corresponding set of experimental data points with x and y error bars, the algorithm expands a symmetric region around the evaluation curve until 68.3% of a set of points, randomly sampled from the experimental data, fall within the region. For a given evaluation curve, the region expanded in this way represents, by definition, a

one-standard-deviation interval about the evaluation that accounts for the experimental data. The algorithm is tested against several benchmarks, and is shown to be well-behaved, even when there are large gaps in the available experimental data. The performance of the algorithm is assessed quantitatively using the tools of statistical-inference theory.

NTIS

*Neutrons; Uncertain Systems; Evaluation; Sampled Data Systems; Accuracy*

**20070029302** Lawrence Livermore National Lab., Livermore, CA USA

**Notes on Longitudinal Dynamics in UMER**

Harris, J. R.; Jan. 10, 2007; 12 pp.; In English

Report No.(s): DE2007-900104; UCRL-TR-227174; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

*Longitudinal Stability; Dynamic Characteristics*

**20070029303** Lawrence Livermore National Lab., Livermore, CA USA

**Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing**

Schilling, O.; Mueschke, N.; Latini, M.; Jan. 11, 2007; 8 pp.; In English

Report No.(s): DE2007-900103; UCRL-CONF-227196; No Copyright; Avail.: Department of Energy Information Bridge

The validity of gradient-diffusion closures for modeling turbulent transport in multi-mode Rayleigh Taylor and reshocked Richtmyer Meshkov instability-induced mixing is investigated using data from three dimensional spectral/tenth-order compact difference and ninth-order weighted essentially non-oscillatory simulations, respectively. Details on the numerical methods, initial and boundary conditions, and validation of the results are discussed elsewhere (2,3). First, mean and fluctuating fields are constructed using spatial averaging in the two periodic flow directions. Then, quantities entering eddy viscosity-type gradient-diffusion closures, such as the turbulent kinetic energy and its dissipation rate (or turbulent frequency), and the turbulent viscosity are constructed. The magnitudes of the terms in the turbulent kinetic energy transport equation are examined to identify the dominant processes. It is shown that the buoyancy (or shock) production term is the dominant term in the transport equation, and that the shear production term is relatively small for both the Rayleigh Taylor and Richtmyer Meshkov cases. Finally, a priori tests of gradient-diffusion closures of the unclosed terms in the turbulent kinetic energy transport equation are performed by comparing the terms constructed directly using the data to the modeled term. A simple method for estimating the turbulent Schmidt numbers appearing in the closures is proposed. Using these turbulent Schmidt numbers, it is shown that both the shape and magnitude of the profiles of the dominant terms in the turbulent kinetic energy transport equation across the mixing layer are generally well captured.

NTIS

*Closures; Diffusion; Gradients; Taylor Instability; Turbulence*

**20070029306** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Self-Consistent Simulations of High-Intensity Beams and E-Clouds with WARP POSINST**

Vay, J. L.; Friedman, A.; Grote, D. P.; January 2006; 7 pp.; In English

Report No.(s): DE2007-900710; No Copyright; Avail.: National Technical Information Service (NTIS)

We have developed a new, comprehensive set of simulation tools aimed at modeling the interaction of intense ion beams and electron clouds (e-clouds). The set contains the 3-D accelerator PIC code WARP and the 2-D slice ecloud code POSINST, as well as a merger of the two, augmented by new modules for impact ionization and neutral gas generation. The new capability runs on workstations or parallel supercomputers and contains advanced features such as mesh refinement, disparate adaptive time stepping, and a new drift-Lorentz particle mover for tracking charged particles in magnetic fields using large time steps. It is being applied to the modeling of ion beams (1 MeV, 180 mA, K+) for heavy ion inertial fusion and warm dense matter studies, as they interact with electron clouds in the High-Current Experiment (HCX). In earlier papers, we described the capabilities and presented recent simulation results with detailed comparisons against the HCX experiment, as well as their application (in a different regime) to the modeling of e-clouds in the Large Hadron Collider (LHC). We concentrate here on the description of the implementation of the quasi-static mode of operation, for comparison with other codes, and introduce a new consideration on the estimate of computing time between the quasi-static and the fully self-consistent modes.

NTIS

*Electron Beams; Ion Beams; Simulation*

**20070029307** Lawrence Livermore National Lab., Livermore, CA USA

**Simulated Performance of a Second Generation Compact Compton Imaging Detector**

Manini, H. A.; Jan. 18, 2007; 23 pp.; In English

Report No.(s): DE2007-900099; UCRL-TR-227308; No Copyright; Avail.: National Technical Information Service (NTIS)

Simulations are performed using GEANT4 of a second-generation compact Compton imaging detector called CCI2 which uses silicon and germanium detector crystals. Realistic simulated detector geometry and realistic detector parameters are used. Results are obtained for the CCI2 detector for the intrinsic photopeak efficiency, imaging efficiency, and angular resolution, and simulated images are created for point sources with various energies and source angles.

NTIS

*Imaging Techniques; Simulation*

**20070029310** Lawrence Livermore National Lab., Livermore, CA USA

**Application of Morse Theory to Analysis of Rayleigh Taylor Topology**

Miller, P. L.; Bremer, P. T.; Cabot, W. H.; Cook, A. W.; Laney, D. E.; Jan. 30, 2006; 6 pp.; In English

Report No.(s): DE2007-900096; UCRL-PROC-227587; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a novel Morse Theory approach for the analysis of the complex topology of the Rayleigh-Taylor mixing layer. We automatically extract bubble structures at multiple scales and identify the resolution of interest. Quantitative analysis of bubble counts over time highlights distinct mixing trends for a high-resolution Direct Numerical Simulation (DNS).

NTIS

*Topology; Mixing Layers (Fluids); Bubbles; Extraction*

**20070029318** Lawrence Livermore National Lab., Livermore, CA USA

**Improved Charged Particle Model in CALEICF**

Managan, R. A.; Jan. 18, 2007; 12 pp.; In English

Report No.(s): DE2007-900089; UCRL-CONF-227316; No Copyright; Avail.: National Technical Information Service (NTIS)

Modeling ICF capsules and test problems involving thermonuclear plasmas requires modeling the charged particles produced by the thermonuclear reactions. The charged particles escaping from an ICF capsule are one of the main diagnostics of capsule performance. Caleicf can locally deposit the charged particle energy into the electron and ion fields instantaneously or track them using a Monte Carlo algorithm. Test problems revealed that Caleicf's charged particle package needed improvement. The package has been enhanced to include the thermal energy of the reacting particles and to model the created particles energy distribution. The thermal energy of the reacting particles is accounted for as described in Ballabio, et al. (Ballabio et al., 1998) and Warshaw (Warshaw, 2001). This energy is removed from the background ion energy and distributed between the created particles. The particle energy distributions are modeled with an approximation used by Ballabio, et al. This distribution is a modified Gaussian (based on the square root of the energy) that has a functional form similar to the exact distribution (see Warshaw). The skewness of the distribution matches that of the exact distribution within 1-2%. The thermal energy and the parameters of the distribution can be calculated using  $\langle v \rangle$  and its first two derivatives with respect to temperature. The new model will be compared with the original one for several test problems and ICF calculations.

NTIS

*Charged Particles; Thermonuclear Reactions; Particle Energy*

**20070029319** Lawrence Livermore National Lab., Livermore, CA USA

**Preliminary Low Frequency Electromagnetic Analysis of a Flux Concentrator**

Mayhall, D. J.; Jun. 13, 2006; 14 pp.; In English

Report No.(s): DE2007-900087; UCRL-TR-221994; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this investigation was to conduct a quick, preliminary transient magnetostatic analysis of a Brechna-type(1) flux concentrator to determine its feasibility for collecting positrons in the International Linear Collider. The magnetostatic transient module of Maxwell 3D, Version 10, from the Ansoft Corporation was used to model the flux concentrator.

NTIS

*Concentrators; Feasibility; Low Frequencies*



**20070029320** Lawrence Livermore National Lab., Livermore, CA USA

**Isochoric Implosions for Fast Ignition**

Clark, D. S.; Tabak, M.; Jun. 09, 2006; 18 pp.; In English

Report No.(s): DE2007-900086; UCRL-CONF-221925; No Copyright; Avail.: National Technical Information Service (NTIS)

Fast Ignition (FI) exploits the ignition of a dense, uniform fuel assembly by an external energy source to achieve high gain. In conventional ICF implosions, however, the fuel assembles as a dense shell surrounding a low density, high-pressure hotspot. Such configurations are far from optimal for FI. Here, it is shown that a self-similar spherical implosion of the type originally studied by Guderley (Luftfahrtforschung 19, 302 (1942).) may be employed to implode a dense, quasi-uniform fuel assembly with minimal energy wastage in forming a hotspot. A scheme for realizing these specialized implosions in a practical ICF target is also described.

NTIS

*Ignition; Implosions; Isochoric Processes*

**20070029322** Lawrence Livermore National Lab., Livermore, CA USA

**Rayleigh Taylor Instability induced Mixing. Initial Conditions Modeling, Three Dimensional Simulations and Comparisons with Experiment**

Mueschke, N.; Schilling, O.; Andrews, M.; Jan. 11, 2007; 6 pp.; In English

Report No.(s): DE2007-900080; UCRL-CONF-227192; No Copyright; Avail.: National Technical Information Service (NTIS)

A spectral/compact finite-difference method with a third-order Adams Bash forth Moulton time evolution scheme is used to perform a direct numerical simulation (DNS) of Rayleigh Taylor flow. The initial conditions are modeled by parameterizing the multi-mode velocity and density perturbations measured just off of the splitter plate in water channel experiments. Parameters in the DNS are chosen to match the experiment as closely as possible. The early-time transition from a weakly-nonlinear to a strongly-nonlinear state, as well as the onset of turbulence, is examined by comparing the DNS and experimental results. The mixing layer width, molecular mixing parameter, vertical velocity variance, and density variance spectrum obtained from the DNS are shown to be in good agreement with the corresponding experimental values.

NTIS

*Simulation; Taylor Instability; Comparison*

**20070029325** Lawrence Livermore National Lab., Livermore, CA USA

**Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation**

Kerr, P.; Rowland, M.; Dietrich, D.; Stoeffl, W.; Wheeler, B.; Aug. 21, 2006; 13 pp.; In English

Report No.(s): DE2007-900071; UCRL-CONF-223845; No Copyright; Avail.: National Technical Information Service (NTIS)

Active interrogation with low-energy neutrons provides a search technique for shielded highly enriched uranium. We describe the technique and show initial results using a low-dose 60 keV neutron beam. This technique produces a clear induced fission signal in the presence of small quantities of <sup>235</sup>U. The technique has been validated with low-Z and high-Z shielding materials. The technique uses a forward-directed beam of 60 keV neutrons to induce fission in <sup>235</sup>U. The induced fission produces fast neutrons which are then detected as the signature for <sup>235</sup>U. The beam of neutrons is generated with a 1.93 MeV proton beam impinging on a natural lithium target. The proton beam is produced by a radio-frequency quadrupole (RFQ) LINAC. The 60 keV neutron beam is forward directed because the <sup>7</sup>Li(p,n) reaction is just at threshold for the proton energy of 1.93 MeV.

NTIS

*Amount; Dosage; Interrogation; Neutrons; Uranium*

**20070029327** Lawrence Livermore National Lab., Livermore, CA USA

**CCG-LCONE CT Reconstruction Code User and Programmers Guide**

Jackson, J. A.; Nov. 08, 2006; 86 pp.; In English

Report No.(s): DE2007-900183; UCRL-TR-225936; No Copyright; Avail.: National Technical Information Service (NTIS)

This document describes a Computed Tomography (CT) reconstruction code called CCG-LCONE. CCG-LCONE is used to reconstruction objects from projections acquired on a cone beam radiographic system. This document will describe in brief

the theory behind parts of the code, as well as detail the structure of the code, so it will function as both a User's Guide and a Programmer's Guide. The introduction will describe CT in general and cone beam systems in particular. It will explain why CCG-LCONE was developed and give an overview of the design and function.

NTIS

*Computer Programming; Manuals; Tomography*

**20070029329** Lawrence Livermore National Lab., Livermore, CA USA

**Status and Prospects of the Fast Ignition Inertial Fusion Concept**

Key, M. H.; Nov. 21, 2006; 42 pp.; In English

Report No.(s): DE2007-900178; UCRL-TR-226302; No Copyright; Avail.: National Technical Information Service (NTIS)

Fast ignition is an alternate concept in inertial confinement fusion, which has the potential for easier ignition and greater energy multiplication. If realized it could improve the prospects for inertial fusion energy. It poses stimulating challenges in science and technology and the research is approaching a key stage in which the feasibility of fast ignition will be determined. This review covers the concepts, the state of the science and technology, the near term prospects and the challenges and risks involved in demonstrating high gain fast ignition.

NTIS

*Ignition; Inertial Confinement Fusion; Energy Consumption; Thermonuclear Power Generation*

**20070029336** Lawrence Livermore National Lab., Livermore, CA USA

**Neutron Production by Muon Spallation I: Theory**

Luu, T.; Haggmann, C.; Nov. 22, 2006; 18 pp.; In English

Report No.(s): DE2007-900172; UCRL-TR-226323; No Copyright; Avail.: National Technical Information Service (NTIS)

We describe the physics and codes developed in the Muon Physics Package. This package is a self-contained Fortran90 module that is intended to be used with the Monte Carlo package MCNPX. We calculate simulated energy spectra, multiplicities, and angular distributions of direct neutrons and pions from muon spallation.

NTIS

*Muons; Neutrons; Spallation*

**20070029345** Lawrence Livermore National Lab., Livermore, CA USA

**Recent Physics Results from NSTX**

Menard, J. E.; Bell, M. G.; Bell, R. E.; Bialek, J. M.; Boedo, J. A.; Oct. 08, 2006; 14 pp.; In English

Report No.(s): DE2007-900160; UCRL-CONF-225102; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Spherical Torus Experiment (NSTX) has made considerable progress in advancing the scientific understanding of high performance long-pulse plasmas needed for ITER and future low-aspect-ratio Spherical Torus (ST) devices. Plasma durations up to 1.6s (5 current redistribution times) have been achieved at plasma currents of 0.7 MA with non-inductive current fractions above 65% while achieving T and N values of 16% and 5.7 (%mT/MA), respectively. Newly available Motional Stark Effect data has allowed systematic study and validation of current drive sources and improved the understanding of hybrid-like scenarios. In MHD research, six mid-plane ex-vessel radial field coils have been utilized to infer and correct intrinsic error fields, provide rotation control, and actively stabilize the n=1 resistive wall mode at ITER-relevant low plasma rotation values. In transport and turbulence, the low aspect ratio and wide range of achievable in NSTX provide unique data for confinement scaling studies. A new high-k scattering diagnostic is investigating turbulent density fluctuations with wave numbers extending from ion to electron gyro-scales. In the area of energetic particle research, cyclic neutron rate drops have been associated with the destabilization of multiple large Toroidal Alfvén Eigenmodes (TAEs) similar to the sea-of-TAE modes predicted for ITER. Three wave coupling processes between energetic particle modes and TAEs have also been observed for the first time. In boundary physics, advanced shape control has been utilized to study the role of magnetic balance in H-mode access and ELM stability. Peak divertor heat flux has been reduced by a factor of 5 using an H-mode compatible radiative divertor, and Lithium conditioning has demonstrated particle pumping and improved thermal confinement. Finally, non-solenoidal plasma start-up research is particularly important for the ST, and Coaxial Helicity Injection has now produced 160kA plasma currents on closed magnetic flux surfaces.

NTIS

*Toruses; Operating Systems (Computers)*

**20070029347** Lawrence Livermore National Lab., Livermore, CA USA

**Global Local Dynamic Models**

Pfeffer, A.; Das, S.; Lawless, D.; Ng, B.; Oct. 12, 2006; 8 pp.; In English

Report No.(s): DE2007-900155; UCRL-CONF-225258; No Copyright; Avail.: Department of Energy Information Bridge

Many dynamic systems involve a number of entities that are largely independent of each other but interact with each other via a subset of state variables. We present global/local dynamic models (GLDMs) to capture these kinds of systems. In a GLDM, the state of an entity is decomposed into a globally influenced state that depends on other entities, and a locally influenced state that depends only on the entity itself. We present an inference algorithm for GLDMs called global/local particle filtering, that introduces the principle of reasoning globally about global dynamics and locally about local dynamics. We have applied GLDMs to an asymmetric urban warfare environment, in which enemy units form teams to attack important targets, and the task is to detect such teams as they form. Experimental results for this application show that global/local particle filtering outperforms ordinary particle filtering and factored particle filtering.

NTIS

*Dynamic Models; Dynamical Systems; Independent Variables*

**20070029350** Lawrence Livermore National Lab., Livermore, CA USA

**Ultra Fast Coherent Diffraction Imaging of Single Particles, Clusters and Biomolecules**

Hajdu, J.; Chapman, H.; Oct. 07, 2006; 42 pp.; In English

Report No.(s): DE2007-900146; UCRL-TR-225072; No Copyright; Avail.: National Technical Information Service (NTIS)

Theoretical studies and simulations predict that with a very short and very intense coherent X-ray pulse a single diffraction pattern may be recorded from a large macromolecule, a virus, or a cell without the need for crystalline periodicity (Neutze et al., 2000; Jurek et al., 2004; Hau-Riege, 2004 et al.; Bergh et al., 2004). Measurement of the over-sampled X-ray diffraction pattern permits phase retrieval and hence structure determination (Bates, 1982; Fienup, 1982; Sayre et al., 1998; Miao et al., 1999; Robinson et al., 2001; Marchesini et al., 2003; Chapman, 2006). Although individual samples will be destroyed by the very intense X-ray pulse, a three-dimensional data set could be assembled when copies of a reproducible sample are exposed to the beam one by one (Huldt et al., 2003). The challenges in carrying out such an experiment requires an interdisciplinary approach, drawing upon structural biology, atomic and plasma physics, mathematics, statistics, and XFEL physics. The potential for breakthrough science in this area is great with impact not only in the biological areas but wherever structural information at or near atomic resolution on the nanoscale is valuable.

NTIS

*Biochemistry; Diffraction; Imaging Techniques; Coherent Radiation*

**20070029357** Stanford Linear Accelerator Center, Stanford, CA, USA

**AdS/CFT and QCD**

Brodsky, S. J.; de Teramond, G. F.; Feb. 2007; 9 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-899840; SLAC-PUB-12361; No Copyright; Avail.: Department of Energy Information Bridge

The AdS/CFT correspondence between string theory in AdS space and conformal field theories in physical spacetime leads to an analytic, semi-classical model for strongly-coupled QCD which has scale invariance and dimensional counting at short distances and color confinement at large distances. Although QCD is not conformally invariant, one can nevertheless use the mathematical representation of the conformal group in five-dimensional anti-de Sitter space to construct a first approximation to the theory. The AdS/CFT correspondence also provides insights into the inherently non-perturbative aspects of QCD, such as the orbital and radial spectra of hadrons and the form of hadronic wavefunctions. In particular, we show that there is an exact correspondence between the fifth-dimensional coordinate of AdS space  $z$  and a specific impact variable  $a_e$  which measures the separation of the quark and gluonic constituents within the hadron in ordinary space-time. This connection allows one to compute the analytic form of the frame-independent light-front wavefunctions, the fundamental entities which encode hadron properties and allow the computation of decay constants, form factors, and other exclusive scattering amplitudes. New relativistic lightfront equations in ordinary space-time are found which reproduce the results obtained using the 5-dimensional theory. The effective light-front equations possess remarkable algebraic structures and integrability properties. Since they are complete and orthonormal, the AdS/CFT model wavefunctions can also be used as a basis for the diagonalization of the full light-front QCD Hamiltonian, thus systematically improving the AdS/CFT approximation.

NTIS

*Baryons; Hadrons; Quantum Chromodynamics; String Theory*

**20070029364** Lawrence Livermore National Lab., Livermore, CA USA

**Summary of LLNL Russian Projects**

Schilling, O.; Jan. 22, 2007; 24 pp.; In English

Report No.(s): DE2007-902309; UCRL-TR-227384; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this project is to develop and demonstrate more efficient methods for solving radiation transport equations using adaptivity in angle variables. Conventional angular discretization methods require that the angular finite-difference grid be fine enough in any region. If the grid is too coarse, the well-known ray effects appear. In addition, subdomains appear with a highly anisotropic particle flux distribution over directions (where a very fine angular difference grid must be used), as well as subdomains where the distribution is nearly isotropic. In view of this, a promising approach to multi-dimensional transport solution efficiency enhancement using finite-difference approximations is one employing adaptive grids. Such adaptive methods are expected to resolve the ray effect problem in a cost-efficient manner. The algorithm for solving the radiation transport equation using an angle-adaptive method with dynamic criteria for constructing the grid was evaluated using a set of benchmark test problems (pipe, slit, vacuum, and spherical).

NTIS

*Radiation Transport; Computational Grids; Finite Difference Theory; Flux (Rate)*

**20070029377** Lawrence Livermore National Lab., Livermore, CA USA

**Feasibility of Measuring  $^3\text{He}$  Bubble Diameter Populations in Deuterium-Tritium Ice Layers Using Mie Scattering**

Izumi, N.; Feb. 01, 2007; 18 pp.; In English

Report No.(s): DE2007-902305; UCRL-TR-227651; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report, the author assesses the feasibility of using Mie scattering to quantify the diameter distribution of  $^3\text{He}$  bubbles in DT ice layers. Mie scattering methods are often used for diameter measurements of particulates in emulsions like pigments and ink products. This suggests that similar techniques could be used to measure the distribution of  $^3\text{He}$  bubbles in DT ice layers, which is important for NIF ICF capsules. To investigate the achievable performance of bubble diameter measurements using Mie scattering, he performed numerical modeling using exact analytical expressions. Mie scattering is light scattering by spherical particulates which have different refractive indices than their surrounding medium. Mie's theoretical model of this problem applies to diffraction by any number of spheres that are all of the same diameter and composition, provided they are randomly distributed and separated from each other by distances that are large compared to the light scattering wavelength.

NTIS

*Bubbles; Deuterium; Helium; Ice; Mie Scattering; Tritium*

**20070029378** Lawrence Livermore National Lab., Livermore, CA USA

**Ultrafast, In Situ Probing of Shocked Solids at the Mesoscale and Beyond: a New Paradigm for Materials Dynamics**

Lorenzana, H.; Belak, J.; Campbell, G.; King, W.; Nikkel, D.; Feb. 22, 2007; 10 pp.; In English

Report No.(s): DE2007-902303; UCRL-TR-228191; No Copyright; Avail.: National Technical Information Service (NTIS)

Understanding material response under dynamic conditions and extreme pressures at the lattice level is important for being able to generate predictive models of material response. Despite many decades of study, material behavior is primarily inferred from bulk measurements on dynamically loaded samples or the microstructure from recovery experiments and not determined from lattice level measurements made in-situ at the relevant length scale of the governing physics. In the work described here, we report on progress made in advancing this frontier with research conducted under LDRD 04-ERD-071. Specifically, we present advances in, and applications of, dynamic x-ray diffraction, Extended X-ray Absorption Fine Structure and dynamic transmission electron microscopy.

NTIS

*Mesoscale Phenomena; Solids*

**20070029381** Lawrence Livermore National Lab., Livermore, CA USA

**Gas Detector LCLS Engineering Specifications Document**

Hau-Riege, S.; Pax, P.; Feb. 16, 2007; 14 pp.; In English

Report No.(s): DE2007-902298; UCRL-TR-228121; No Copyright; Avail.: National Technical Information Service (NTIS)

There are two Gas Detectors, located upstream and downstream of the FEL attenuation materials, which provide a non-intrusive measure of the FEL pulse energy in the fundamental, in real-time, on a pulse-by-pulse basis. The FEL operators and the users will use this information to monitor the performance of the FEL and the Attenuator and to cross-calibrate other

detectors. The Gas Detectors measure the FEL pulse energy by measuring the fluorescence induced in a small volume of N<sub>2</sub> gas by the passage of the FEL.

NTIS

*Coherent Light; Free Electron Lasers; Gas Detectors; Light Sources; Linear Accelerators*

**20070029389** Orrick, Herrington and Sutcliffe, LLP, Irvine, CA, USA; California Univ., Berkeley, CA, USA

**Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma**

Rostoker, N., Inventor; Binderbauer, M., Inventor; Qerushi, A., Inventor; Tahsiri, H., Inventor; 11 Mar 04; 41 pp.; In English  
Contract(s)/Grant(s): N00014-99-1-0857

Patent Info.: Filed Filed 11 Mar 04; US-Patent-Appl-SN-10-799 530

Report No.(s): PB2007-104641; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system and method for containing plasma and forming a Field Reversed Configuration (FRC) magnetic topology are described in which plasma ions are contained magnetically in stable, non-adiabatic orbits in the FRC. Further, the electrons are contained electrostatically in a deep energy well, created by tuning an externally applied magnetic field. The simultaneous electrostatic confinement of electrons and magnetic confinement of ions avoids anomalous transport and facilitates classical containment of both electrons and ions. In this configuration, ions and electrons may have adequate density and temperature so that upon collisions they are fused together by nuclear force, thus releasing fusion energy. Moreover, the fusion fuel plasmas that can be used with the present confinement system and method are not limited to neutronic fuels only, but also advantageously include advanced fuels.

NTIS

*Confinement; Electrostatics; Plasma Control; Plasmas (Physics)*

**20070029392** Stanford Linear Accelerator Center, Stanford, CA, USA

**Conformal Template and New Perspectives for Quantum Chromodynamics**

Brodsky, S. J.; Mar. 01, 2007; 19 pp.; In English

Report No.(s): DE2007-900589; SLAC-PUB-12381; No Copyright; Avail.: Department of Energy Information Bridge

Conformal symmetry provides a systematic approximation to QCD in both its perturbative and nonperturbative domains. One can use the AdS/CFT correspondence between Anti-de Sitter space and conformal gauge theories to obtain an analytically tractable approximation to QCD in the regime where the QCD coupling is large and constant. For example, there is an exact correspondence between the fifth-dimensional coordinate of AdS space and a specific impact variable which measures the separation of the quark constituents within the hadron in ordinary space-time. This connection allows one to compute the analytic form of the frame-independent light-front wave functions of mesons and baryons, the fundamental entities which encode hadron properties and allow the computation of exclusive scattering amplitudes. One can also use conformal symmetry as a template for perturbative QCD predictions where the effects of the nonzero beta function can be systematically included in the scale of the QCD coupling. This leads to fixing of the renormalization scale and commensurate scale relations which relate observables without scale or scheme ambiguity. The results are consistent with the renormalization group and the analytic connection of QCD to Abelian theory at  $N(c) \rightarrow 0$ .

NTIS

*Quantum Chromodynamics; Templates*

**20070029397** Lawrence Livermore National Lab., Livermore, CA USA

**Test Suite for Nuclear Data I. Deterministic Calculations for Critical Assemblies and Replacement Coefficients**

Pruet, J.; Brown, D. A.; Descalle, M. A.; May 23, 2006; 90 pp.; In English

Report No.(s): DE2007-900468; UCRL-TR-221568; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors describe tools developed by the Computational Nuclear Physics group for testing the quality of internally developed nuclear data and the fidelity of translations from ENDF formatted data to ENDL formatted data used by Livermore. These tests include S(n) calculations for the effective k value characterizing critical assemblies and for replacement coefficients of different materials embedded in the Godiva and Jezebel critical assemblies. For those assemblies and replacement materials for which reliable experimental information is available, these calculations provide an integral check on the quality of data. Because members of the ENDF and reactor communities use calculations for these same assemblies in their validation process, a comparison between their results with ENDF formatted data and our results with data translated into the ENDL format provides a strong check on the accuracy of translations. As a first application of the test suite we present

a study comparing ENDL 99 and ENDF/B-V. They also consider the quality of the ENDF/B-V translation previously done by the Computational Nuclear Physics group. No significant errors are found.

NTIS

*Coefficients; Data Acquisition; Replacing; Nuclear Physics*

**20070029400** Lawrence Livermore National Lab., Livermore, CA USA

**Materials and Fabrication Issues for Large Machined Germanium Immersion Gratings**

Kuzmenko, P. J.; Davis, P. J.; Little, S. L.; Hale, L. C.; May 23, 2006; 16 pp.; In English

Report No.(s): DE2007-900461; UCRL-CONF-221559; No Copyright; Avail.: National Technical Information Service (NTIS)

LLNL has successfully fabricated small (1.5 cm<sup>2</sup> area) germanium immersion gratings. We studied the feasibility of producing a large germanium immersion grating by means of single point diamond flycutting. Our baseline design is a 63.4(sup o) blaze echelle with a 6 cm beam diameter. Birefringence and refractive index inhomogeneity due to stresses produced by the crystal growth process are of concern. Careful selection of the grating blank and possibly additional annealing to relieve stress will be required. The Large Optics Diamond Turning Machine (LODTM) at LLNL is a good choice for the fabrication. It can handle parts up to 1.5 meter in diameter and 0.5 meter in length and is capable of a surface figure accuracy of better than 28 nm rms. We will describe the machine modifications and the machining process for a large grating. A next generation machine, the Precision Optical Grinder and Lathe (POGAL), currently under development has tighter specifications and could produce large gratings with higher precision.

NTIS

*Fabrication; Germanium; Submerging*

**20070029402** Lawrence Livermore National Lab., Livermore, CA USA

**Summary Report--FY2006 ITER Work Accomplished**

Martovetsky, N. N.; Apr. 11, 2006; 89 pp.; In English

Report No.(s): DE2007-900453; UCRL-TR-220518; No Copyright; Avail.: National Technical Information Service (NTIS)

Six parties (EU, Japan, Russia, US, Korea, China) will build International Thermonuclear Experimental Reactor (ITER). The U.S. proposed to deliver at least 4 out of 7 modules of the Central Solenoid. Phillip Michael (MIT) and the author were tasked by DoE to assist ITER in development of the ITER CS and other magnet systems. They work to help Magnets and Structure division headed by Neil Mitchell. During this visit the author worked on the selected items of the CS design and carried out other small tasks, like PF temperature margin assessment.

NTIS

*Fusion Reactors; Solenoids; Superconducting Magnets; Thermonuclear Reactions; Tokamak Devices*

**20070029403** Lawrence Livermore National Lab., Livermore, CA USA

**Science & Technology Review January/February 2007**

Radousky, H. B.; Dec. 01, 2006; 28 pp.; In English

Report No.(s): DE2007-900450; UCRL-TR-52000-07-1/2; No Copyright; Avail.: National Technical Information Service (NTIS)

Contents: Features: Another Step for High-Energy-Density science and Teller's Legacy; Titan Leads the Way in Laser--Matter Science; Identifying the Source of Stolen Nuclear Materials; Research Highlights: Tiny Tubes Make the Flow Go, and Acidic Microbe Community Fosters the Unique; Departments: The Laboratory in the News; Patents and Awards; and Abstracts.

NTIS

*High Energy Interactions; Science; Technologies*

**20070029404** Lawrence Livermore National Lab., Livermore, CA USA

**Flash X-ray (FXR) Linear Induction Accelerator(LIA) Optimization Upgrade of the OTR Emittance Diagnostic**

Houck, T. L.; Wargo, P. E.; Dec. 21, 2006; 17 pp.; In English

Report No.(s): DE2007-900448; UCRL-TR-226954; No Copyright; Avail.: National Technical Information Service (NTIS)

Knowing the electron beam parameters at the exit of an accelerator is critical for several reasons. Foremost is to optimize the application of the beam, which is flash radiography in the case of the FXR accelerator. The beam parameters not only determine the theoretical dose, x-ray spectrum, and radiograph resolution (spot size), they are required to calculate the final

transport magnetic fields that focus the beam on the bremsstrahlung converter to achieve the theoretical limits. Equally important is the comparison of beam parameters to the design specifications. This comparison indicates the health of the accelerator, warning the operator when systems are deteriorating or failing. For an accelerator of the size and complexity of FXR, a large suite of diagnostics is normally employed to measure and/or infer beam parameters. These diagnostics are distributed throughout the accelerator and can require a large number of shots (measurements) to calculate a specific beam parameter. The OTR Emittance Diagnostic, however, has the potential to measure all but one of the beam parameters simultaneous at a specific location. Using measurements from a scan of a few shots, this final parameter can also be determined. Since first deployment, the OTR Emittance Diagnostic has been limited to measuring only one of the seven desired parameters, the beam's divergence. This report describes recent upgrades to the diagnostic that permit full realization of its potential.

NTIS

*Emittance; Linear Accelerators; Radiography; X Rays*

**20070029413** Fermi National Accelerator Lab., Batavia, IL, USA; Freiburg Univ., Germany

**SUSY Multilepton Signatures at Tevatron**

Titov, M.; January 2006; 13 pp.; In English

Report No.(s): DE2007-900831; FERMILAB-CONF-07-041-E; No Copyright; Avail.: National Technical Information Service (NTIS)

One of the most striking signature of supersymmetric models with electroweak symmetry breaking is the presence of multilepton event topologies in the decay products. In this paper searches are presented for physics beyond the Standard Model (SM) in final states containing charged leptons from proton-antiproton collision data at a center-of-mass energy of 1.96 TeV, collected with Run II CDF and DO Detectors in 2002-2006, and corresponding to integrated luminosities of up to 1.1 fb<sup>-1</sup>. In any of the searches no excess of candidates was observed with respect to the SM predictions and limits on masses and production cross-sections are set at the 95% CL.

NTIS

*Leptons; Particle Accelerators; Proton-Antiproton Interactions; Signatures*

**20070029415** Fermi National Accelerator Lab., Batavia, IL, USA; Carnegie-Mellon Univ., Pittsburgh, PA USA

**Spectroscopy and Decay of B Hadrons at the Tevatron**

Paulini, M.; January 2006; 22 pp.; In English

Report No.(s): DE2007-900829; FERMILAB-CONF-07-051-E; No Copyright; Avail.: National Technical Information Service (NTIS)

This document presents information on the spectroscopy and decay of B hadrons at the Tevatron.

NTIS

*Hadrons; Particle Accelerators; Spectroscopy*

**20070029416** Purdue Univ., West Lafayette, IN USA

**Search for Chargino and Neutralino at Run II of the Tevatron Collider**

Canepa, A.; Aug. 2006; 186 pp.; In English

Report No.(s): DE2007-900820; No Copyright; Avail.: National Technical Information Service (NTIS)

In this dissertation we present a search for the associated production of charginos and neutralinos, the supersymmetric partners of the Standard Model bosons. We analyze a data sample representing 745 pb<sup>-1</sup> of integrated luminosity collected by the CDF experiment at the pp Tevatron collider. We compare the Standard Model predictions with the observed data selecting events with three leptons and missing transverse energy. Finding no excess, we combine the results of our search with similar analyses carried out at CDF and set an upper limit on the chargino mass in SUSY scenarios.

NTIS

*Particle Accelerators; Bosons; Supersymmetry*

**20070029418** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA; State Univ. of New York, Stony Brook, NY, USA

**New Strategic Plan Takes the ALS into the Future**

Kirz, J.; Chemla, D. S.; Feinberg, B.; Hussain, Z.; Krebs, G. F.; January 2007; 4 pp.; In English

Report No.(s): DE2007-900657; No Copyright; Avail.: Department of Energy Information Bridge

A new strategic plan is in place to upgrade the ALS so it can continue to address fundamental questions, such as

size-dependent and dimensional-confinement phenomena at the nanoscale; correlation and complexity in physical, biological, and environmental systems; and temporal evolution, assembly, dynamics and ultrafast phenomena. Moreover, the growing number of ALS users (now exceeding 2,000 per year) requires increased attention. Accordingly, our plan concentrates on projects that will continue to make it possible for ALS users to address grand scientific and technological challenges with incisive world-class tools and quality user support. Our highest priority is to begin top-off operation, in which electrons are injected into the storage ring at intervals of approximately 1 minute. The combination of top-off and concurrent development of small-gap in-vacuum undulators and superconducting undulators will allow an increase in brightness from eight to more than 100 times, depending on the specific undulators and photon energy range. As part of our core mission in the VUV and soft x-ray regions, we plan to exploit these accelerator developments to extend our capabilities for high spatial and temporal resolution and utilize the remarkable coherence properties of the ALS in a new generation of beamlines. Ranked by priority, several proposed beamlines will follow completion of five new beamlines already under construction or funded. The intellectual excitement of the ALS has been a powerful tool in the recruitment and retention of outstanding staff, but additional sustained efforts are required to increase diversity both in gender and in underrepresented groups. To this end, we intend to expand the ALS Doctoral Fellowship Program by giving special emphasis to underrepresented groups.

NTIS

*Light Sources; Superconductivity; High Resolution; Brightness*

**20070029426** Stanford Linear Accelerator Center, CA, USA; Edinburgh Univ., UK

#### **Charmless B Decays**

Gratl, W.; Jan. 2007; 11 pp.; In English

Report No.(s): DE2007-900602; SLAC-PUB-12300; No Copyright; Avail.: Department of Energy Information Bridge

Rare charmless hadronic B decays are a good testing ground for the standard model. The dominant amplitudes contributing to this class of B decays are CKM suppressed tree diagrams and  $b \rightarrow s$  or  $b \rightarrow d$  loop diagrams (penguins). These decays can be used to study interfering standard model (SM) amplitudes and CP violation. They are sensitive to the presence of new particles in the loops, and they provide valuable information to constrain theoretical models of B decays.

NTIS

*Hadrons; CP Violation; Particle Decay*

**20070029428** Science Applications International Corp., San Diego, CA, USA

#### **Overview of the Pulse Line Ion Accelerator**

Briggs, R. J.; Bieniosek, F. M.; Coleman, J. E.; Eylon, S.; Henestroza, E.; Jun. 2006; 4 pp.; In English

Report No.(s): DE2007-900655; No Copyright; Avail.: National Technical Information Service (NTIS)

An overview of the Pulse Line Ion Accelerator (PLIA) concept and its development is presented. In the PLIA concept a pulse power driver applied to one end of a helical pulse line creates a traveling wave pulse that accelerates and axially confines a heavy ion beam pulse. The motivation for its development at the IFE-VNL is the acceleration of intense, short pulse, heavy ion beams to regimes of interest for studies of High Energy Density Physics and Warm Dense Matter. Acceleration scenarios with constant parameter helical lines are described which result in output energies of a single stage much larger than the several hundred kilovolt peak voltages on the line, with a goal of 3-5 MeV/meter acceleration gradients. The main attraction of the concept is the very low cost it promises. It might be described crudely as an air core induction linac where the pulse-forming network is integrated into the beam line so the accelerating voltage pulse can move along with the ions to get voltage multiplication.

NTIS

*Ion Accelerators; High Energy Interactions*

**20070029429** Argonne National Lab., IL USA; Stanford Linear Accelerator Center, CA, USA

#### **X-Ray Absorption Edge Detector for High-Resolution Measurement of Undulator Effective K-Parameter**

Yang, B.; Galayda, J. N.; January 2006; 9 pp.; In English

Report No.(s): DE2007-900613; SLAC-PUB-12352; No Copyright; Avail.: National Technical Information Service (NTIS)

The spectrum of angle-integrated undulator radiation displays a sharp edge at every harmonic photon energy. A technique utilizing this feature to measure minute changes in K-parameters of an undulator in a free-electron laser has been proposed. To date, this technique requires the use of crystal monochromators as bandpass filters whose energy centroid depends on the incident angle of the x-ray beam. In this work we propose to use the absorption edge of an appropriate element as an energy-selective detector whose response is truly independent of the angle of the x-ray beam, and hence independent of



electron beam direction and emittance. We will discuss the basic design concept of the detection system and illustrate its projected performance with computer simulations.

NTIS

*High Resolution; X Ray Absorption*

**20070029430** Universita degli Studi La Sapienza, Rome, Italy; Stanford Linear Accelerator Center, CA, USA  
**Measurements of CP-Violating Asymmetries in  $B^0$  to  $a_1^{+-}(1260)$   $\pi^{\pm}$  Decays**

Palombo, F.; Mar. 01, 2007; 6 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-900598; SLAC-PUB-12357; No Copyright; Avail.: National Technical Information Service (NTIS)

This document presents measurements on CP-violating asymmetries in the decays.

NTIS

*Asymmetry; Invariance; CP Violation*

**20070029431** Stanford Linear Accelerator Center, CA, USA; British Columbia Univ., Vancouver, British Columbia, Canada  
**Radiative Penguin Decays at the B Factories**

Cuhadar-Doenzelmann, T.; Mar. 2007; 1 pp.; In English

Report No.(s): DE2007-900612; SLAC-PUB-12384; No Copyright; Avail.: National Technical Information Service (NTIS)

Such rare decays, pioneered by CLEO, are brought to a more mature state by the B-Factories. The results shown here are based on one-fourth to one-half of the total integrated luminosity. Both theoretical and experimental updates will further constraint physics beyond the Standard Model (SM).

NTIS

*Industrial Plants; Leptons*

**20070029432** Fermi National Accelerator Lab., Batavia, IL, USA; Texas Univ., Austin, TX, USA

**Long Baseline Neutrino Physics in the U.S**

Kopp, S. E.; January 2006; 6 pp.; In English

Contract(s)/Grant(s): DE-FG03-93ER40757

Report No.(s): DE2007-900837; FERMILAB-CONF-06-465; No Copyright; Avail.: National Technical Information Service (NTIS)

Long baseline neutrino oscillation physics in the U.S. is centered at the Fermi National Accelerator Laboratory (FNAL), in particular at the Neutrinos at the Main Injector (NuMI) beamline commissioned in 2004-2005. Already, the MINOS experiment has published its first results confirming the disappearance of neutrinos across a 735 km baseline. The forthcoming NO $\nu$ A experiment will search for the transition and use this transition to understand the mass hierarchy of neutrinos. These, as well as other conceptual ideas for future experiments using the NuMI beam, will be discussed. The turn-on of the NuMI facility has been positive, with over 310 kW beam power achieved. Plans for increasing the beam intensity once the Main Injector accelerator is fully-dedicated to the neutrino program will be presented.

NTIS

*Neutrinos; Oscillations*

**20070029434** Stanford Linear Accelerator Center, CA, USA

**e-/e+ Accelerating Structure with Cyclic Variation of Azimuth Asymmetry**

Krasnykh, A.; Jan. 2007; 3 pp.; In English

Report No.(s): DE2007-900611; SLAC-PUB-12275; No Copyright; Avail.: National Technical Information Service (NTIS)

A classical electron/positron accelerating structure is a disk-loaded cylindrical waveguide. The accelerator structure here has azimuth symmetry. The proposed structure contains a disk-loaded cylindrical waveguide where there is a periodical change of RF-field vs. azimuth. The modulation deforms the rf-field in such a manner that the accelerated particles undergo transverse focusing forces. The new class of accelerator structures covers the initial part of e+/e- linacs where a bunch is not rigid and additional transverse focusing fields are necessary. We discuss a bunch formation with a high transverse aspect ratio in the proposed structure and particularly in the photoinjector part of a linac.

NTIS

*Asymmetry; Azimuth; Electrons*

**20070029436** Stanford Linear Accelerator Center, CA, USA

**Employment of Second Order Ruled Surfaces in Design of Sheet Beam Guns**

Krasnykh, A.; Jan. 2007; 3 pp.; In English

Report No.(s): DE2007-900610; SLAC-PUB-12277; No Copyright; Avail.: National Technical Information Service (NTIS)

A novel 3D method of sheet beam gun design has recently been developed. Second order ruled surfaces (SORS) can be used to define the geometry of the gun electrodes. The gun design process is made simpler if SORS are derived from analytical formulas. A proposed method is discussed and illustrated.

NTIS

*Electron Beams; Electron Guns; Accelerators*

**20070029438** Stanford Linear Accelerator Center, CA, USA

**Coreless Approaches for On/Off Marx Type Modulators**

Krasnykh, A.; Jan. 2007; 3 pp.; In English

Report No.(s): DE2007-900609; SLAC/PUB-12278; No Copyright; Avail.: National Technical Information Service (NTIS)

SLAC was first to report using ON/OFF switches in Marx type modulator. The development of Marx type modulator was bounded with the NLC need. The high energy physics runs based on the ILC concept where longer modulator pulse width is required. The SLAC idea of coreless modulators was useful for other applications (medicine, military, home security, etc.). The discussed conception is presented as a continuation of the earlier published articles. Several types of the Marx ON/OFF type modulators are under consideration. This article describes the new coreless approach, based on the solid state ON/OFF Marx's topology. An AC high voltage network feeds individual Marx's cells through the inductive and diode assemblies. Further integration of the ON/OFF Marx type modulator and its power supply is proposed. Two topologies are under consideration. The first scheme is an integration of DC/DC converters with ON/OFF Marx. The second topology is based on the usage of AC network directly with ON/OFF Marx scheme.

NTIS

*Modulators; Switching Circuits; Accelerators*

**20070029440** Stanford Linear Accelerator Center, CA, USA

**Topology of On/Off Marx Modulator with Protection of Load and Solid State Switches**

Krasnykh, A.; Jan. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-900608; SLAC-PUB-12279; No Copyright; Avail.: National Technical Information Service (NTIS)

This article discusses a proposal for an ultra fast feedback response that will protect the load and solid state switches of the ON/OFF Marx type modulators. The feedback guards main elements of a modulator against possible arcs in the load, particularly arcs inside of the electron guns. The chief concept behind the proposed response system is an employment of a fraction of the output modulator power as a controlling and guarding pulse during the delivery time. The time constant of the proposed feedback loop lies in the nanosecond range. Peculiarities of proposed topology are discussed.

NTIS

*Loads (Forces); Modulators; Protection; Solid State; Switches; Topology*

**20070029441** Stanford Linear Accelerator Center, CA, USA

**Constraints on Meta-Stable de Sitter Flux Vacua**

Soroush, M.; Feb. 2007; 22 pp.; In English

Report No.(s): DE2007-900605; SLAC-PUB-12367; No Copyright; Avail.: Department of Energy Information Bridge

We consider flux compactification of type IIB string theory as the orientifold limit of an F-theory on a Calabi-Yau fourfold. We show that when supersymmetry is dominantly broken by the axion-dilaton and the contributions of the F-terms associated with complex structure moduli are small, the Hessian of the flux potential always has tachyonic modes for de Sitter vacua. This implies that there exist no meta-stable de Sitter vacua in this limit. Moreover, we find that the stability requirement imposes a relation between the values of cosmological constant and the scale of supersymmetry breaking for non-supersymmetric anti de Sitter vacua in this limit. The proof is general and does not rely on the details of the geometry of the compact Calabi-Yau internal space. We finally analyze the consequences of these constraints on the statistics of meta-stable de Sitter vacua and address some other related issues.

NTIS

*Vacuum; Proving; String Theory; Supersymmetry; Tachyons*

**20070029443** Stanford Linear Accelerator Center, CA, USA

**Emittance Correction in the 2006 ILC Bunch Compressor**

Tenenbaum, P.; Feb. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-900604; SLAC-TN-07-004; No Copyright; Avail.: Department of Energy Information Bridge

A recent study (1) has indicated substantial potential emittance growth in the ILC bunch compressor due to quad misalignments, BPM misalignments, and pitches in the RF cavities. Table 1 summarizes several results from (1). In this simulation, quad misalignments and cavity pitches are Gaussian distributed and are considered with respect to the nominal survey line; BPM misalignments are also Gaussian-distributed but are considered with respect to the quadrupole axis. It is assumed that the BPM offsets with respect to the quads are found in a previous quad-shunting BBA step which is not simulated.

NTIS

*Bunching; Compressors; Emittance*

**20070029446** Lawrence Livermore National Lab., Livermore, CA USA

**Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash**

Luu, T.; Bilotto, P.; Church, J.; Descalle, M. A.; Hall, J.; Jan. 26, 2007; 61 pp.; In English

Report No.(s): DE2007-900435; UCRL-TR-227515; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of any alarm algorithm should be that it provide the necessary tools to derive confidence limits on whether the existence of fissile materials is present in cargo containers. It should be able to extract these limits from (usually) noisy and/or weak data while maintaining a false alarm rate (FAR) that is economically suitable for port operations. It should also be able to perform its analysis within a reasonably short amount of time (i.e. seconds). To achieve this, it is essential that the algorithm be able to identify and subtract any interference signature that might otherwise be confused with a fissile signature. Lastly, the algorithm itself should be user-intuitive and user-friendly so that port operators with little or no experience with detection algorithms may use it with relative ease. In support of the Nuclear Car Wash project at Lawrence Livermore Laboratory, we have developed an alarm algorithm that satisfies the above requirements. The description of the this alarm algorithm, dubbed ALARMA, is the purpose of this technical report.

NTIS

*Algorithms; Fissionable Materials; Warning Systems*

**20070029450** Sandia National Labs., Albuquerque, NM USA

**Chiral Multichromic Single Crystals for Optical Devices**

Kemp, R. A.; Fleix, A. M.; Dec. 01, 2006; 22 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): DE2007-900406; SAND2006-7904; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes our findings during the study of a novel system that yields multicolored materials as products. This system is quite unusual as it leads to multi-chromic behavior in single crystals, where one would expect that only a single color would exist. We have speculated that these novel solids might play a role in materials applications such as non-linear optics, liquid crystal displays, piezoelectric devices, and other similar applications. The system examined consisted of a main-group alkyl compound (a p block element such as gallium or aluminum) complexed with various organic di-imines. The di-imines had substituents of two types either alkyl or aromatic groups attached to the nitrogen atoms. We observed that single crystals, characterized by X-ray crystallography, were obtained in most cases. Our research during January-July, 2006, was geared towards understanding the factors leading to the multichromic nature of the complexes. The main possibilities put forth initially considered (a) the chiral nature of the main group metal, (b) possible reduction of the metal to a lower-valent, radical state, (c) the nature of the ligand(s) attached to the main group metal, and (d) possible degradation products of the ligand leading to highly-colored products.

NTIS

*Chirality; Crystals; Electro-Optics; Optical Equipment; Single Crystals*

**20070029493** Stanford Linear Accelerator Center, CA, USA

**Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings**

Rivetta, C.; Mastorides, T.; Fox, J. D.; Teytelman, D.; Van Winkle, D.; Feb. 2007; 4 pp.; In English

Report No.(s): DE2007-900593; SLAC-PUB-12375; No Copyright; Avail.: National Technical Information Service (NTIS)

A time domain modeling and simulation tool for beam-cavity interactions in LER and HER rings at PEP II are presented.

The motivation for this tool is to explore the stability margins and performance limits of PEP II RF systems at higher currents and upgraded RF configurations. It also serves as test bed for new control algorithms and can define the ultimate limits of the architecture. The time domain program captures the dynamical behavior of the beam-cavity interaction based on a reduced model. The ring current is represented by macro-bunches. Multiple RF station in the ring are represented via one or two macro-cavities. Each macro-cavity captures the overall behavior of all the 2 or 4 cavity RF station. Station models include nonlinear elements in the klystron and signal processing. This allows modeling the principal longitudinal impedance control loops interacting with the longitudinal beam model. Validation of simulation tool is in progress by comparing the measured growth rates for both LER and HER rings with simulation results. The simulated behavior of both machines at high currents are presented comparing different control strategies and the effect of non-linear klystrons in the growth rates.

NTIS

*Simulation; Storage Rings (Particle Accelerators); Models; Longitudinal Control*

**20070029495** Y-12 National Security Complex, Oak Ridge, TN, USA

**Far Field Approximation in the Generalized Geometry Holdup (GGH) Model**

Oberer, R. B.; Gunn, C. A.; Chiang, L. G.; Sep. 07, 2006; 13 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22800

Report No.(s): DE2007-900342; Y/DK-2176 R1; No Copyright; Avail.: National Technical Information Service (NTIS)

Quantitative gamma spectrometry measurements of uranium frequently require corrections for attenuation by an equipment or container layer and by the uranium bearing material itself. It is common to correct for attenuation using the far-field approximation. Under this approximation, the minimum thickness of equipment or material is used for the correction rather than an average thickness over the detector field-of-view. In reality this aspect of the far-field approximation is really a narrow field-of-view approximation. The price of this simplification is the introduction of a bias. This bias will be investigated in this paper. In addition, there is a distance dependence of the radial response of a detector. This dependence will also be investigated.

NTIS

*Descriptive Geometry; Far Fields; Uranium*

**20070029496** Y-12 National Security Complex, Oak Ridge, TN, USA

**Self Attenuation Correction for Holdup Measurements. An Historical Perspective**

Oberer, R. B.; Gunn, C. A.; Chiang, L. G.; Jul. 12, 2006; 15 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR228000

Report No.(s): DE2007-900340; Y/DK-2187; No Copyright; Avail.: Department of Energy Information Bridge

Self attenuation has historically caused both conceptual as well as measurement problems. The purpose of this paper is to eliminate some of the historical confusion by reviewing the mathematical basis and by comparing several methods of correcting for self attenuation focusing on transmission as a central concept.

NTIS

*Gamma Rays; Histories; Attenuation*

**20070029499** Boston Univ., Boston, MA, USA; Utah Univ., Salt Lake City, UT, USA; Columbia Univ., New York, NY, USA; Fermi National Accelerator Lab., Batavia, IL, USA

**National Software Infrastructure for Lattice Quantum Chromodynamics**

Brower, R. C.; DeTar, C. E.; Edwards, R. G.; Holmgren, D. J.; Mawhinney, R. D.; Jun. 01, 2006; 5 pp.; In English

Contract(s)/Grant(s): DE-AC05-84ER40150

Report No.(s): DE2007-900270; JLAB-THY-06-610; DOE/ER/40150-4237; No Copyright; Avail.: Department of Energy Information Bridge

Quantum chromodynamics (QCD) is the widely accepted theory of the strong interactions of quarks and gluons. Only through large scale numerical simulation has it been possible to work out the predictions of this theory for a vast range of phenomena relevant to the US Department of Energy experimental program. Such simulations are essential to support the discovery of new phenomena and more fundamental interactions. With support from SciDAC the USQCD collaboration has developed software and prototyped custom computer hardware to carry out the required numerical simulations. We have developed a robust, portable data-parallel code suite. It provides a user-friendly basis for writing physics application codes for carrying out the calculations needed to predict the phenomenology of QCD. We are using this efficient and optimized code base to develop new physics application code, to improve the performance of legacy code, and to construct higher level tools,

such as QCD-specific sparse matrix solvers. We give a brief overview of the design of the data parallel API and its various components. We describe performance gains achieved in the past year. Finally, we present plans for further improvements under SciDAC-2.

NTIS

*Quantum Chromodynamics; Gluons; Quarks; Numerical Analysis*

**20070029500** Stanford Univ., CA, USA; Stanford Linear Accelerator Center, CA, USA; Colorado State Univ., Fort Collins, CO, USA

**Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel**

LePort, F.; Pocar, A.; Bartosek, L.; DeVoe, R.; Fierlinger, P.; Nov. 2006; 12 pp.; In English

Report No.(s): DE2007-900243; SLAC-PUB-12364; No Copyright; Avail.: National Technical Information Service (NTIS)

A novel technique has been developed to build vessels for liquid xenon ionization detectors entirely out of ultra-clean fluoropolymer. We describe the advantages in terms of low radioactivity contamination, provide some details of the construction techniques, and show the energy resolution achieved with a prototype all-fluoropolymer ionization detector.

NTIS

*Fluoropolymers; Ionization Chambers; Liquefied Gases; Xenon*

**20070029505** Lawrence Livermore National Lab., Livermore, CA USA

**Theory of (3He alpha) Surrogate Reactions for Deformed Uranium Nuclei**

Thompson, I.; Escher, J. E.; Nov. 09, 2006; 9 pp.; In English

Report No.(s): DE2007-900185; UCRL-TR-225984; No Copyright; Avail.: National Technical Information Service (NTIS)

We present the one-step theory of neutron-pickup transfer reactions with  $^3\text{He}$  projectiles on  $^{235}\text{U}$  and  $^{238}\text{U}$ . We find all the neutron eigenstates in a deformed potential, and use those in a given energy range for (( $^3\text{He}$ ,alpha) DWBA pickup calculations to find the spin and parity distributions of the residual target nuclei. A simple smoothing convolution is used to take into account the spreading width of the single-neutron hole states into the more complicated compound nuclear states. We assume that the initial target is an even-even rotor, but can take into account spectator neutrons outside such a rotor by recombining their spin and parity at the end of the calculations.

NTIS

*Deformation; Neutrons; Uranium*

**20070029563** Naval Research Lab., Washington, DC USA

**Interaction of Intense Electron Beams with Plasma**

Andrews, M L; Fleischmann, H H; Ury, M; Levine, L S; Vitkovitsky, I M; Apr 15, 1969; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468756; NRL-MR-2017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468756>

An exploratory experiment has been performed on the propagation of intense relativistic electron beams through an ionized medium. The beam was produced on the Cornell facility and consisted of a 50 kAmp stream of 350 keV electrons. The initial plasma was produced by a conical theta pinch gun located 1.5 m downstream of the diode and it is estimated that the initial electron density at beam injection was about  $10^{13}$  cu cm. Beam propagation was observed photographically, on an X-ray diode at the end of the tube, and on magnetic loops along the tube. Results suggest that the bulk of the beam propagates down the tube at speeds of  $1.8 \times 10^8$  m/sec. The magnetic probe signals indicate that there is appreciable counter streaming current within the plasma volume.

DTIC

*Electron Beams; Electron Density (Concentration); Plasmas (Physics)*

**20070029586** Johns Hopkins Univ., Baltimore, MD USA

**Turbulence and Complex Flow Phenomena in Multi-Stage Axial Turbomachines**

Katz, Joseph; Meneveau, Charles; May 10, 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0019

Report No.(s): AD-A468816; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468816>

The objective of this project is to measure the flow within axial turbomachines and use the data to address turbulence

modeling issues. Measurements are performed in two-stage transparent machines located in an optically index matched facility, which allows unobstructed 2-D and Stereo PIV measurements. Data provide insight on blade-wake, wake- boundary layer and wake-wake interactions. This report examines and elucidates several phenomena: i. Variations in turbulence within a wake generated by an upstream IGV blade while being ingested by a rotor passage; ii. Non-uniform turbulence production and diffusion leading to formation of turbulent hot spots within a rotor wake due to flow non-uniformities generated by upstream wakes; iii. Unsteady flow caused by an upstream wake stabilizes the boundary layer on a rotor blade and reduces its momentum thickness; iv. Comparisons of data covering an entire stage to RANS predictions; and V. Measurements of subgrid-scale stresses and dissipation rate, and comparisons to model predictions as well as associated implications of spatial averaging in followed by ensemble averaging in sustially non-uniform flows.

DTIC

*Turbomachinery; Turbulence*

**20070029590** CSA Engineering, Inc., Mountain View, CA USA

**Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft**

Rogers, Lynn; Searle, I R; Ikegami, R; Gordon, R W; Conley, D; Mar 1997; 12 pp.; In English

Report No.(s): AD-A468821; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468821>

Although high-cycle fatigue cracks in secondary structure are often termed 'nuisance cracks', they are costly to repair. Often the repairs do not last long because the repaired part still responds in a resonant fashion to the environment. Although the use of visco-elastic materials for passive damping applications is well understood there have been few applications to high-cycle fatigue problems because the design information: temperature resonant response frequency and strain levels are difficult to determine. The Damage Dosimeter and the Durability Patch are an effort to resolve these problems with the application of compact off-the-shelf electronics and a damped bonded repair patch.

DTIC

*Aircraft; Damping; Durability*

**20070029733** Florida Univ., Gainesville, FL USA

**Position Analysis of Planar Tensegrity Structures**

Bayat, Jahan B; Aug 2006; 108 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-00-1-0021

Report No.(s): AD-A468992; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468992>

Tensegrity is an abbreviation of tension and integrity. Tensegrity structures are spatial structures formed by a combination of rigid elements in compression (struts) and connecting elements that are in tension (ties). In three-dimensional tensegrity structures no pair of struts touches, and the end of each strut is connected to non-coplanar ties, which are in tension. In two-dimensional tensegrity structures, struts still do not touch. A tensegrity structure stands by itself in its equilibrium position and maintains its form solely because of the arrangement of its struts and ties. The potential energy of the system stored in the springs is at a minimum in the equilibrium position when no external force or torque is applied. A closed-form solution of a two-spring, three-spring, and fourspring planar tensegrity mechanism was developed to determine all possible equilibrium configurations when no external force or moment is applied. Here closed form means that all solution equilibrium poses will be determined, although for each case a high-degree polynomial will have to be solved numerically.

DTIC

*Planar Structures; Potential Energy; Structural Analysis; Tensegrity Structures*

**20070029932** South Carolina Univ., Columbia, SC, USA

**Implementation of the Polarized HD Target at the Thomas Jefferson National Accelerator. Reporting Period for January 1, 2002 to December 31, 2006**

Djalali, C.; Tedeschi, D.; Jan. 30, 2007; 46 pp.; In English

Contract(s)/Grant(s): DE-FG02-032ER45959

Report No.(s): DE2007-898823; No Copyright; Avail.: National Technical Information Service (NTIS)

The original goal of this proposal was to study frozen spin polarized targets (HD target and other technologies) and produce a conceptual design report for the implementation of such a target in the HALL B detector of the Thomas Jefferson National Accelerator Facility (JLab). During the first two years of the proposal, we came to the conclusion that the best suited

target for JLab was a frozen spin target and helped with the design of such a target. We have not only achieved our original goal but have exceeded it by being involved in the actual building and testing of parts the target.

NTIS

*Particle Accelerators; Targets*

**20070029933** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade**

Johnson, M. B.; McMahan, M. A.; Gimpel, T. L.; Tiffany, W. S.; Jan. 2006; 5 pp.; In English

Report No.(s): DE2007-898567; No Copyright; Avail.: Department of Energy Information Bridge

The BASE Light Ion Facility upgrades have been completed. All proton beams are now delivered to Cave 4A. New control software, a larger diameter beam window, and improved quality assurance measures have been added.

NTIS

*Ion Beams; Light Ions; Linear Accelerators; Proton Beams; Space Bases; Targets*

**20070029960** Stanford Linear Accelerator Center, CA, USA

**Design and Application of the Reconstruction Software for the BaBar Calorimeter**

Strother, P. D.; Jul. 2006; 131 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-885541; SLAC-R-828; No Copyright; Avail.: Department of Energy Information Bridge

The BaBar high energy physics experiment will be in operation at the PEP-II asymmetric  $e(\text{sup } +)e(\text{sup } -)$  collider in Spring 1999. The primary purpose of the experiment is the investigation of CP violation in the neutral B meson system. The electromagnetic calorimeter forms a central part of the experiment and new techniques are employed in data acquisition and reconstruction software to maximize the capability of this device. The use of a matched digital filter in the feature extraction in the front end electronics is presented. The performance of the filter in the presence of the expected high levels of soft photon background from the machine is evaluated. The high luminosity of the PEP-II machine and the demands on the precision of the calorimeter require reliable software that allows for increased physics capability. BaBar has selected C++ as its primary programming language and object oriented analysis and design as its coding paradigm. The application of this technology to the reconstruction software for the calorimeter is presented. The design of the systems for clustering, cluster division, track matching, particle identification and global calibration is discussed with emphasis on the provisions in the design for increased physics capability as levels of understanding of the detector increase. The CP violating channel  $B(\text{sup } 0) \rightarrow J/\psi K(\text{sub } S)(\text{sup } 0)$  has been studied in the two lepton, two  $(\pi)(\text{sup } 0)$  final state. The contribution of this channel to the evaluation of the angle  $\sin 2(\beta)$  of the unitarity triangle is compared to that from the charged pion final state. An error of 0.34 on this quantity is expected after 1 year of running at design luminosity.

NTIS

*Calorimeters; Heat Measurement; Software Engineering*

**20070029970** Stanford Linear Accelerator Center, CA, USA

**Beam Dynamics in a Spectrometer for the Polarized Positron Production Experiment**

Batygin, Y. K.; January 2005; 19 pp.; In English

Report No.(s): DE2007-881535; SLAC-PUB-11827; No Copyright; Avail.: Department of Energy Information Bridge

The proposed experiment E-166 at SLAC is designed to demonstrate the possibility of producing longitudinally polarized positrons from circularly polarized photons to be used in future Linear Collider. The experimental set-up utilizes a low emittance 50 GeV electron beam passing through a helical undulator in the Final Focus Test Beam line of the SLAC accelerator. Circularly polarized photons generated by the electron beam in the undulator hit a target and produce electron-positron pairs. The purpose of the post-target spectrometer is to select the positron beam and to deliver it to a polarimeter whilst keeping the positron beam polarization as high as possible. This paper analyzes positron transmission and polarization in the E-166 spectrometer experiment. The positron transmission has a maximum value of 7% for a positron beam energy of 5.5 MeV, while positron polarization is approximately 60%.

NTIS

*Positrons; Spectrometers*

**20070029995** Fermi National Accelerator Lab., Batavia, IL, USA; Istituto Nazionale di Fisica Nucleare, Rome, Italy  
**W + Jet Production at CDF**

Messina, A.; Oct. 01, 2006; 4 pp.; In English

Report No.(s): DE2007-900378; FERMILAB-CONF-06-377-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The study of jets produced in events containing a W bosons provides a useful test of Quantum Chromo-Dynamics (QCD) at high momentum transfers. Recently a lot of work has been channeled to develop sophisticated Monte Carlo programs capable of handling more particle in the final state at the leading order (LO), or in some cases, next-to-leading order (NLO). Measurements of W + jet cross sections are an important test of QCD and may be used to validate these new approaches. A good understanding of W + jet production is vital to reduce the uncertainty on the background to top pair production and to increase the sensitivity to higgs and new physics searches at the Tevatron and the LHC.

NTIS

*Bosons; Quantum Chromodynamics; High Energy Interactions; Momentum Transfer*

**20070029996** Fermi National Accelerator Lab., Batavia, IL, USA; Karlsruhe Univ., Germany  
**New Results on X(3872) from CDF**

Kreps, M.; Nov. 01, 2006; 4 pp.; In English

Report No.(s): DE2007-900377; FERMILAB-CONF-06-392-E; No Copyright; Avail.: National Technical Information Service (NTIS)

In 2003 the X(3872) particle was discovered by the Belle collaboration. Despite results collected since then, the nature of the state still remains unclear. In this contribution we report on new results on properties of the X(3872) state using data collected with CDF II detector at the Fermilab Tevatron. The dipion mass spectrum and angular distributions are used to determine the JPC quantum numbers of the state.

NTIS

*High Energy Interactions; Angular Distribution*

**20070029997** Fermi National Accelerator Lab., Batavia, IL, USA  
**Some Searches for New Physics with the D0 Detector**

Kajfasz, E.; Nov. 01, 2006; 4 pp.; In English

Report No.(s): DE2007-900376; FERMILAB-CONF-06-414-E; No Copyright; Avail.: National Technical Information Service (NTIS)

We present recent results on Technicolor and Leptoquark searches obtained analyzing up to 0.4 fb<sup>-1</sup> of data taken at Fermilab by the D0 experiment during the first part of the Tevatron Run II.

NTIS

*High Energy Interactions; Particle Accelerators*

**20070029998** Fermi National Accelerator Lab., Batavia, IL, USA  
**Survey and Alignment of the Fermilab Electron Cooling System**

Oshinowo, B. O.; Leibfritz, J.; Sep. 01, 2006; 15 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-900374; FERMILAB-CONF-06-506; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of achieving the Tevatron luminosity of 3x10<sup>32</sup> cm<sup>-2</sup>s<sup>-1</sup> requires Electron Cooling in the Recycler Ring to provide an increased flux of antiprotons. The Fermilab Electron Cooling system has been designed to assist accumulation of antiprotons for the Tevatron collider operations. The installation along with the survey and alignment of the Electron Cooling system in the Recycler Ring were completed in November 2004. The Electron Cooling system was fully commissioned in May 2005 and the first cooling of antiprotons was achieved in July 2005. This paper discusses the alignment methodology employed to survey and align the Electron Cooling system.

NTIS

*Alignment; Cooling; Cooling Systems; Particle Accelerators; Surveys*



**20070029999** Fermi National Accelerator Lab., Batavia, IL, USA; New Mexico Univ., Albuquerque, NM, USA  
**First Observation of Bottom Baryon Sigma(b) States at CDF**

Gorelov, I. V.; Jan. 01, 2007; 8 pp.; In English

Report No.(s): DE2007-900370; FERMILAB-CONF-07-027-E; No Copyright; Avail.: National Technical Information Service (NTIS)

This document presents the latest results on the search for bottom baryon sigma states using the Collider Detector at Fermilab (CDF) data.

NTIS

*Baryons; Quantum Chromodynamics*

**20070030000** Technische Hochschule, Aachen, Germany

**Resonant Second Generation Slepton Production at the Tevatron**

Autermann, C.; Dec. 2006; 250 pp.; In English

Report No.(s): DE2007-900364; No Copyright; Avail.: National Technical Information Service (NTIS)

In this thesis a search for R-parity violating supersymmetry is presented. Two different approaches, determined by the event topologies, are chosen to search for resonant slepton production and for the pair and associated of gauginos.

NTIS

*Leptons; Particle Accelerators; Theses*

**20070030029** Fermi National Accelerator Lab., Batavia, IL, USA; Illinois Univ. at Urbana-Champaign, Urbana, IL, USA  
**Measurements of the B Production Cross Section in Proton-Antiproton Collisions at  $s^{1/2} = 1.96$  TeV using Semileptonic Decays of b Hadrons**

Kraus, J. A.; Jun. 01, 2006; 303 pp.; In English

Report No.(s): DE2007-900363; DE-AC02-76CH03000; No Copyright; Avail.: National Technical Information Service (NTIS)

Contents: Introduction; Theory; CDF Detector; Datasets, Triggers, and Monte Carlo Generation; Trigger Efficiencies; Office Efficiencies and Partial Awareness; Cross Section Results; and Glossary.

NTIS

*Hadrons; Particle Collisions; Particle Decay; Proton-Antiproton Interactions*

**20070030030** Simon Fraser Univ., Burnaby, British Columbia, Canada

**t-tbar Production at the Tevatron. Event Selection and Cross Section Measurement**

ONeil, D. C.; Mar. 01, 2007; 4 pp.; In English

Report No.(s): DE2007-900358; FERMILAB-CONF-06-522-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The Fermilab Tevatron is currently the only collider capable of producing and studying top quarks. The dominant mechanism for top quark production at the Tevatron is tt production via the strong interaction. The precise measurement of the cross section of this process is a test of the QCD prediction. In Run II of the Tevatron it should be possible to achieve an experimental error on this cross section which is comparable or better than the current theoretical precision. This paper presents the basic event selection criteria for tt events at the Tevatron and the latest measurements of the tt cross section.

NTIS

*Particle Accelerators; Quarks; Cross Sections*

**20070030031** Fermi National Accelerator Lab., Batavia, IL, USA

**Possible Use of Electron Lenses in LHC**

Shiltsev, V.; Oct. 01, 2006; 5 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-900356; FERMILAB-CONF-06-505-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

We present basic facts about electron lenses used in high-energy accelerators and discuss their possible application in the LHC. Four proposals are presented: (a) electron lenses for compensation of head-on beam-beam effects; (b) electron lens as

tune-spreader for better beam stability; (c) as electromagnetic primary collimator for ions and protons; (d) satellite bunch cleaning by electron lenses. Main requirements are discussed.

NTIS

*Electron Optics; Lenses*

**20070030033** Ladas and Parry, Los Angeles, CA, USA

**Integrated Plasmon and Dielectric Waveguides**

Baehr-Jones, T., Inventor; Hochberg, M. J., Inventor; Scherer, A., Inventor; 26 Apr 05; 12 pp.; In English

Contract(s)/Grant(s): AFOSR-FA9550-04-1-0413

Patent Info.: Filed Filed 26 Apr 05; US-Patent-Appl-SN-11-116 110

Report No.(s): PB2007-108637; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A metal waveguide is coupled to a dielectric waveguide to obtain transmission of light in a plasmon mode along an edge of the metal waveguide. Efficient, broadband light transmission is obtained, achieving a low insertion loss, using standard processing tools. An efficient integrated optical circuit is obtained.

NTIS

*Dielectric Properties; Dielectric Waveguides; Patent Applications; Plasmons; Waveguides*

## 71 ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

**20070026464** Library of Congress, Washington, DC USA

**Acoustic Thermometry of Ocean Climate: Marine Mammal Issues**

Buck, Eugene H; May 12, 1995; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466194; CRS-95-603; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466194>

After global warming became a concern in the mid-1950s, researchers proposed measuring deep ocean temperatures to reveal any significant trends in core ocean warming. Acoustic thermometry can detect changes in ocean temperature by receiving low-frequency sounds transmitted across an ocean basin because the speed of sound is proportional to water temperature. Acoustic Thermometry of Ocean Climate (ATOC) is an international program involving 11 institutions in seven nations. It is designed as a 30-month 'proof-of-concept' project to provide data on possible global climate change, with funding provided by the U.S. Department of Defense. A Marine Mammal Research Program (MMRP) was established as part of ATOC to assess the effects of ATOC sound signals on marine mammals. The proposed ATOC sources will be located 15 kilometers off the coast of Kauai, Hawaii, and near the Pioneer Seamount in California. A debate has arisen over ATOC's impact on marine mammals versus the benefits of better global warming information derived from it. Among the concerns are questions regarding the effects of low-frequency sound on marine mammals, and the baseline data available on marine mammals near the proposed source locations. In response to concerns expressed by the public, environmentalists, scientists, and Congress, the National Marine Fisheries Service (NMFS) held a series of public hearings on the Marine Mammal Protection Act (MMPA) permit applications by Scripps Institution of Oceanography for ATOC. Consequently, ATOC was delayed until draft environmental impact statements could be prepared. The Office of Naval Research funded a National Research Council (NRC) investigation of current knowledge and research needs with respect to the effects of low-frequency sound on marine mammals. The NRC report, released in March 1994, concluded that the data were insufficient to determine the possible effects of low-frequency sound on marine mammals.

DTIC

*Animals; Environmental Surveys; Low Frequencies; Marine Biology; Marine Mammals; Oceans; Sound Transmission; Structural Basins; Temperature Measurement; Underwater Acoustics*

**20070026528** Florida Univ., Gainesville, FL USA

**Design and Validation of an Aeroacoustic Anechoic Test Facility**

Jansson, D; Mathew, J; Hubner, J P; Sheplak, M; Cattafesta, L; Jun 2002; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466386; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466386>

This paper discusses the design and initial validation of a newly constructed aeroacoustic anechoic test facility at the

University of Florida. The facility will enable and assist research in the areas of aeroacoustics, structural acoustics, and industrial noise/vibration control. General facility features and characteristics are described and documented. Experimental results focus on the free-field characteristics of the chamber via the ISO 3745 standard and preliminary evaluations of the acoustic data quality for subsonic axisymmetric turbulent jet noise measurements. Initial free-field results comply with the tolerances set by the ISO standard except for a few bands close to the corner containing the chamber door. The preliminary jet noise measurements yield reasonable comparisons to the fine-scale turbulent jet noise similarity spectrum at 90 degrees. The results also reveal the need for acoustic treatment and vibration control of the chamber traverse and fan that supplies supplemental entrainment air.

DTIC

*Acoustics; Aeroacoustics; Aerodynamic Noise; Anechoic Chambers; Test Facilities*

**20070026556** Florida Univ., Gainesville, FL USA

**Acoustic Proximity Ranging in the Presence of Secondary Echoes**

Li, Xi; Wu, Renbiao; Rasmi, Srihari; Li, Jian; Cattafesta, III, Louis N; Sheplak, Mark; Oct 2003; 14 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0105

Report No.(s): AD-A466444; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466444>

Proximity ranging is very important in many applications. Ultrasonic sensors have proven to be very cost effective tools for this purpose. Most of the currently available time-of-flight based acoustic proximity ranging systems use the conventional matched filter based time delay estimation approaches to measure short distances between proximity objects. However, in the presence of strong and closely spaced secondary echoes, the aforementioned matched filter based algorithms tend to fail or suffer from severe performance degradations due to their poor resolutions. In this paper, a computationally efficient time delay estimation algorithm, referred to as multiecho parameter estimation for acoustic ranging systems, is described for the joint proximity range estimation and secondary echo mitigation. The effectiveness of the proposed algorithm is demonstrated by both numerical and experimental examples.

DTIC

*Audio Equipment; Echoes; Rangefinding; S Waves*

**20070027312** Naval Postgraduate School, Monterey, CA USA

**A Geometric Investigation of Acoustical Wavefront Scattering and Healing Induced by Ocean Internal Waves**

Salazar, Maxsimo; Mar 2007; 56 pp.; In English

Report No.(s): AD-A467113; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Observed ocean acoustic wavefronts show surprising stability in long range acoustic transmission experiments. This suggests that ocean scattering processes tend to re-distribute acoustic energy dominantly along the wavefront rather than across it. The purpose of this thesis is to elucidate the physical mechanism for this type of scattering by presenting a ray based physical model. Analytic formulae are presented that predict wavefront distortions caused by ocean internal waves and other processes. Applications of this study include wavefront healing near underwater obstacles, out of plane scattering and the vertical redistribution of energy of off axis sources.

DTIC

*Acoustic Scattering; Healing; Internal Waves; Ocean Surface; Water Waves; Wave Fronts*

**20070027396** Naval Postgraduate School, Monterey, CA USA

**A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields**

Tombul, Serdar; Mar 1, 2007; 103 pp.; In English

Report No.(s): AD-A467413; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Results of the ATOC project's AET experiment have shown that at 75 Hz Rytov theory may be used for predicting the phase variations. This paper is focused on establishing the regimes of validity for Rytov theory at 75-400 Hz acoustic frequency range and up to 200 km distance. Ray paths correspond to grazing angles of 0, 5, 10 and 14 are considered, thus spanning the range of possible ray geometry from surface reflection to axial propagation. We find that the Rytov and simulation spectra are in very good agreement in the frequency range from the buoyancy frequency up to a grazing angle dependent on the transition frequency between 1 and 0.2 cph. For frequencies less than the transition frequency the Rytov spectra are in fairly good agreement with the simulations for all ranges and grazing angles between 0 and 10. For the 14 beam the Rytov

theory dramatically under predicts the spectral energy at frequencies less than 1 cph. When there is significant variability in phase and log-amplitude, we also find that significant spectral energy can exist at frequencies greater than the buoyancy frequency. This energy is not predicted by the Rytov model and represents the effect of strong interference and scattering not treated in the weak fluctuation approach of the Rytov theory. This study will increase the interest in the weak fluctuation theory (WFT) as an acoustic prediction tool.

DTIC

*Acoustic Propagation; Acoustic Velocity; Fluctuation Theory; Internal Waves; Oceanography; Oceans; Sound Transmission; Underwater Acoustics; Wave Propagation*

**20070027553** Air Force Research Lab., Edwards AFB, CA USA

**Dark Core Analysis of Coaxial Injectors at Sub-, Near-, and Supercritical Conditions in a Transverse Acoustic Field**

Leyva, Ivett A; Chehroudi, Bruce; Talley, Douglas; May 2007; 12 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A467843; AFRL-PR-ED-TP-2007-164; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experimental study on the effects of an externally-imposed transverse acoustic field in sub-, near-, and supercritical N<sub>2</sub> coaxial jets is presented. Such fields and their interaction with the jets (i.e., breakup, mixing, etc.) is believed to play a critical role during combustion instabilities in liquid rocket engines. The shear coaxial injector used here is similar to those used in cryogenic liquid rockets. By using N<sub>2</sub> as the working fluid, the chemistry effects on combustion instability are separated from the effects of a transverse acoustic field on coaxial jets. Furthermore, through this choice, ambiguities associated with composition dependence on mixtures' critical properties are eliminated. The acoustic oscillations are generated by a piezo-siren and have a frequency of ~3kHz. The pressures in the chamber range from 215-716 psia to span sub-, near-, and supercritical conditions. The outer to inner jet velocity ratio varies from ~1.2 to 23 and the momentum flux ratio varies from ~0.2 to 23. These ratios are mainly varied by changing the temperature and flow rates of the outer jet. At least 2000 backlit images were taken at 41kHz for each run. The main metric investigated is the length of the dark, or inner jet, core length. Both the axial length of the jet and the total, or curved, length are studied. A functional relation of the form  $A/MR^n$  describes the behavior of the axial length with the exponent being 0.2 (A:20-25) for subcritical conditions and 0.5 (A:5-12) for near and supercritical conditions. These results agree with historical data. The standard deviation of the axial length, which due to the large number of data points is within 0.03% of the RMS of the jet lengths fluctuations, also decreases with velocity ratio, for sub-, near-, and supercritical conditions.

DTIC

*Acoustics; Injectors; Liquid Propellant Rocket Engines; Sound Fields*

**20070028698** Air Force Research Lab., Rome, NY USA

**The Matrix Pencil and its Applications to Speech Processing**

Haddad, Darren H; Noga, Andrew J; Mar 2007; 152 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-459E

Report No.(s): AD-A466668; AFRL-IF-RS-TR-2007-89; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466668>

Matrix Pencils facilitate the study of differential equations resulting from oscillating systems. Certain problems in linear ordinary differential equations, such as speech processing, can be represented as the problem of finding a canonical pencil strictly equivalent to a given pencil. It was originally applied by the radar community to phased array radar for signal directional finding applications. The Matrix Pencil (MP) algorithm is a direct data approach, and is a nonstochastic method. This approach has many benefits over a statistical approach. One benefit allows the user to approximate the error of the reconstructed signal without reconstructing the signal. Second, it takes less time and less computational power to execute the algorithm. Third, the matrix pencil approach has a lower variance of the estimates of the parameters of interest than a statistical approach such as traditional Linear Prediction Coding (LPC). Speech processing has many applications which directly assist in the advancement of technology. These technologies utilize speech tools that include, but are not limited to speech compression, speech enhancement, speech recovery, pitch estimation, and cochannel interference reduction. However, the speech processing community has not grasped the power of the MP algorithm, which will likely make a significant leap forward in improving these speech processing tools.

DTIC

*Algorithms; Oscillations; Differential Equations; Coding; Error Signals*

**20070029550** Naval Undersea Warfare Center, Newport, RI USA

**Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness**

Klingbeil, Ralph; Shannon, John; Galdorisi, George; Sep 2004; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468697; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468697>

This report describes an analysis of two selected concepts for improving Anti-Submarine Warfare (ASW) performance and effectiveness by means of network-enabled sharing of information during ASW operations. These concepts are identified as Shared Situational Awareness (SSA) and Collaborative Information Environment (CIE). It is shown that the application of queueing theory models provide useful tools for quantitatively estimating the value-added of implementing these concepts. In addition, queueing theory can be used to examine the tradeoffs between 'information systems' and 'shooters.' In general, queueing theory can support analysis whenever military operations, such as ASW, can be characterized as 'demand for service' processes. For the SSA and CIE concepts, an ASW tactical situation (TACSIT) is described and metrics are defined and quantified by means of queueing models. Insights, conclusions, and recommendations are then developed from the parametric quantitative results about the potential improvements to ASW performance and effectiveness achievable through implementation of these network-enabled concepts. Thirty-two briefing charts summarize the presentation.

DTIC

*Antisubmarine Warfare; Classifications; Combat; Command and Control; Control Theory; Multisensor Fusion; Network Control; Queueing Theory; Situational Awareness; Targets; Warfare*

**20070029684** Naval Undersea Warfare Center, Newport, RI USA

**Signal Event Detection System**

Kennedy, Shawn P, Inventor; May 22, 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020287; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020287>

A soft impact location system and method which detects and processes wide-band acoustic signatures for testing long-range munitions. The system incorporates a real-time digital signal-processing algorithm that detects the impact signature, processes it, and calculates the time-of-arrival (TOA). The system comprises a polyphase filter bank, boxcar filter, a detection analyzer for detecting an impact, and time-tagging software for calculating the time of impact. The system splits the received hydrophone signal into evenly spaced energy bands, processes each band individually, and then recombines the data to provide a precise time of detection.

DTIC

*Acoustic Properties; Detection; Ordnance; Patent Applications; Position (Location); Signal Detection*

**20070029974** National Marine Fisheries Service, Washington, DC, USA

**NOAA National Passive Acoustics Workshop, 2006**

Van Parijs, S.; Southall, B.; Mar. 2007; 70 pp.; In English; Developing a Strategic Program Plan for NOAA's Passive Acoustics Ocean Observing System (PAOOS), 11-13 Apr. 2006, Woods Hole, MA, USA

Report No.(s): PB2007-110765; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Sound is the primary means by which many marine organisms convey and sense information over any appreciable spatial scale. Acoustic sensing is an optimal means for detecting and characterizing physical and biological features of ocean areas. Heightened public attention on the effects of anthropogenic sound in the marine environment provides impetus for the expansion of passive acoustic observing capabilities in general and for NOAA's leadership efforts in particular, in passive acoustics deployment, data acquisition, and management. Passive acoustics is an exceedingly powerful means of achieving many NOAA missions. Expansion of U.S. marine acoustic sensing capabilities is supported by a large variety of scientific, legislative, and policy directives, as well as number of international resolutions. Various National Research Council (NRC) reports have highlighted the wide variety of information that can be obtained through passive acoustic deployments, and have recommended that increased investments be made to realize these opportunities (e.g., NRC, 2003). Passive acoustic deployments provide enhanced and unique scientific data on (a) living marine resources; (b) biotic and abiotic characteristics of marine ecosystems; and (c) the effects of anthropogenic sound on protected species and their ecosystems. The National Passive Acoustics Workshop held in April 2006 in Woods Hole, MA, the purpose of which was to develop a draft strategic program plan for NOAA's Passive Acoustics Oceans Observing System (PAOOS) and to identify critical data requirements. The workshop recommended that NOAA's PAOOS provide data on biological, geophysical, oceanographic, meteorological, and anthropogenic ocean events.

NTIS

*Acoustics; Detection; Oceans; Organisms; Project Planning*

## ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 *Nuclear Physics*.

**20070026565** Tokyo Univ., Japan

### **Development of a Charged-particle Accumulator Using an RF Confinement Method II**

Hayano, Ryugo; Nace, William A; Aug 24, 2006; 12 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0280

Report No.(s): AD-A466481; AOARD-54047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466481>

This report covers research and development of a charged-particle accumulator which ultimately should lead to the entrapment of a large quantity of antiparticles (antiprotons and positrons) and produce a large quantity of antimatter.

DTIC

*Accumulators; Charged Particles; Confinement; Radio Frequencies*

**20070026656** California Univ., Berkeley, CA USA

### **Scalability, Complexity and Reliability in Quantum Information Processing**

Stamper-Kurn, Dan; Vazirani, Umesh; Weiss, David; Whaley, K B; Mar 2007; 72 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-2-0524; DARPA ORDER-L483; Proj-L483

Report No.(s): AD-A466664; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466664>

This program was a theory/experiment collaboration focusing on the fundamental need for scalability in the development of quantum information processing. Theory and experiment were connected and interleaved at several levels. The theory objectives were 1) to develop new theoretical tools to enable the implementation of reliable quantum information processing in scalable systems and 2) to characterize the relations between quantum algorithms and architectures, between fault tolerance and architectures, between quantum and classical complexity classes, and to develop secure primitives for quantum cryptography. The experimental objectives were to develop scalable quantum component technology based on gas phase systems using atoms and light fields. Specific experimental goals were scalable implementation of universal quantum logic in optical lattices and achievement of deterministic control in atom/cavity systems.

DTIC

*Atoms; Data Processing; Quantum Theory; Reliability*

**20070027293** Air Force Research Lab., Wright-Patterson AFB, OH USA

### **Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint)**

Naninaparampil, Jose; Eapen, Kalathil C; Voevodin, Andrey A; Sanders, Jeffrey H; Dec 2006; 33 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A467077; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Lubrication of Micro Electro Mechanical Systems (MEMS) became very important as the devices became complex and more and more parts had interacting areas. In previous reports, self-assembled monolayers and long chains of fluocarbons were used to lubricate MEMS components with significant success. In this report, a method based on atomic force microscopy is described that measures and compares ionic liquid lubricity. Effect of ring structure is studied in the case of substituted pyridinium and imidazolium rings as cations in ethyl methyl pyridinium and ethyl methyl imidazolium ethyl sulfate. Effect of alkyl chain length on friction was studied for butyl methyl pyrrolidinium and hexyl methyl pyrrolidinium bis(trifluoro methyl sulfonyl) imide. Some of the ionic liquids that exhibited promising results from AFM study are tested on MEMS test devices. The friction and wear data obtained for these liquids applied on hydrogenated silicon showed ample correlation to the failure life span of hydrogenated MEMS test devices. This shows that AFM-liquid cell based tests of ionic liquid lubricity is a good characterization technique for screening lubricants for MEMS devices.

DTIC

*Atomic Force Microscopy; Friction; Lubrication; Microelectromechanical Systems; Microscopy*

**20070028532** Hawaii Univ., Honolulu, HI USA

**Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope**  
Tokunaga, A T; Bond, T; Elias, J; Chun, M; Richter, M; Liang, M; Lacy, J; Daggert, L; Tollestrup, E; Ressler, M; Warren, D;  
Fisher, S; Carr, J; Jan 2006; 13 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A feasibility design study was undertaken to assess the requirements of a mid-infrared echelle spectrograph (MIREs) with a resolving power of 120,000 and its associated mid-infrared adaptive optics (MIRAO) system on the Thirty-Meter Telescope. Our baseline design incorporates a 2Kx2K Si:As array or array mosaic for the spectrograph and a 1Kx1K Si:As array for the slit viewer. Various tradeoffs were studied to minimize risk and to optimize the sensitivity of the instrument. Major challenges are to integrate the spectrograph to the MIRAO system and, later, to an adaptive secondary, the procurement of a suitable window and large KRS-5 lenses, and the acquisition of large format mid-IR detector arrays suitable for the range of background conditions. We conclude that the overall risk is relatively low and there is no technical reason that should prevent this instrument from being ready for use at first light on the Thirty-Meter Telescope.

DTIC

*High Resolution; Infrared Spectroscopy; Spectral Resolution; Spectrographs; Telescopes; Tradeoffs*

**20070029713** Air Force Research Lab., Hanscom AFB, MA USA

**Proceedings of the Quantum Computation for Physical Modeling Workshop 2004. Held in North Falmouth, MA on 12-15 September 2004**

Yepez, Jeffrey; Havel, Timothy; Oct 2005; 180 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A468934; AFRL-VS-HA-TR-2007-1053; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468934>

This workshop focused on the development of prototype quantum information processors, quantum algorithms used for physical modeling applications, and efficient numerical simulations. The Air Force Research Laboratory hosted the Quantum Computation for Physical Modeling (QCPM) Workshop 2004 on 12-15 September 2004, our third bi-annual workshop on quantum computation for physical modeling held at The Harbor View Hotel on Martha's Vineyard. The workshop was hosted by our laboratory and sponsored by the Air Force Office of Scientific Research (AFOSR). The three day workshop comprised six sessions spanning the following research areas: (1) quantum algorithms; (2) quantum effects and devices; (3) superconductive quantum information processing; (4) nuclear magnetic resonance quantum information processing; (5) quantum information, quantum cryptography and quantum communication. We reviewed the research progress carried out by our extramural university research programs following our laboratory's in-house basic research mission and funded through confederated AFOSR grants. Our workshop focused on the development of prototype quantum information processors and quantum algorithms used for physical modeling applications and efficient numerical simulations. The workshop was an outstanding and unqualified success and represents a new milestone in our progress toward achieving a practical quantum computer using state-of-the-art nanotechnology.

DTIC

*Conferences; Data Processing; Quantum Computation; Quantum Theory*

**20070029834** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Hyperspectral Imagery Target Detection Using Improved Anomaly Detection and Signature Matching Methods**

Smetek, Timothy E; Jun 2007; 389 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469195; AFIT/DS/ENS/07-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469195>

This research extends the field of hyperspectral target detection by developing autonomous anomaly detection and signature matching methodologies that reduce false alarms relative to existing benchmark detectors. The proposed anomaly detection methodology adapts multivariate outlier detection algorithms for use with hyperspectral datasets containing thousands of high-dimensional spectral signatures. In so doing, the limitations of existing, non-robust anomaly detectors are identified, an autonomous clustering methodology is developed to divide an image into homogeneous background materials, and competing multivariate outlier detection methods are evaluated. To arrive at a final detection algorithm, robust parameter design methods are employed to determine parameter settings that achieve good detection performance over a range of hyperspectral images and targets. The final anomaly detection algorithm is tested against existing local and global anomaly detectors, and is shown to achieve superior detection accuracy when applied to a diverse set of hyperspectral images. The

proposed signature matching methodology employs image-based atmospheric correction techniques in an automated process to transform a target reflectance signature library into a set of image signatures. This set of signatures is combined with an existing linear filter to form a target detector that is shown to perform as well or better relative to detectors that rely on complicated, information-intensive atmospheric correction schemes. The performance of the proposed methodology is assessed using a range of target materials in both woodland and desert hyperspectral scenes.

DTIC

*Anomalies; Detection; Imagery; Signatures; Target Acquisition*

## 73

### NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

**20070026517** Tokyo Univ., Gifu, Japan

#### **Development of a Charged-Particle Accumulator Using an RF Confinement Method**

Hayano, Ryugo S; Mar 12, 2007; 10 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0025

Report No.(s): AD-A466363; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466363>

This report documents development of a superconducting charged-particle accumulator whose ultimate goal is to trap a large number of antiparticles and to produce a large quantity of antimatter.

DTIC

*Accumulators; Antiprotons; Charged Particles; Confinement; Radio Frequencies*

**20070026627** Library of Congress, Washington, DC USA

#### **Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress**

O'Rourke, Ronald; Apr 2, 2007; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466585; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466585>

Some Members of Congress, particularly on the House Armed Services Committee, have expressed interest in expanding the use of nuclear power to a wider array of Navy surface ships, especially the Navy's planned CG(X) cruiser. The Navy wants to procure the first CG(X) in FY2011, and is currently studying design options for the ship, including the use of nuclear power.

DTIC

*Navy; Nuclear Powered Ships; Ocean Surface*

**20070026637** Library of Congress, Washington, DC USA

#### **The Iran Sanctions Act (ISA)**

Katzman, Kenneth; Jan 25, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466623; CRS-RS20871; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466623>

No firms have been sanctioned under the Iran Sanctions Act (ISA). Set to expire in August 2006, bills in the 109th Congress, H.R. 282 (passed by the House on April 26, 2006), S. 333, and H.R. 6198 extended it and added provisions to apply it more strictly. The latter bill, (P.L. 109-293, signed September 30, 2006), extended it until December 31, 2011, changed its name from the Iran-Libya Sanctions Act (ILSA) to ISA by terminating application to Libya, and allows substantial Administration flexibility in applying the new provisions. This report will be updated. See also CRS Report RL32048, Iran: U.S. Concerns and Policy Responses, by Kenneth Katzman.

DTIC

*Foreign Policy; International Trade; Iran*



**20070027753** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Feb 22, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468472; CRS-RS21592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

International Atomic Energy Agency (IAEA) inspections since 2003 have revealed two decades' worth of undeclared nuclear activities in Iran, including uranium enrichment and plutonium separation efforts. Iran agreed in 2003 to suspend sensitive activities in negotiations with Germany, France, and the UK (European Union-3), which broke down in August 2005. On September 24, 2005, the IAEA Board of Governors found Iran to be in noncompliance with its Nuclear Nonproliferation Treaty (NPT) safeguards agreement and reported Iran's case to the U.N. Security Council in February 2006. The Security Council called upon Iran to resuspend enrichment and reprocessing, reconsider construction of its heavy water reactor, ratify and implement the Additional Protocol, and implement transparency measures. The Security Council passed UNSCR 1696 on July 31, 2006, and on December 23, 2006, the Security Council adopted limited sanctions under UNSCR 1737. Iran has continued its enrichment activities, failing to meet deadline after deadline, the most recent being February 21, 2007. This report will be updated as needed.

DTIC

*Agreements; Enrichment; Inspection; Iran; Nuclear Fuels; Nuclear Weapons; Plutonium; Uranium*

**20070027758** Florida Univ., Gainesville, FL USA

**Characterization Of Commonly Encountered Explosives Using Highfield Asymmetric Waveform Ion Mobility Spectrometry Coupled With Mass Spectrometry**

Boock, Jared J; May 2007; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468495; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this research was to characterize explosive compounds using high-field asymmetric waveform ion mobility spectrometry (FAIMS) as an ion separation device interface to a mass spectrometer (MS). FAIMS is a relatively recently developed technology that is promising adding a dimension of separation. This method was employed in such a way as to be conducive to possible future development of field instruments (e.g., use of atmospheric pressure chemical ionization (APCI)). In addition, several experiments were conducted with the application of this method, mainly dealing with optimization of the instrument parameters. These experiments led to the development of a new method: high-resolution FAIMS. An ion mobility spectrometer was used as a desolvation and ion focusing device to drastically improve FAIMS resolution. This allowed for the separation of mixtures that otherwise could not have been separated. The resolution was high enough that isomers of the same explosive were successfully resolved. This can be beneficial to forensics studies.

DTIC

*Asymmetry; Explosives; Mass Spectroscopy; Mobility; Spectrometers; Waveforms*

**20070027818** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Mar 8, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468578; CRS-RS21592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

International Atomic Energy Agency (IAEA) inspections since 2003 have revealed two decades' worth of undeclared nuclear activities in Iran, including uranium enrichment and plutonium separation efforts. Iran agreed in 2003 to suspend sensitive activities in negotiations with Germany, France, and the UK (EU-3), which broke down in August 2005. On September 24, 2005, the IAEA Board of Governors found Iran to be in noncompliance with its Nuclear Nonproliferation Treaty (NPT) safeguards agreement and reported Iran's case to the U.N. Security Council in February 2006. The Security Council called upon Iran to resuspend enrichment and reprocessing, reconsider construction of its heavy water reactor, ratify and implement the Additional Protocol, and implement transparency measures. Iran has continued its enrichment activities, failing to meet deadline after deadline. On December 23, 2006, the Security Council adopted limited sanctions under UNSCR 1737 and gave Iran another 60 days. However, the February 21, 2007, deadline has passed with little progress, and further sanctions may be under consideration. This report will be updated as needed.

DTIC

*Enrichment; Iran; Reactor Technology; United Nations; Uranium*

**20070028748** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Sep 6, 2006; 7 pp.; In English

Report No.(s): AD-A467363; CRS-RS21592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

International Atomic Energy Agency (IAEA) inspections since 2003 have revealed two decades worth of undeclared nuclear activities in Iran, including uranium enrichment and plutonium separation efforts. Iran agreed in 2003 to suspend sensitive activities in negotiations with Germany, France, and the UK (EU-3), which broke down in August 2005. On September 24, 2005, the IAEA Board of Governors found Iran to be in noncompliance with its Nuclear Nonproliferation Treaty (NPT) safeguards agreement and reported Iran's case to the U.N. Security Council in February 2006. The Security Council called upon Iran to resuspend enrichment and reprocessing, reconsider construction of its heavy water reactor, ratify and implement the Additional Protocol, and implement transparency measures. Iran continued enrichment activities and failed to meet the Security Council's request, even after the permanent members plus Germany (P-5+1) offered Iran a new proposal on June 6. The Security Council passed UNSCR 1696 on July 31, 2006, giving Iran a deadline of August 31 to comply. Iran still failed to suspend enrichment, which may prompt negotiations on sanctions. This report will be updated as needed.

DTIC

*Iran; Nuclear Weapons; Nuclear Reactors*

**20070028751** Library of Congress, Washington, DC USA

**India's Nuclear Separation Plan: Issues and Views**

Squassoni, Sharon; Dec 22, 2006; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467312; CRS-RL33292; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On July 18, 2005, President Bush and Indian Prime Minister Manmohan Singh announced the creation of a 'global partnership,' which would include 'full' civil nuclear cooperation between the USA and India. This is at odds with nearly three decades of U.S. nonproliferation policy and practice. President Bush promised India he would persuade Congress to amend the pertinent laws to approve the agreement, as well as persuade U.S. allies to create an exception to multilateral Nuclear Suppliers Group (NSG) guidelines for India. India committed to, among other things, separating its civilian nuclear facilities from its military nuclear facilities, declaring civilian facilities to the International Atomic Energy Agency (IAEA) and placing them under IAEA safeguards, and signing an Additional Protocol. See CRS Report RL33016, U.S. Nuclear Cooperation With India: Issues for Congress, by Sharon Squassoni, for further details on the agreement. The separation plan announced by Prime Minister Singh and President Bush on March 2, 2006, and further elaborated on May 11, 2006, would place 8 power reactors under inspection, bringing the total up to 14 out of a possible 22 under inspection. Several fuel fabrication and spent fuel storage facilities were declared, as well as 3 heavy water plants that were described as 'safeguards-irrelevant.' The plan excludes from international inspection 8 indigenous power reactors, enrichment and spent fuel reprocessing facilities (except as currently safeguarded), military production reactors and other military nuclear plants and 3 heavy water plants. Administration officials have defended the separation plan as credible and defensible because it covers more than just a token number of Indian facilities, provides for safeguards in perpetuity, and includes upstream and downstream facilities.

DTIC

*India; Nuclear Power Plants*

**20070029966** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Hot Leg Piping Materials Issues (U)**

Jul. 19, 2006; 8 pp.; In English

Report No.(s): DE2007-884668; B-MT(SPME)-24; No Copyright; Avail.: Department of Energy Information Bridge

With Naval Reactors (NR) approval of the Naval Reactors Prime Contractor Team (NRPCT) recommendation to develop a gas cooled reactor directly coupled to a Brayton power conversion system as the space nuclear power plant (SNPP) for Project Prometheus (References a and b) the reactor outlet piping was recognized to require a design that utilizes internal insulation (Reference c). The initial pipe design suggested ceramic fiber blanket as the insulation material based on requirements associated with service temperature capability within the expected range, very low thermal conductivity, and low density. Nevertheless, it was not considered to be well suited for internal insulation use because its very high surface area and proclivity for holding adsorbed gases, especially water, would make outgassing a source of contaminant gases in the He-Xe working fluid. Additionally, ceramic fiber blanket insulating materials become very friable after relatively short service periods at working temperatures and small pieces of fiber could be dislodged and contaminate the system. Consequently, alternative

insulation materials were sought that would have comparable thermal properties and density but superior structural integrity and greatly reduced outgassing.

NTIS

*Nuclear Power Plants; Pipes (Tubes)*

## 74 OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

**20070026409** Northrop Grumman Space Technology, Dayton, OH USA

### **Assured Reference Technology Research (ARTHR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT)**

McLaughlin, Daniel; Wells, Jeffrey; Wurthh, Timothy; Dresher, Daniel; Feb 2007; 34 pp.; In English

Contract(s)/Grant(s): FA8650-04-D-1600-0004; Proj-5034

Report No.(s): AD-A466112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466112>

The use of fiber optics is considered herein as a means to distribute Radio Frequency (RF) signals across Printed Circuit Boards (PCB). The use of fiber optics is studied with an emphasis on reducing inter-board Electromagnetic Interference (EMI). High performance RF circuits are especially sensitive to EMI and other Radio Frequency Interference (RFI), resulting in poor circuit to circuit isolation, spurious signals, additional filtering requirements, and increased shielding constraints. Fiber-optic cable has beneficial characteristics of extremely low cross coupling and is not conductive along its length; this equates to tremendous promise as a means for distributing RF signals with limited EM/RFI. The innovative concept is applicable to PCBs which have a level of RF signals traversing near multiple sensitive RF circuits.

DTIC

*Circuit Boards; Fiber Optics; Printed Circuits; Radio Frequencies; Radio Frequency Interference*

**20070026419** Florida Univ., Gainesville, FL USA

### **Real-Time Sonar Beamforming on High-Performance Distributed Computers**

George, Alan D; Markwell, Jeff; Fogarty, Ryan; Jan 2000; 23 pp.; In English

Contract(s)/Grant(s): N00014-98-1-0188

Report No.(s): AD-A466124; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466124>

Rapid advancements in acoustical beamforming techniques for array signal processing are producing algorithms with increased levels of computational complexity. Concomitantly, autonomous arrays capable of performing most or all of the processing in situ have become a focus for mission-critical applications. To address these changes, future sonar systems will take advantage of parallel in-array processing by coupling transducer nodes with low-power processing devices to achieve higher performance and fault tolerance at lower cost. This paper explores parallel algorithms for conventional beamforming (CBF) designed for an in-array processing system. The parallel algorithms presented offer scaled speedup and provide the basis for adaptations in advanced beamforming algorithms.

DTIC

*Beamforming; Computers; Real Time Operation; Signal Processing; Sonar*

**20070026576** Tri-Service General Hospital, Taipei, Taiwan, Province of China

### **How Important is Oblique Vision in Aviation?**

Chang, Cheng-Jong; Aug 15, 2006; 24 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0308; FA5209-05-T-0134

Report No.(s): AD-A466498; AOARD-054003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466498>

(A) We propose a basic system layout that combines with the microdisplay for contrast sensitivity function measurement. The optical components need to be modified to eliminate the aberrations. (B) We made the power and control electronics for this system that increase the capabilities to build the specific deformable pattern by our self. (C) We measured the interferences patterns for the deformable mirror and build the influences matrix (D) We did NOT complete the system due the limited

resources. It is believed that without appropriate financial management, it is not easy to complete the whole system in schedules. (E) We have measured the interferences patterns of the deformable mirror with our driving power system. Preliminary results indicate that there might be some problems for the driving issues in the deformable mirror that leads to the slower or breakdown of the elimination of the aberration. Also, the reason that the optical components in this layout can not work perfectly is due to the large aberrations near the camera lens of the CCD and also part of the relay system. A modified design is accomplished.

DTIC

*Adaptive Optics; Detection; Vision; Wave Fronts*

**20070026694** Texas Univ., Austin, TX USA

**Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues**

Sardar, Dhiraj K; Yow, Raylon M; Thomas, Robert J; Dec 2006; 25 pp.; In English

Contract(s)/Grant(s): FA8650-05-1-6641; Proj-7757

Report No.(s): AD-A466743; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466743>

The objective of this research was to systematically measure the temperature dependence of optical properties of various bovine eye tissues at elevated temperatures (above body temperature) using different experimental and computational techniques. The temperature dependence of absorption and scattering coefficients of bovine ocular tissue in the temperature range of 24 to 40 degrees C at 980nm was measured. After computing diffuse reflectance and total transmittance, it was determined that any temperature dependence of the diffuse reflectance and total transmittance could not be discerned with the current setup in the temperature range of interest. The average diffuse reflectance and total transmittance values over all measured temperatures were input into the inverse adding doubling computer program. The resulting absorption coefficients were comparable to those reported by Sardar et al., but the scattering coefficients were not, perhaps due to some specular reflection inadvertently measured in the previous work. The rate of change of the refractive index with respect to temperature was performed at 632.8nm for bovine aqueous and vitreous humor in the temperature range of 37 to 41 degrees C. using the Mach-Zehnder interferometer setup. The measured refractive index with respect to temperature for bovine aqueous humor was comparable to that of water, while the measured value for bovine vitreous humor was slightly less than the value for water. These values are necessary for accurately modeling thermal lensing and hence light propagation in the eye.

DTIC

*Cattle; Computation; Measurement; Optical Properties; Radiation Spectra; Refractivity; Scattering; Temperature Dependence; Tissues (Biology)*

**20070026785** Army Tank-Automotive and Armaments Command, Warren, MI USA

**Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting**

Meitzler, Tom; Bryk, Darryl; Sohn, E J; Gillis, Jennifer; Lane, Kim; Oct 14, 2004; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467436; TARDEC-14344; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467436>

The purpose of this preliminary set of measurements is to obtain a qualitative idea of the magnitude of visible and infrared emissions of the Black-Out (BO) lamps on a M1025 vehicle HMMWV. The question to be answered is the degree of infrared security that exists with the present BO drive and marker lamps. Also, what effect, if any, does an IR filter kit has on the infrared security of the vehicle.

DTIC

*Electromagnetic Radiation; Emission; Illuminating; Infrared Filters; Luminaires; Mobility*

**20070027364** Air Force Research Lab., Kirkland AFB, NM USA

**Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT)**

Butterworth, Jeffrey A; Hindman, Charles; Lacy, Seth; Jan 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4846

Report No.(s): AD-A467283; AFRL-VS-PS-TP-2007-1022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

High performance laser communication systems require adaptive optics based wavefront correction systems to correct

aberrations that result from imperfections in optical hardware and atmospheric conditions. Traditionally, deformable membrane mirrors are used for wavefront correction. These mirrors are bulky and require excessive amounts of power, both of which can be detrimental to a space application. Liquid crystal based optical phased arrays (OPAs) offer an attractive alternative to these traditional devices. This paper presents a method of correcting wavefront aberrations with an OPA device by utilizing phase reconstruction of point-source images and Zernike polynomial parameterizations of the OPA. Limitations of common OPA architectures that reduce the effectiveness of the proposed wavefront correction method will be discussed. A simulation will demonstrate the effectiveness of the proposed technique.

DTIC

*Aberration; Correction; Optical Communication; Parameterization; Phased Arrays; Polynomials; Wave Fronts*

**20070027684** Air Force Research Lab., Rome, NY USA

**Rapid C4I High Performance Computing for Hyperspectral Imaging Exploitation**

Ramseyer, George O; Spetka, Scott E; Linderman, Richard E; Romano, Brian C; Jun 2001; 8 pp.; In English

Report No.(s): AD-A468111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A multidisciplinary effort has been initiated which spans the C4I and signal/image processing computational technology areas to integrate diverse capabilities of existing hyperspectral image exploitation systems. The primary objective of the project is to develop and demonstrate support for the rapid, low latency exploitation of hyperspectral information. A flexible and open framework will service exploitation requests from C4I users by tapping into large, dynamic databases of previously processed and raw data to deliver products to the requester with minimal latency. A web-based interface is being developed so that any authorized user with a web browser can input requests. The user can select data sources, exploitation time intervals, and a parallelized exploitation method for execution. To maximize productivity and minimize the decision making cycle of the requestors, algorithm parallelization efforts seek to achieve a minimal latency before initial results begin to stream back to the requestor in typical web prioritized fashion.

DTIC

*Exploitation; Imagery; Imaging Techniques*

**20070027816** Arizona Univ., Tucson, AZ USA

**Preflight and Vicarious Calibration of Hyperspectral Imagers**

Thome, K J; Biggar, S F; Jan 15, 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-06-C-0012; Proj-1010

Report No.(s): AD-A468574; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the work period during the first year of the project to develop a comprehensive calibration/characterization plan describing methods to evaluate the alignment and focus of the optical elements, image quality based on the MTF of the system, stray light, spectral response, polarization sensitivity, detector-to-detector radiometric calibration in both a relative and absolute sense. In addition to the preflight characterization calibration plan, the work includes discussions of vicarious calibration approaches that act as a supplement to the onboard calibration systems to ensure that the sensor is behaving properly while in use.

DTIC

*Calibrating; Imagery*

**20070028548** University of Southern California, Los Angeles, CA USA

**Next-Generation Image and Sound Processing Strategies: Exploiting the Biological Model**

Mel, Bartlett W; Grzywacz, Norberto M; Itti, Laurent; Narayanan, Shri; May 1, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0746

Report No.(s): AD-A467440; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our overarching goal in this project is to extend the technical state-of-the-art in mid-level visual and auditory signal processing using an integrative biologically inspired approach. The work described in this progress report is a continuation of our efforts to (1) imitate biological sensory feature extraction methods, and (2) use those biologically-inspired sensory features to focus attention on the most important information in complex visual and auditory scenes.

DTIC

*Image Processing; Images*

**20070028563** Mirick, OConnell, DeMallie, and Lougee, LLP, Westborough, MA, USA

**Polarized Optical Probes**

Chinnock, R. B., Inventor; 30 Apr 04; 13 pp.; In English

Contract(s)/Grant(s): NHI-1 R43 CA103083-01

Patent Info.: Filed Filed 30 Apr 04; US-Patent-Appl-SN-10-835-747

Report No.(s): PB2007-104058; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A variably-polarizing optical probe assembly. The assembly includes an optical probe having one or more optical light delivery channels that emit incident light from the sample end of the probe toward a sample being investigated, and one or more optical light-receiving channels that receive incident light from the sample. A variably-polarizing substrate assembly is coupled to the sample end of the probe. The substrate assembly includes an optically transmitting substrate and one or more discrete polarizer areas on a face of the substrate, each such polarizer area defining a polarization orientation, with the polarizer areas together defining one or more different polarization orientations. The substrate assembly is arranged relative to the probe such that one polarizer area covers at least one light delivery channel and one polarizer area covers at least one light-receiving channel.

NTIS

*Optical Properties; Probes; Polarizers*

**20070028579** Workman Nydegger, Salt Lake, UT, USA

**Vertical Cavity Surface Emitting Laser Having a Gain Guide Aperture Interior to an Oxide Confinement Layer**

Cox, J. A., Inventor; Struzelecka, E., Inventor; 6 Jun 06; 7 pp.; In English

Contract(s)/Grant(s): 70NANB5H1114

Patent Info.: Filed Filed 6 Jun 06; US-Patent-Appl-SN-11-147-135

Report No.(s): PB2007-104192; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A VCSEL with current confinement achieved by an oxide insulating region and by an ion implant region. An annular shaped oxide layer is formed, and a gain guide ion implant is formed. The ion implant gain guide includes a central region having high conductivity. The VCSEL further includes first and second mirrors that are separated by an optical path of at least one wavelength. Furthermore, the oxide insulating region beneficially has a optical path of less than 1/4 wavelength. The ion implanted spatial region is beneficially concentrically aligned with the oxide insulating region.

NTIS

*Apertures; Confinement; Laser Cavities; Oxides; Surface Emitting Lasers*

**20070028903** Lawrence Livermore National Lab., Livermore, CA USA

**Visible and Infrared Optical Design for the ITER Upper Ports**

Lasnier, C. J.; Seppala, L. G.; Morris, K.; Groth, M.; Fenstermacher, M. E.; Mar. 04, 2007; 93 pp.; In English

Report No.(s): DE2007-902282; UCRL-TR-228629; No Copyright; Avail.: National Technical Information Service (NTIS)

This document contains the results of an optical design scoping study of visible-light and infrared optics for the ITER upper ports, performed by LLNL under contract for the US ITER Project Office. ITER is an international collaboration to build a large fusion energy tokamak with a goal of demonstrating net fusion power for pulses much longer than the energy confinement time. At the time of this report, six of the ITER upper ports are planned to each to contain a camera system for recording visible and infrared light, as well as other diagnostics. The performance specifications for the temporal and spatial resolution of this system are shown in the Section II, Functional Specifications. We acknowledge a debt to Y. Corre and co-authors of the CEA Cadarache report ITER wide-angle viewing and thermographic and visible system. Several of the concepts used in this design are derived from that CEA report. The infrared spatial resolution for optics of this design is diffraction-limited by the size of the entrance aperture, at lower resolution than listed in the ITER diagnostic specifications. The size of the entrance aperture is a trade-off between spatial resolution, optics size in the port, and the location of relay optics. The signal-to-noise ratio allows operation at the specified time resolutions.

NTIS

*Design Analysis; Fusion Reactors; Infrared Radiation; Optical Equipment; Thermonuclear Reactions; Tokamak Devices*

**20070029223** Lawrence Livermore National Lab., Livermore, CA USA

**EUV Inspection of Reticle Defect Repair Sites**

Goldberg, K.; Barty, A.; Mar. 02, 2007; 9 pp.; In English

Report No.(s): DE2007-902264; UCRL-PROC-228584; No Copyright; Avail.: Department of Energy Information Bridge

We report the actinic (EUV wavelength) and non-actinic inspection of a multilayer-coated mask blank containing an array

of open-field defect repair sites, created in different ways. The comparison of actinic bright-field and dark-field measurements shows the importance of having both local reflectivity and scattering measurements. Although effective mask blank repair capabilities have not been adequately demonstrated, the data acquired in this experiment have been very instructive. Correlation with non-actinic inspection methods shows the difficulty of establishing a successful predictive model of the EUV response without EUV cross-comparison. The defect-repair sites were also evaluated with SEM, AFM, and 488-nm-wavelength confocal microscopy. The data raise important questions about mask quality specifications and the requirements of future commercial actinic inspection tools.

NTIS

*Defects; Extreme Ultraviolet Radiation; Inspection; Masks; Reticles*

**20070029240** Lawrence Livermore National Lab., Livermore, CA USA

**Development of Technologies to Utilize Laser Plasma Radiations Sources for Radiation Effects Sciences**

Davis, J. F.; Feb. 02, 2007; 16 pp.; In English

Report No.(s): DE2007-900876; UCRL-TR-227708; No Copyright; Avail.: National Technical Information Service (NTIS)

This final report will cover work performed over the period of November 11, 2005 to September 30, 2006 on the contract to develop technologies using laser sources for radiation effects sciences. The report will discuss four topic areas; the laser source experiments on the Gekko Laser at Osaka, Japan, planning for the Charge State Freeze Out experiments to be performed in calendar year 2007, a review of previous xenon gasbags on the LANL Trident laser to provide planning support to the May-June 2007 HELEN experiments.

NTIS

*Laser Plasmas; Lasers; Plasma Radiation; Radiation Effects*

**20070029245** Lawrence Livermore National Lab., Livermore, CA USA

**Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors**

Jones, S. M.; Oilvier, S.; Chen, D.; Satta, S.; Joeres, S.; Feb. 06, 2007; 16 pp.; In English

Report No.(s): DE2007-900861; UCRL-CONF-227784; No Copyright; Avail.: National Technical Information Service (NTIS)

The widely differing spatial, temporal, and density scales needed to accurately model the fast ignition process and other short-pulse laser-plasma interactions leads to a computationally challenging project that is difficult to solve using a single code. This report summarizes the work performed on a three year LDRD to couple together three independent codes using PYTHON to build a new integrated computational tool. An example calculation using this new model is described.

NTIS

*Adaptive Optics; Deformable Mirrors; Ignition*

**20070029287** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA; State Univ. of New York, Albany, NY, USA; SEMATECH, Austin, TX USA

**Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool**

Naulleau, P.; Cain, J.; Dean, K.; Goldberg, K. A.; January 2006; 7 pp.; In English

Report No.(s): DE2007-901033; No Copyright; Avail.: National Technical Information Service (NTIS)

Although tremendous progress has been made in the crucial area of fabrication of extreme ultraviolet (EUV) projection optics, the realization diffraction-limited high numerical aperture (NA) optics (above 0.2 NA) remains a concern. The highest NA EUV optics available to date are the 0.3-NA Microfield Exposure Tool (MET) optics used in an experimental exposure station at Lawrence Berkeley National Laboratory (1) and commercial METs (2) at Intel and SEMATECH-North. Even though these optics have been interferometrically demonstrated to achieve diffraction-limited wavefront quality, the question remains as to whether or not such performance levels can be maintained after installation of the optics into the exposure tool. Printing-based quantitative aberration measurements provide a convenient mechanism for the characterization of the optic wavefront error in the actual lithography tool. We present the lithographic measurement of low-order aberrations in the Berkeley MET tool, including a quantitative measurement of astigmatism and spherical error and a qualitative measurement of coma. The lithographic results are directly compared to interferometry results obtained from the same optic. Measurements of the Berkeley MET indicate either an alignment drift or errors in the interferometry on the order of 0.5 to 1 nm.

NTIS

*Aberration; Exposure; Extreme Ultraviolet Radiation; Numerical Aperture*

**20070029299** Lawrence Livermore National Lab., Livermore, CA USA

**High Efficiency Grazing Incidence Pumped X ray Laser**

Dunn, J.; Keenan, R.; Price, D. F.; Patel, P. K.; Smith, R. F.; Sep. 29, 2006; 17 pp.; In English

Report No.(s): DE2007-900117; UCRL-TR-224880; No Copyright; Avail.: National Technical Information Service (NTIS)

The main objective of the project is to demonstrate a proof-of-principle, new type of high efficiency, short wavelength x-ray laser source that will operate at unprecedented high repetition rates (10Hz) that could be scaled to 1kHz or higher. The development of a high average power, tabletop x-ray laser would serve to complement the wavelength range of 3rd and future 4th generation light sources, e.g. the LCLS, being developed by DOE-Basic Energy Sciences. The latter are large, expensive, central, synchrotron-based facilities while the tabletop x-ray laser is compact, high-power laser-driven, and relatively inexpensive. The demonstration of such a unique, ultra-fast source would allow us to attract funding from DOE-BES, NSF and other agencies to pursue probing of diverse materials undergoing ultrafast changes. Secondly, this capability would have a profound impact on the semiconductor industry since a coherent x-ray laser source would be ideal for 'at wavelength' approximately 13 nm metrology and microscopy of optics and masks used in EUV lithography. The project has major technical challenges. We will perform grazing-incidence pumped laser-plasma experiments in flat or groove targets which are required to improve the pumping efficiency by ten times. Plasma density characterization using our existing unique picosecond x-ray laser interferometry of laser-irradiated targets is necessary. Simulations of optical laser propagation as well as x-ray laser production and propagation through freely expanding and confined plasma geometries are essential. The research would be conducted using the Physics Directorate Callisto and COMET high power lasers. At the end of the project, we expect to have a high-efficiency x-ray laser scheme operating below 20 nm at 10Hz with a pulse duration of approximately 2 ps. This will represent the state-of-the-art in x-ray lasers and would be a major step forward from our present picosecond laser-driven x-ray lasers. There is an added bonus of creating the shortest wavelength laboratory x-ray laser, below 4.5 nm and operating in the water window, by using the high-energy capability of the Titan laser.

NTIS

*Grazing Incidence; X Ray Lasers; Light Sources*

**20070029300** Lawrence Livermore National Lab., Livermore, CA USA

**Second Preliminary Report on X-Ray Yields from OMEGA II Targets**

Fournier, K. B.; May, M. J.; MacLaren, S. A.; Coverdale, C. A.; Davis, J. F.; Aug. 30, 2006; 45 pp.; In English

Report No.(s): DE2007-900115; UCRL-TR-224095; No Copyright; Avail.: National Technical Information Service (NTIS)

We present details about X-ray yields measured with LLNL and SNL diagnostics in soft and moderately hard X-ray bands from laser-driven, doped-aerogel targets shot on 07/14/06 during the OMEGA II test series. Yields accurate to plus or minus 25% in the 5-15 keV band are measured with Livermores HENWAY spectrometer. Yields in the sub-keV to 3.2 keV band are measured with LLNLs DANTE diagnostic, the DANTE yields may be 35-40% too large. SNL ran a PCD-based diagnostic that also measured X-ray yields in the spectral region above 4 keV, and also down to the nearly sub-keV range. The PCD and HENWAY and DANTE numbers are compared. The time histories of the X-ray signals are measured with LLNLs H11 PCD, and from two SNL PCDs with comparable filtering. There is a persistent disagreement between the H11 PCD and SNL PCD measured FWHM, which is shown not to be due to analysis techniques. The recommended X-ray waveform is that from the SNL PCD p66k10, which was recorded on a fast, high-bandwidth TDS 6804 oscilloscope, and which are not plotted here.

NTIS

*Diagnosis; Targets; X Rays; X Ray Lasers*

**20070029311** Lawrence Livermore National Lab., Livermore, CA USA

**Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2)**

Schneider, M. B.; Holder, J. P.; James, D. L.; Bruns, H. C.; Celeste, J. R.; Jul. 26, 2006; 18 pp.; In English

Report No.(s): DE2007-900093; UCRL-CONF-223133; No Copyright; Avail.: Department of Energy Information Bridge

The soft x-ray imager (SXRI) built for the first experiments at the National Ignition Facility (NIF) has four soft x-ray channels and one hard x-ray channel. The SXRI is a snout that mounts to a four strip gated imager. This produces four soft x-ray images per strip, which can be separated in time by approximately 60 p sec. Each soft x-ray channel consists of a mirror plus a filter. The diagnostic was used to study x-ray burnthrough of hot hohlraum targets at the NIF and OMEGA lasers. The SXRI snout design and issues involved in selecting the desired soft x-ray channels are discussed.

NTIS

*Diagnosis; Lasers; X Ray Imagery; X Rays*



**20070029346** Lawrence Livermore National Lab., Livermore, CA USA

**Laser Plasma Interactions in High Energy Density Plasmas**

Baldis, H.; Oct. 20, 2006; 14 pp.; In English

Report No.(s): DE2007-900158; UCRL-TR-225455; No Copyright; Avail.: National Technical Information Service (NTIS)

High temperature hohlraums (HTH) are designed to reach high radiation temperatures by coupling a maximum amount of laser energy into a small target in a short time. These 400-800 (micro)m diameter gold cylinders rapidly fill with hot plasma during irradiation with multiple beams in 1ns laser pulses. The high-Z plasmas are dense, (electron density,  $n(\text{sub } e)/n(\text{sub } c)$  approximately 0.1-0.4), hot (electron temperature,  $T(\text{sub } e)$  approximately 10keV) and are bathed in a high-temperature radiation field (radiation temperature,  $T(\text{sub } \text{rad})$  approximately 300eV). Here  $n(\text{sub } c)$ , the critical density, equals  $9 \times 10^{21}/\text{cm}^3$ . The laser beams heating this plasma are intense (approximately  $10^{15}$  -  $10^{17}$  W/cm<sup>2</sup>). The coupling of the laser to the plasma is a rich regime for Laser-Plasma Interaction (LPI) physics. The LPI mechanisms in this study include beam deflection and forward scattering. In order to understand the LPI mechanisms, the plasma parameters must be known. An L-band spectrometer is used to measure the electron temperature. A ride-along experiment is to develop the x-radiation emitted by the thin back wall of the half-hohlraum into a thermal radiation source.

NTIS

*Laser Plasma Interactions; Plasmas (Physics)*

**20070029476** Lawrence Livermore National Lab., Livermore, CA USA

**Compact Imaging Spectrometer Utilizing Immersed Gratings**

Lerner, S. A., Inventor; 6 Oct 03; 7 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed 6 Oct. 03; US-Patent-Appl-SN-10-680 847

Report No.(s): PB2007-108629; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A compact imaging spectrometer comprising an entrance slit for directing light, lens means for receiving the light, refracting the light, and focusing the light; an immersed diffraction grating that receives the light from the lens means and diffracts the light, the immersed diffraction grating directing the diffracted light back to the lens means; and a detector that receives the light from the lens means.

NTIS

*Imaging Spectrometers; Spectrometers; Gratings (Spectra)*

**20070029758** University of Central Florida, Orlando, FL USA

**Coherence and Polarization Properties of Far Fields Generated by Quasi-Homogeneous Planar Electromagnetic Sources (Postprint)**

Korotkova, Olga; Hoover, Brian G; Gamiz, Victor L; Wolf, Emil; Feb 3, 2005; 12 pp.; In English

Contract(s)/Grant(s): FA9451-04-C-0353

Report No.(s): AD-A469044; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469044>

In studies of radiation from partially coherent sources the so-called quasi-homogeneous (QH) model sources have been very useful, for instance in elucidating the behavior of fields produced by thermal sources. The analysis of the fields generated by such sources has, however, been largely carried out in the framework of scalar wave theory. In this paper we generalize the concept of the QH source to the domain of the electromagnetic theory, and we derive expressions for the elements of the cross-spectral density matrix, for the spectral density, the spectral degree of coherence, the degree of polarization, and the Stokes parameters of the far field generated by planar QH sources of uniform states of polarization. We then derive reciprocity relations analogous to those familiar in connection with the QH scalar sources. We illustrate the results by determining the properties of the far field produced by transmission of an electromagnetic beam through a system of spatial light modulators.

DTIC

*Electromagnetic Radiation; Far Fields; Light Modulators*

**20070029957** Northeastern Univ., Boston, MA, USA

**Final Scientific/Technical Phase I Report on Sliding Mode Pulsed Current Averaging IC Drivers for High-Brightness Light Emitting Diodes**

Shteynberg, A.; Aug. 17, 2006; 25 pp.; In English

Contract(s)/Grant(s): DE-FG02-05ER86261

Report No.(s): DE2007-889754; No Copyright; Avail.: National Technical Information Service (NTIS)

This project developed new Light Emitting Diode (LED) driver ICs associated with specific (uniquely operated) switching

power supplies that optimize performance for High Brightness LEDs (HB-LEDs). The drivers utilize a digital control core with a newly developed nonlinear, hysteretic/sliding mode controller with mixed-signal processing. The drivers are flexible enough to allow both traditional microprocessor interface as well as other options such as on the fly adjustment of color and brightness.

NTIS

*Brightness; Light Emitting Diodes; Sliding; Supplying; Switching*

## 75

### PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**20070029244** Lawrence Livermore National Lab., Livermore, CA USA

#### **Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions**

Town, R. P. J.; Chung, H. K.; Langdon, A. B.; Lasinski, B. F.; Lund, S. M.; Feb. 06, 2007; 11 pp.; In English

Report No.(s): DE2007-900863; UCRL-TR-227795; No Copyright; Avail.: National Technical Information Service (NTIS)

The widely differing spatial, temporal, and density scales needed to accurately model the fast ignition process and other short-pulse laser-plasma interactions leads to a computationally challenging project that is difficult to solve using a single code. This report summarizes the work performed on a three year LDRD to couple together three independent codes using PYTHON to build a new integrated computational tool. An example calculation using this new model is described.

NTIS

*Ignition; Predictions; Targets*

**20070029298** Lawrence Livermore National Lab., Livermore, CA USA

#### **Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry**

Nilsen, J.; Castor, J. I.; Iglesias, C. A.; Cheng, K. T.; Dunn, J.; Sep. 08, 2006; 12 pp.; In English

Report No.(s): DE2007-900119; UCRL-PROC-224273; No Copyright; Avail.: Department of Energy Information Bridge

For decades the electron density of plasmas has been measured using optical interferometers. With the availability of good X-ray laser sources in the last decade interferometers have been extended into the wavelength range 14-72 nm, which has enabled researchers to probe even higher density plasmas. The data analysis assumes that the index of refraction is less than one and is due only to the free electrons in the plasmas. Recent interferometer experiments using Al plasmas observed an index of refraction greater than one at 14 nm and showed how the anomalous dispersion from bound electrons can dominate the free electron contribution to the index of refraction in many plasmas. Using our average-atom and atomic physics codes together with experimental data we searched for other plasmas that would have an index of refraction greater than one in an X-ray laser interferometer operating at 47 nm. We identified several promising candidates. We present the calculations and the experimental confirmation that doubly ionized Ag, Sn, and C plasmas have an index of refraction greater than one at the 46.9 nm wavelength (26.44 eV) of the capillary discharge Ne-like Ar soft X-ray laser. These results show that bound electrons can dominate the index of refraction of numerous plasmas over a broad range of soft X-ray wavelengths.

NTIS

*Laser Interferometry; Plasmas (Physics); X Ray Lasers*

**20070029398** Lawrence Livermore National Lab., Livermore, CA USA

#### **Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation**

Nevins, W. M.; Candy, J.; Cowley, S.; Dannert, T.; Dimits, A.; May 23, 2006; 67 pp.; In English

Report No.(s): DE2007-900467; UCRL-CONF-221590; No Copyright; Avail.: National Technical Information Service (NTIS)

Numerical simulations of electron temperature gradient (ETG) turbulence are presented which characterize the ETG fluctuation spectrum, establish limits to the validity of the adiabatic ion model often employed in studying ETG turbulence, and support the tentative conclusion that plasma-operating regimes exist in which ETG turbulence produces sufficient electron heat transport to be experimentally relevant. We resolve prior controversies regarding simulation techniques and convergence by benchmarking simulations of ETG turbulence from four microturbulence codes, demonstrating agreement on the electron heat flux, correlation functions, fluctuation intensity, and rms flow shear at fixed simulation cross section and resolution in the plane perpendicular to the magnetic field. Excellent convergence of both continuum and particle-in-cell codes with time step

and velocity-space resolution is demonstrated, while numerical issues relating to perpendicular (to the magnetic field) simulation dimensions and resolution are discussed. A parameter scan in the magnetic shear,  $s$ , demonstrates that the adiabatic ion model is valid at small values of  $s$  ( $s < 0.4$  for the parameters used in this scan) but breaks down at higher magnetic shear. A proper treatment employing gyrokinetic ions reveals a steady increase in the electron heat transport with increasing magnetic shear, reaching electron heat transport rates consistent with analyses of experimental tokamak discharges.

NTIS

*Electron Energy; Temperature Gradients; Tokamak Devices; Turbulence; Numerical Analysis; Simulation*

## 76

### SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

**20070026521** NDE Computational Consultants, Dublin, OH USA

#### **Impact Location for a Multilayer Transversely Isotropic Plate**

Martin, Steven A; Jata, Kumar V; Kuhr, Samuel J; Medina, Enrique A; Oct 2006; 11 pp.; In English

Contract(s)/Grant(s): F33615-03-C-5220; Proj-4349

Report No.(s): AD-A466369; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466369>

This paper will address analytical research work performed on impact location in an anisotropic multilayered thermal protection structure. The propagation of elastodynamic waves through the multilayer structure and the possibility that the layers are transversely isotropic are two complications that are addressed. The method used is an extension of classical triangulation based on the use of the fixed geometry of the multilayer plate structure, quasi-longitudinal modes, and the generalized Snell's law for transversely isotropic materials. The impact localization problem is recast as a minimization problem whose objective function is the sum of the distances between all combination pairs of constant time difference curves for the sensor pairs. An initial estimate is made for the parameter values for the collection of constant time difference curves. The Newton-Kantorovich algorithm is then used to generate a sequence of iterations which converge to the minimum of the objective function. This generates a point on each of the collection of curves. The centroid of this point set is calculated and used for the approximation for the impact point.

DTIC

*Anisotropy; Isotropism; Isotropy; Position (Location)*

**20070029256** Arkansas Univ., Fayetteville, AR, USA

#### **Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications.**

Naseem, H. A.; Abu-Safe, H. H.; January 2005; 32 pp.; In English

Contract(s)/Grant(s): DE-FG02-02ER45965

Report No.(s): DE2007-899164; DOE/ET-45965; No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of this project was to investigate metal-induced crystallization of amorphous silicon at low temperatures using excitation sources such as laser and rapid thermal annealing, as well as, electric field. Deposition of high quality crystalline silicon at low temperatures allows the use of low cost soda-lime glass and polymeric films for economically viable photovoltaic solar cells and low cost large area flat panel displays. In light of current and expected demands on Si supply due to expanding use of consumer electronic products throughout the world and the incessant demand for electric power the need for developing high grade Si thin films on low cost substrate becomes even more important. We used hydrogenated and un-hydrogenated amorphous silicon deposited by plasma enhanced chemical vapor deposition and sputtering techniques (both of which are extensively used in electronic and solar cell industries) to fabricate nano-crystalline, poly-crystalline (small as well as large grain), and single-crystalline (epitaxial) films at low temperatures. We demonstrated Si nanowires on flat surfaces that can be used for fabricating nanometer scale transistors. We also demonstrated lateral crystallization using Al with and without an applied electric field. These results are critical for high mobility thin film transistors (TFT) for large area display applications. Large grain silicon (30-50 nm grain size for  $< 0.5$   $\mu\text{m}$  thick films) was demonstrated on glass substrates at low temperatures. We also demonstrated epitaxial growth of silicon on (100) Si substrates at temperatures as low as 450°C. Thin film Si solar cells are being projected as the material of choice for low cost high efficiency solar cells when properly coupled with excellent light-trapping schemes. Ar ion laser (CW) was shown to produce dendritic nanowire structures at low power

whereas at higher powers yielded continuous polycrystalline films. The power density required for films in contact with Al was demonstrated to be at least two orders of magnitude lower than that reported in the literature before. Polysilicon was successfully achieved on polyimide (KaptonCO) films. Thin film Si solar cells on lightweight stable polymer offer great advantage for terrestrial and space power applications. In summary we have demonstrated through this research the viability of producing low cost nano-, poly-, and epitaxial Si material on substrates of choice for applications in economically viable environmentally friendly sustainable solar power systems. This truly enabling technology has widespread applications in multibillion dollar electronic industry and consumer products.

NTIS

*Additives; Amorphous Silicon; Crystallization; Excitation; Low Temperature; Microelectronics; Silicon; Solar Cells*

**20070029260** Fermi National Accelerator Lab., Batavia, IL, USA

#### **AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System**

Velev, G. V.; DiMarco, J.; Harding, D. J.; Kashikhin, V.; Lamm, M.; January 2006; 3 pp.; In English

Report No.(s): DE2007-901114; FERMILB-CONF-06-235-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

The first prototype of a new corrector package for the Fermilab Booster Synchrotron is presently in production. This water-cooled package includes normal and skew dipole, quadrupole and sextupole elements to control orbit, tune and chromaticity of the beam over the full range of Booster energies (0.4-8 GeV). These correctors operate at the 15 Hz excitation cycle of the main synchrotron magnets, but must also make more rapid excursions, in some cases even switching polarity in approximately 1 ms at transition crossing. To measure the dynamic field changes during operation, a new method based on a relatively slow rotating coil system is proposed. The method pieces together the measured voltages from successive current cycles to reconstruct the field harmonics. This paper describes the method and presents initial field quality measurements from a Tevatron corrector.

NTIS

*Alternating Current; Electric Fields; Particle Accelerators; Rotation; Synchrotrons*

**20070029278** Stanford Linear Accelerator Center, Stanford, CA, USA

#### **Variable Directional Coupler for an Alternate ILC High-Power RF Distribution Scheme**

Nantista, C. D.; Adolphsen, C.; Feb. 2007; 3 pp.; In English

Report No.(s): DE2007-900986; SLAC-PUB-12372; No Copyright; Avail.: National Technical Information Service (NTIS)

We describe the design and functionality of an RF directional coupler for which the power division between the output ports is mechanically variable. In an alternate power distribution scheme for the ILC, power is delivered to cavities in pairs, through hybrids. Four pairs, or eight cavities, are fed from one waveguide feed, from which one fourth, one third, and one half of the power is coupled out at consecutive directional couplers. Three such feeds are powered by a single 10 MW klystron. Experience suggests that cavities considered useable will display some variation in the operational accelerating gradient they can sustain. With fixed distribution, the klystron power must be kept below the level at which the weakest cavity out of 24 receives its power limit. This problem can be solved by installing variable attenuators, but that means wasting precious power. With adjustable coupling, distribution can be optimized for more efficient use both of available power and of the accelerating cavities. This novel device, feeding cavities paired by similar performance, can provide such benefit to the ILC.

NTIS

*Couplers; Particle Accelerators; Radio Frequencies*

**20070029292** Fermi National Accelerator Lab., Batavia, IL, USA

#### **Fermi Timing and Synchronization System**

Wilcox, R.; Staples, J.; Doolittle, L.; Byrd, J.; Ratti, A.; January 2006; 41 pp.; In English

Report No.(s): DE2007-900945; No Copyright; Avail.: National Technical Information Service (NTIS)

The Fermi FEL will depend critically on precise timing of its RF, laser and diagnostic subsystems. The timing subsystem to coordinate these functions will need to reliably maintain sub-100fs synchronicity between distant points up to 300m apart in the Fermi facility. The technology to do this is not commercially available, and has not been experimentally demonstrated in a working facility. Therefore, new technology must be developed to meet these needs. Two approaches have been researched by different groups working with the Fermi staff. At MIT, a pulse transmission scheme has been developed for synchronization of RF and laser devices. And at LBL, a CW transmission scheme has been developed for RF and laser synchronization. These respective schemes have advantages and disadvantages that will become better understood in coming

years. This document presents the work done by both teams, and suggests a possible system design which integrates them both. The integrated system design provides an example of how choices can be made between the different approaches without significantly changing the basic infrastructure of the system. Overall system issues common to any synchronization scheme are also discussed.

NTIS

*Circuits; Free Electron Lasers; Synchronism; Time Measurement*

**20070029294** Lawrence Livermore National Lab., Livermore, CA USA

**Quantitative Experiments with Electrons in a Positively Charged Beam**

Molvik, A. W.; Vay, J. L.; Covo, M. K.; Coehn, R.; Baca, D.; Dec. 07, 2006; 35 pp.; In English

Report No.(s): DE2007-900881; UCRL-PROC-226637; No Copyright; Avail.: National Technical Information Service (NTIS)

Intense ion beams are difficult to maintain as non-neutral plasmas. Experiments and simulations are used to study the complex interactions between beam ions and (unwanted) electrons. Such electron clouds limit the performance of many accelerators. To characterize electron clouds, a number of parameters are measured including: total and local electron production and loss for each of three major sources, beam potential versus time, electron line-charge density, and gas pressure within the beam. Electron control methods include surface treatments to reduce electron and gas emission, and techniques to remove electrons from the beam, or block their capture by the beam. Detailed, self-consistent simulations include beam-transport fields, and electron and gas generation and transport; these compute unexpectedly rich behavior, much of which is confirmed experimentally. For example, in a quadrupole magnetic field, ion and dense electron plasmas interact to produce multi-kV oscillations in the electron plasma and distortions of the beam velocity space distribution, without the system becoming homogenous or locally neutral.

NTIS

*Electron Beams; Electron Clouds; Electrons; Ion Beams; Particle Accelerators*

**20070029411** Fermi National Accelerator Lab., Batavia, IL, USA

**Massive Metrology: Development and Implementation of a 3D Reference Frame for the Realignment of Fermilab's Tevatron**

Greenwood, J. A.; Wojcik, G. J.; Sep. 2006; 14 pp.; In English

Report No.(s): DE2007-899065; FERMILAB-CONF-06-510-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors of this paper will discuss the project known as TeVnet. TeVnet is a combined horizontal and vertical survey network that was developed to provide spatial control for the three key machines of the Fermilab accelerator complex Tevatron, Main Injector, and Anti-Proton source. This paper focuses on the survey network design, observation, and analysis, of an effort with the objective of increased performance and reliability of the accelerator complex by ensuring spatially correct placement of the beam-line components.

NTIS

*Coordinates; Metrology; Particle Accelerators*

**20070029494** UT-Battelle, LLC, Oak Ridge, TN, USA

**Superconductors on Iridium Substrates and Buffer Layers**

Paranthaman, M. P., Inventor; Aytug, T., Inventor; 23 Mar 04; 23 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Patent Info.: Filed Filed 23 Mar 04; US-Patent-Appl-SN-10-809 174

Report No.(s): PB2007-104091; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Superconducting materials have been applied epitaxially to biaxially textured support materials in the ongoing effort to fabricate robust, flexible superconductors characterized by sufficiently high high critical current density ( $J_{sub.c}$ ) and scalability to industrially useful lengths. An important class of substrates is known as rolling assisted, biaxially textured substrates (RABiTS). The present invention is an important stepping stone in that effort.

NTIS

*Iridium; Substrates; Superconductors (Materials)*

## PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics*, *73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

**20070027711** Air Force Research Lab., Edwards AFB, CA USA

### **Effect of Thermal Conductivity on the Knudsen Layer at Ablative Surfaces**

Pekker, L; Keidar, M; Cambier, J L; Mar 23, 2007; 14 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A468327; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we develop an analytical model of Knudsen layer at the ablative wall taking into account the temperature gradient in the bulk gas. The region of validity of the existing models and effect of the temperature gradient on the Knudsen layer properties are calculated.

DTIC

*Ablation; Ablative Materials; Thermal Conductivity*

**20070027815** American Bureau of Shipping (ABS), Houston, TX USA

### **Consequence Assessment Methods for Incidents Involving Releases From Liquefied Natural Gas Carriers**

May 13, 2004; 129 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FERC04C40196

Report No.(s): AD-A468573; GEMS-1288209; 131-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Liquefied natural gas (LNG) has been transported by sea since 1959 in specially designed LNG carriers. These vessels have a remarkable safety record and provide an essential link in the movement of LNG from production locations to consumer locations. However, stakeholders recognize that there are possibilities for some serious incidents involving LNG carriers, particularly in light of increased awareness and concern about potential terrorist actions. The Federal Energy Regulatory Commission (FERC) sponsored this study with the goal of identifying appropriate consequence analysis methods for estimating flammable vapor and thermal radiation hazard distances for potential LNG vessel cargo releases during transit and while at berth. This work considers the flammable vapor and thermal radiation hazards created by unconfined LNG spills on water resulting from an LNG cargo release. This includes review of literature on experimental LNG spills and on consequence assessment methodologies that are applicable to modeling of incidents involving LNG spills on water.

DTIC

*Liquefied Natural Gas; Radiation Hazards; Spilling*

**20070029833** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

### **Characterization of a Hall Effect Thruster Using Thermal Imaging**

Tomaszewski, James W; Mar 2007; 86 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469185; AFIT/GA/ENY/07-M18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469185>

A Hall thruster uses ionized xenon as a propellant for space propulsion applications. The heat produced by thruster components and the xenon plasma transfers to space and the spacecraft, impacting thruster and spacecraft design, as well as thruster efficiency and lifetime. Therefore, thermal information was gathered and analyzed in order to better understand the thermal characteristics of an operating thruster and to provide data applicable to improving the thruster efficiency and lifetime. This paper contains analysis of thruster temperatures obtained using a commercially available FLIR A40M thermographic imager in order to characterize a Busek Inc. 200W Hall Effect Thruster operating in Chamber 6 at the Air Force Research Laboratory at Edwards AFB, CA. This method is non-intrusive in that the thruster is viewed from outside the chamber through a zinc selenide window and provides temperature data on the entire visible area of the thruster for output to a computer for further processing. Maximum temperatures observed were above 773 K on the alumina plasma sprayed portion of the cathode, the anode, and on the thruster body near the exit plane. Magnet core winding temperature varied from 620 K near the exit plane to 475 K near the rear of the thruster. If these temperatures are near the magnet core temperature, it suggests they are not near the Curie temperature for iron of 1043 K or the Curie temperature of 858 K of iron alloyed with nickel. Initial heating rates

of up to 138 K/min and initial cooling rates of up to 218 K/min were observed. The steady state temperature images and the heating data indicated a possible interaction between xenon and the thruster components.

DTIC

*Hall Effect; Hall Thrusters; Thermal Mapping; Thermodynamic Properties*

## 80

### SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

**20070029420** NASA Johnson Space Center, Houston, TX, USA

#### **Baylor College of Medicine Saturday Morning Science Workshop**

Robinson, Judith; April 29, 2007; 1 pp.; In English; Baylor college of Medicine Saturday Morning Science Workshop, 29 Apr. 2006, Houston, TX, USA; No Copyright; Avail.: Other Sources; Abstract Only

This program is targeting inner city students who are deemed 'underachieving' by their teachers.

Author

*Students; Achievement; Education*

## 81

### ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**20070028559** NASA Johnson Space Center, Houston, TX, USA

#### **Developing Metrics in Systems Integration (ISS Program COTS Integration Model)**

Lueders, Kathryn; August 22, 2007; 11 pp.; In English; SOLE 2007, 19-23 Aug. 2007, Pittsburgh, PA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20070028559>

This viewgraph presentation reviews some of the complications in developing metrics for systems integration. Specifically it reviews a case study of how two programs within NASA try to develop and measure performance while meeting the encompassing organizational goals.

CASI

*Systems Integration; Metrology; Space Transportation*

## 82

### DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

**20070026357** RAND Corp., Santa Monica, CA USA

#### **Measuring the Value of High Level Fusion**

Moore, III, Louis R; Gonzales, Daniel; Jun 2004; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A465987; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA465987>

In most current ground force combat simulations, the operational movements and command intent of forces follow prescribed, inflexible objectives and plans. Because of this limitation, the value of advanced intelligence, surveillance, and reconnaissance (ISR) and high-level fusion is reflected only in better targeting and not in improved operational-level command and control (C2). RAND has developed an agent interaction-based constructive simulation called the Ground C4-ISR Assessment Model (GCAM) to help examine the contributions of C4-ISR to ground forces. In GCAM simulated ground force commanders make decisions on the basis of shared awareness derived from information produced by Level 1 (Identify/Correlate), Level 2 (Aggregate/Resolve), and Level 3 (Interpret/Determine/Predict) fusion processes. In this way simulated ground commanders can adapt their plans in response to perceived changes in enemy capability, activity, or intent, or to

perceived changes to the battlefield environment. This paper details the representation of high-level fusion processes used in GCAM and developed with the support of the U.S. Army Model Improvement Program. Those processes are modeled using the Assistant Secretary of Defense for Networks and Information Integration (ASD-NII) Decision Support Center (DSC) Multi-INT fusion study Knowledge Matrix methodology. The information or knowledge added by high-level fusion and analysis of raw sensor data from multiple sources is represented in this methodology by increased information quality levels for activity, capability, and intent. This research will allow military analysts to demonstrate the utility and the relative importance of improved C2 and high-level fusion capabilities for Army and Joint forces.

DTIC

*Military Operations; Multisensor Fusion; Situational Awareness*

**20070026359** Paine Coll., Augusta, GA USA

**The Control of Multi-Agent Systems (MAS)**

Lawless, W F; Bergman, Margo; Feltovich, Nick; Jun 2004; 15 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466002>

Doubt continues that current theories and practices can produce agent or multiagent system (MAS) autonomy (Pynadath et al., 2001), imperiling future MAS missions (Lawless & Grayson, 2004). One possible reason is that from the view of methodological individualism (Nowak & Sigmund, 2004), reality is a stable phenomenon meaning that a single best view of reality is mathematically possible, a thesis that Benardete (2002) rejects. Alternatively, social reality is bistable (bistability occurs when a phenomena exists in one of two interdependent states; e.g., bistable interpretations refer to two stable, incommensurable interpretations of one data set, illustration, or phenomenon), and is best modeled by the quantum relations (Bohr, 1955). Given multiple interpretations of the same context or situation, to control an MAS, a group or decision maker can choose to avoid multiple interpretations as advised by Nash (1950) in order to converge mathematically to a consensus which we conclude is optimal to enact solutions for well-defined problems (wdp's), or to exploit these multiple interpretations which we conclude is the only way to solve ill-defined problems (idp's) (Lawless & Grayson, 2004).

DTIC

*Data Processing; Decision Making*

**20070026368** Silver Bullet Solutions, Inc., Arlington, VA USA

**A Roadmap for Developing Architectures in a Net-Centric World**

Tieso, John V; McDaniel, David; Jun 2004; 24 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466032; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466032>

Architectures are beginning to impact on the process that should accompany data collection and dissemination, more needs to be done to ensure that valid, useful data reaches the right people at the right time, enabling them to take the right action in the emerging Net-Centric Environment. This paper discusses architectural approaches that will facilitate required levels of information transfer and utilization. Information transfer is the critical ingredient in Net-Centric Transformation. Interoperability, integration, and convergence all rely on the availability of valid, current, and confirmable data that can be intelligently pulled as required to satisfy some aspect of a Command, Control, Communications, Computers, Intelligence, Security or Reconnaissance (C4ISR) requirement. A roadmap defines how the architecture is used in creating new systems, systems-of-systems and applications that support net-centricity. The authors propose a method for creating a roadmap to facilitate and focus architecture creation efforts that will maximize their usefulness in development of the Net-Centric Environment. Underlying the paper is a discussion of how two established tools the authors had roles in creating, the DoD Architecture Framework, version 1.0, (DoDAF 1.0) and the Core Architecture Data Model (CADM), provide the structure needed for creating architectures under the roadmap.

DTIC

*Command and Control; Information Transfer; Interoperability*

**20070026378** Naval Postgraduate School, Monterey, CA USA

**A New Perspective on Use of the Critical Decision Method with Intelligence Analysts**

Hutchins, Susan G; Pirolli, Peter L; Card, Stuart K; Jun 2004; 36 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466054>

Intelligence analysts engage in information seeking, evaluation, prediction, and reporting behavior in an extremely



information-intensive work environment. A Cognitive Task Analysis (CTA) was conducted on intelligence analysts to capture data that will provide input to support development of a computational model of the analyst's processes and analytic strategies. A hybrid method was used to conduct the CTA, including a modified version of the critical decision method. Participants were asked to describe an example of a critical analysis assignment where they had to collect, analyze, and produce a report on intelligence of a strategic nature. Procedures used to conduct the CTA are described in this paper along with initial results. Several factors contribute to making the analyst's task challenging: (1) time pressure, (2) a high cognitive workload, and (3) difficult human judgments. Human judgments are involved in considering the plausibility of information, deciding what information to trust, and determining how much weight to place on specific pieces of data. Intelligence analysis involves a complex process of assessing the reliability of information from a wide variety of sources and combining seemingly unrelated events. This problem is challenging because it involves aspects of data mining, data correlation and human judgment.

DTIC

*Cognition; Decision Making; Information Retrieval; Intelligence*

**20070026379** Mitre Corp., Bedford, MA USA

**Air Force Information Workflow Automation through Synchronized Air Power Management (SAPM)**

Benkley, Carl; Chang, Irene; Crowley, John; Oristian, Thomas; Jun 2004; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466055; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466055>

Utilizing emerging information technologies, the Synchronized Air Power Management (SAPM) initiative presents an automated business process to integrate the Air Force (AF) Command and Control (C2) systems at the Wing level. The SAPM Phase I proof-of-concept effort has demonstrated a significant reduction in the time to plan unit taskings, evaluate missions, and execute decisions. SAPM is a joint venture among ESC/AC, AFC2ISRC/DO, MITRE, Microsoft, Lockheed Martin, Northrop Grumman, and DSRC. Implementing Extensible Markup Language (XML) messages, web services, and workflow automation, SAPM expands existing web-based capabilities, enables machine-to-machine interfaces, and streamlines the war fighter kill chain process. SAPM Phase I was successfully demonstrated to senior AF officers and representatives of DoD. Phase II is being developed at the MITRE facility in Bedford, Massachusetts.

DTIC

*Command and Control; On-Line Systems*

**20070026385** Defence Science Technology Lab., Farnborough, UK

**Modelling a Network of Decision Makers**

Gardener, Tim; Moffat, Jim; Pernin, Chris; Jun 2004; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466065; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466065>

New information technologies introduced into military operations provide the impetus to explore alternative operating procedures and command structures. New concepts such as network-centric operations and distributed, decentralized command and control, have been suggested as technologically enabled replacements for platform centric operations and centralized command and control. As attractive as these innovations may seem, it is important that responsible military planners test these concepts before their adoption. To do this it is necessary to build models and simulations and to conduct experiments and exercises. The authors assess the flow of information within three alternative Command and Control (C2) structures using a series of quantitative measures of performance of command and control effectiveness. In terms of the categorization developed by Alberts, these metrics bridge between the information domain and the cognitive domain. The quantitative assessment of information flows within alternative C2 structures is part of a larger programme of work considering the structure of future headquarters for UK armed forces. Outputs are being compared with high level combat models outputs in order to assess the quantitative linkage between our measures of C2 effectiveness and metrics of benefit at the campaign level, measures of force effectiveness.

DTIC

*Command and Control; Decision Making; Models; Warfare*

**20070026387** Defence Research and Development Canada, Valcartier, Quebec Canada

**Information Engineering in Support of Multilateral Joint Operational Interoperability**

Dorion, Eric; Boury-Brisset, Anne-Claire; Jun 2004; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466067; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466067>

In the information age era, there never has been a better time to reflect upon the fact that information in itself is something that has to be engineered. Since command and control is a cognitive process by which the commander gains situation awareness and proceeds to deliberate and coordinated action, one has to ask himself how raw data turns into actual information, and eventually knowledge that will trigger human understanding. Furthermore, the question arises as to how C4ISR system of systems can support this transformation process. Of course, this is no magic. Information systems do the only thing they are good at: Working on large amounts of data at incredible speed. This is where the human fails. However, data must be aggregated in such a way that it results in information that conveys operational meaning to the commander. This is where information technologies alone fail, miserably. The resulting information must capture the semantics of the commander's domain of interest, and this must exist prior the automated data transformation process. The exercise of capturing the semantics of a certain business domain (the nouns, verbs, adjectives, etc.) along with its usage guidance (business rules) can be referred to as information engineering or ontology engineering. Conducting information engineering activities comes in support of the definition of ontologies. By definition, an ontology is an explicit formal specification of how to represent the objects, concepts and other entities that are assumed to exist in some area of interest and the relationships that hold among them.

DTIC

*Command and Control; Interoperability; Semantics*

**20070026417** Ministry of Defense and Aviation, Riyadh, Saudi Arabia

**The Multidimensional Measurements of Geographic Information Systems (GIS) Effectiveness in Crisis Management**

Aldaijy, Emad Y; Jun 2004; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466121; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466121>

Geographic information systems (GIS) provide timely and precise spatial information for command and control systems. GIS support decision makers in formulating plans and making critical decisions in preparedness, response, recovery, and mitigation phase of crisis management. The study developed a validated and prioritized reference decision making model by Panel of experts from Federal Emergency Management Agency (FEMA) that measures GIS effectiveness in crisis management. The model consists of seven factors and forty sub-factors. The seven GIS factors with respect to their importance in ascending order were system quality, information quality, user satisfaction, system use, decision performance, task complexity and feedback, and organizational impact. The data on measuring GIS effectiveness were obtained from a survey. Analyzed results from GIS directors, project managers, technical staff and users indicated that user satisfaction was assessed the lowest factor in the model. Additionally, the lowest assessments of the model sub-factors were: error recovery, documentation of system and procedures, ease of learning, currency of output, top management involvement, training provided to user, and GIS organizational position. The highest assessments in the model sub-factor were given to presentation mapping, viewing the map, and productivity improved by GIS. The major recommendations made include the following: (1) regularly measure the GIS effectiveness for each crisis events and establish a backlog; (2) consider some other measurements of technical, individual, and organizational factors based on GIS future capabilities, crisis context, and organization needs.

DTIC

*Emergencies; Geographic Information Systems; Management Methods*

**20070026418** Raytheon Net Centric Systems, Springfield, VA USA

**S&T Implications for Net Centric Operations**

Franklin, Jude E; Jun 2004; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466122>

The evolving environment for Net Centric Operations (NCO) is changing the requirements and capabilities that are needed for successful military and civil operations. This in turn is demanding science and technology developments of new enabling technologies with associated NCO capabilities. The Office of Naval Research (ONR) has studied these needs and has developed a Technical Taxonomy and associated shortfalls for Naval Net Centric Operations. This paper discusses that taxonomy and provides an examination of eight technology areas that are required to support five enabling functions necessary

for Net Centric Operations. These enabling technology areas are: 1. Reliable communications and infrastructure management, 2. Information distribution management, 3. Geographically distributed, computing infrastructure, 4. Situation understanding, 5. Automated adaptive dynamic planning, 6. Human machine interface, 7. Information assurance and information operations and 8. Modeling and simulation.

DTIC

*Information Systems; Military Technology*

**20070026424** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**Locally Dimensionality Reduction: A New Approach to Indexing High Dimensional Spaces (Preprint)**

Chakrabarti, Kaushik; Mehrotra, Sharad; Jan 2000; 27 pp.; In English

Contract(s)/Grant(s): DAAL01-96-2-0003

Report No.(s): AD-A466132; UCI-TR-MARS-00-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466132>

Many emerging application domains require database systems to support efficient access over highly multidimensional datasets. The current state-of-the-art technique to indexing high dimensional data is to first reduce the dimensionality of the data using Principal Component Analysis and then indexing the reduced dimensionality space using a multidimensional index structure. The above technique, referred to as global dimensionality reduction (GDR), works well when the data set is globally correlated, i.e. most of the variation in the data can be captured by a few dimensions. In practice, datasets are often not globally correlated. In such cases, reducing the data dimensionality using GDR causes significant loss of distance information resulting in a large number of false positives and hence a high query cost. Even when a global correlation does not exist, there may exist subsets of data that are locally correlated. In this paper, we propose a technique called Local Dimensionality Reduction (LDR) that tries to find local correlations in the data and performs dimensionality reduction on the locally correlated clusters of data individually. We develop an index structure that exploits the correlated clusters to efficiently support point, range and k-nearest neighbor queries over high dimensional datasets. Our experiments on synthetic as well as real-life datasets show that our technique (1) reduces the dimensionality of the data with significantly lower loss in distance information compared to GDR and (2) significantly outperforms the GDR, original space indexing and linear scan techniques in terms of the query cost for both synthetic and real-life datasets.

DTIC

*Data Bases; Information Retrieval*

**20070026436** Army Communications Research and Development Command, Fort Monmouth, NJ USA

**C2 Product-Centric Approach to Transforming Current C4ISR Information Architectures**

Mayk, Israel; Goren, Bernard; Jun 2004; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466150; XA-CERDEC/C2/NJ; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466150>

The Army Future Force (FF), including Units of Employment (UE) and subordinate Units of Action (UA) equipped with Future Combat Systems (FCS) and manned by Future Force Warriors (FFW), is distinguished from legacy and interim force units and systems by its exceptional responsiveness, deployability, agility, versatility, lethality, survivability and sustainability. These characteristics are meaningful individually but are not completely independent of each other. To support such characteristics, the Future Force is expected to be an order of magnitude more complex in its force structure, doctrinal requirements and technology than the current legacy force. A coherent, comprehensive and manageable set of complementary reference concepts are needed to facilitate the formulation of an overarching information model, reinforced by the rigor of UML, XML and metadata registries, to support system engineering and integration and to assess interdependencies and tradeoffs among the above characteristics based upon more detailed capabilities and their measures-of-performance (MoPs). In this paper we discuss and motivate the use of such an information model derived from the C2RM that is well suited to flesh out C2 UML architectures and C2 XML schemata. The C2RM defines common layers for C2 entities where each layer defines and requests Information Exchange Requirements (IERs) from peer entities using the layer below as well as provide an Information Exchange Products (IEPs) to peer entities which encapsulate the results of its services as requested by the next higher layer. The IERs/IEPs are organized into a common schema following the outline of an operations order (OPORD).

DTIC

*Command and Control; Information Systems*

**20070026458** Virginia Univ., Charlottesville, VA USA

**Comparing the Performance of Collection Selection Algorithms**

Powell, Allison L; French, James C; Oct 2003; 46 pp.; In English

Contract(s)/Grant(s): N66001-97-C-8542

Report No.(s): AD-A466183; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466183>

The proliferation of online information resources increases the importance of effective and efficient information retrieval in a multicollection environment. Multicollection searching is cast in three parts: collection selection (also referred to as database selection), query processing and results merging. In this work, we focus our attention on the evaluation of the first step, collection selection. In this article, we present a detailed discussion of the methodology that we used to evaluate and compare collection selection approaches, covering both test environments and evaluation measures. We compare the CORI, CVV and gGROSS collection selection approaches using six test environments utilizing three document testbeds. We note similar trends in performance among the collection selection approaches, but the CORI approach consistently outperforms the other approaches, suggesting that effective collection selection can be achieved using limited information about each collection. The contributions of this work are both the assembled evaluation methodology as well as the application of that methodology to compare collection selection approaches in a standardized environment.

DTIC

*Algorithms; Information Retrieval; Information Systems*

**20070026466** Virginia Univ., Charlottesville, VA USA

**Using Dynamic Adjustment of Serialization Order for Real-Time Database Systems**

Lee, Juhnyoung; Son, Sang H; Jan 1993; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466196; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466196>

Studies in [7, 8, 9] concluded that for a variety of reasons, optimistic concurrency control appears well-suited to real-time database systems. Especially, they showed that in a real-time database system that discards tardy transactions, optimistic concurrency control outperforms locking. In this paper, we show that the optimistic algorithms used in those studies incur restarts unnecessary to ensure data consistency. We present a new optimistic concurrency control algorithm that can avoid such unnecessary restarts by adjusting serialization order dynamically, and demonstrate that the new algorithm outperforms the previous ones over a wide range of system workload. It appears that this algorithm is a promising candidate for basic concurrency control mechanism for real-time database systems.

DTIC

*Data Bases; Real Time Operation*

**20070026491** Space and Naval Warfare Systems Command, San Diego, CA USA

**Agile Coalition Environment (ACE)**

McGuire, Michele; Daniel, Dale; Sep 2004; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466315; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466315>

The Agile Coalition Environment (ACE) program consists of a combined synergistic group of emerging network-centric and information assurance (IA) technologies. These combined ACE technologies provide the warfighter with enhanced information sharing, collaborative tools, and situational awareness capabilities that are both dynamic and secure. Warfighters have access to all required user applications and multiple security enclaves of information at a single workstation. Interoperability is achieved across all applications, platforms, and security domains. ACE is presented as a network capability that can be applied to the Coalition Enterprise Information Exchange System (CENTRIXS) as well as other coalition or Community of Interest (COI) networks that require information sharing across multiple security domains between U.S. and coalition forces. ACE technologies have evolved during a 4-year spiral development cycle and have targeted warfighters at all levels for improving interoperability and knowledge management for current and future joint and coalition operations. This evolution for developing tomorrow's IT capabilities has been based on requirements, technology insertion, operational experimentation, and improvements as a result of Joint, Coalition, and Naval Fleet feedback. The USA Pacific Command (USPACOM) is the ACE program's sponsoring organization, and the U.S. Navy Space and Warfare Systems Command (SPAWAR) provides project management and technical support. Twenty-three briefing charts summarize the presentation.

DTIC

*Client Server Systems; Interoperability; Military Operations*

**20070026496** Tasmania Univ., Hobart, Australia

**Towards Next Generation WWW: Push, Reuse and Classification**

Kang, Byeong Ho; Compton, Paul; Motoda, Hiroshi; Kim, Yang Sok; Park, Sung Sik; Apr 2006; 56 pp.; In English  
Contract(s)/Grant(s): FA5209-05-P-0253

Report No.(s): AD-A466329; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466329>

The major problem of the current WWW technology is that it is based on the 'pull' style of information delivery, where the uploaded information waits for visitors, and not the 'push' style (Franklin and Zdonik 1998), where the new information is delivered to the users when it becomes available. Although there are several research studies focusing on the development of 'push' based information delivery, these studies overlook following two important functions: Firstly, many of the new studies are not concerned with existing HTML documents. It is not wise to expect that all people will follow the new suggested representation like XML or RSS and will convert their existing information to the new format. Secondly, the information classification system is the other issue. Without using the appropriate classification system, people find that delivered information is often redundant. Therefore, an automated classification system that selects only the relevant information for each user is required. The main research task for this system is how to implement the incremental knowledge acquisition process for the classification knowledge because human classification knowledge is always heuristic and changes rapidly and, therefore, it is necessary to maintain the knowledge base incrementally.

DTIC

*Classifications; Data Mining; Internets; Web Services*

**20070026504** General Dynamics Advanced Information Systems, Buffalo, NY USA

**Automated Information Extraction System (AIES) Capability Enhancement and Support**

Ganger, Robert; Pierce, David; Crouner, Christopher; LeHouillier, Frank; Lilly, Jeffrey; Jeziorowski, Margaret; Mar 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-D-0002/0005; Proj-R629

Report No.(s): AD-A466340; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466340>

The objective of this effort was to provide enhancements to the Automated Information Extraction System (AIES) to improve its usability as a data collection tool for Social Network Analysis (SNA) for the Joint Warfare Analysis Center (JWAC) located in Dahlgren, VA. This effort continued the development efforts provided under previous tasking to JWAC to expand and enhance the AIES system. Enhancements included attribute discovery and name disambiguation prototypes. Usability considerations included quality of extracted results, integration with other tools and data sources, and graphical user interface (GUI) enhancements to provide JWAC intelligence analysts with deeper data viewing and manipulation capabilities. In general, this effort addressed the challenge of discovering the links and relationships between entities within a domain and providing summaries and visualizations that can be used as decision-making tools by high-level users of the intelligence product. To analyze documents in domains of interest in SNA, additional and deeper capabilities are required in an information extraction system to address critical and relational peculiarities of how the players and activities are expressed and discussed in documents.

DTIC

*Augmentation; Extraction; Information Retrieval; Information Systems*

**20070026532** Army Communications-Electronics Command, Fort Monmouth, NJ USA

**A Pragmatic C4ISR Approach From the US Army CECOM Security Assistance Perspective**

Skidmore, Sr, William E; Klingenburg, Daniel; Apr 2003; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466400; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466400>

Achieving coalition interoperability is difficult; competing National interests (military, economic or political) probably will necessitate imposing compromise solutions. Architecting solutions, which all respective parties would adopt and adhere to, is therefore problematic. To address these problem areas, a combination of a system architecture and design methodology is employed that emphasizes the use of COTS products. There are several recognizable phases within this approach, most of which are recognizable: Operational capability requirement definition; Analysis \* Architecture synthesis; Component solution identification and capabilities assessment; and Design synthesis. This paper will discuss some of the problems defining interoperable coalition system architectures for these defined organizations and our approach to circumventing these obstacles.

The paper will be presented from the US Army CECOM Security Assistance perspective in utilizing US grant funds such as Foreign Military Financing (FMF) to provide solutions for foreign militaries and multinational military organizations.  
DTIC

*Command and Control; Interoperability; Military Operations; Security*

**20070026539** Mitre Corp., Bedford, MA USA

**Building Information Systems for Network-Centric Warfare**

Renner, Scott; Jun 2003; 49 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466409; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466409>

This paper examines the implications of network-centric warfare for information system development: How should we build C2 information systems for net-centric operations? We begin with six highly-probable predictions for the NCW future. From these we derive a number of present implications for system development: things we should do now, and problems we will have to solve along the way. Our answers touch on the information technology to be employed within the systems, the architectural principles that will guide and structure their development, and the acquisition process used to build and deploy the systems.

DTIC

*Command and Control; Information Systems; Warfare*

**20070026542** Army Communications Research and Development Command, Fort Monmouth, NJ USA

**Multinational C2 Experiments Supported by C2 Systems and Modeling and Simulations Addressing Army Transformation of Collaborative Planning and Interoperable Execution in a Coalition Environment**

Mayk, Israel; Klose, Dirk; Jun 2003; 56 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466413; XA-CERDEC/C2/NJ; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466413>

Future deployments of Objective Force units are required to be not only network-centric with respect to their own assets but also with respect to other Joint, National and Coalition assets. The main issue for any network-centric architecture is how to establish connectivity, federation, collaboration and interoperability in a self organizing way among all elements of the force to include combat, combat support, combat service support and C2 assets. When a combat force element such as a unit of action (UA) combat team or task force is organized it may include assets and resources that are not organic and include cross-attached coalition elements. Its combat support forces, combat service support as well as its C2 resources will most likely also require subordinated coalition elements. This necessitates a well thought out alignment of the different C2 processes employed by each of the coalition partners to enable and assure unity of command, synchronization of the tasks and critical battle space de-confliction. The recommended technical solutions and possible changes to tactic, techniques and procedures essential to achieve that alignment must be subject to a rigorous experimentation program supported by evolving C2 systems stimulated by combat simulations that would ensure utmost flexibility to support the full spectrum of operational needs. In addition, the capabilities of Joint, National and Coalition assets to partner with us must also be taken into account.

DTIC

*Command and Control; Interoperability; Simulation; Warfare*

**20070026554** Army Research Lab., Aberdeen Proving Ground, MD USA

**Data Mining Techniques Applied to Urban Terrain Command and Control Experimentation**

O'May, Janet; Heilman, Eric; Bodt, Barry; Jun 2003; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466439; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466439>

Advances in the fields of simulation and data mining are proving relevant to providing battlespace decision support. High performance computing, improved modeling techniques, and new decision support methodologies drive these advances. Combat simulations now generate behaviors at increasingly finer scales. Data mining provides a mechanism for uncovering key patterns in larger data sets such as those generated by modern combat simulations. The capability of simulating detailed courses of action (COAs) opens up the possibility of mining collected data for insights. Specifically, decision support systems could assist commanders in examining simulation data for relationships between the structure of the COA and various battle objectives. Our current experimentation centers on the use of complex or urban terrain for warfighting. The synergy of data

mining tools, high performance computing, and high resolution simulation has the potential to assist battle planners in the improvement of battlefield assessments and the expedient modification of COAs.

DTIC

*Command and Control; Data Mining; Information Retrieval; Terrain*

**20070026570** Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, AZ USA

**From Stove-pipe to Network Centric Leveraging Technology to Present a Unified View**

Abuhantash, Medhat A; Shoultz, Matthew V; Jun 2004; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466489; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466489>

In today's Command and Control (C2) environment critical information is located in many disparate data sources. C2 decision-making can be adversely affected by insufficient or unavailable access to information located in these disparate data sources. This paper will provide an overview of the problems surrounding this issue, a real-world scenario representing the problem, and how the problem was overcome using a network centric approach. The paper will also demonstrate how the application of current technology can be leveraged to present a unified view of data from disparate data sources, and how our organization is leveraging technology to help the Warfighter eliminate the stove-piping of information to increase network centrality. The objective of this paper is to present the reader with insight on how to utilize today's technology to allow leaders to make well-informed decisions, thus increasing their effectiveness in fighting the Global War on Terrorism (GWOT). By understanding our use of technology in support of the Warfighter, the reader will gain key insights on how to improve their own organization's capabilities to support C2 decision-making.

DTIC

*Command and Control; Pipes (Tubes); Warfare*

**20070026575** Defence Science and Technology Organisation, Canberra, Australia

**Systems and Capability Relation Management in Defence Systems-of-System Context**

Chen, Pin; Gori, Ronnie; Pozgay, Angela; Jun 2004; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466495; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466495>

The increasing complexity of Defense System-of-Systems is a challenge for not only capability and systems planning and management, but also engineering disciplines such as System engineering, Software Engineering and Information Systems. The defense requires an improved ability in context-awareness of relations, impact and dependency between systems and capabilities while consider changes or evolutions in various defense capability and system planning, study and management activities. This paper introduces concepts for and an approach to the defense systems and capability management in conjunction with military scenario management and defense architecture data management.

DTIC

*Management Systems; Systems Management*

**20070026583** Naval Research Lab., Washington, DC USA

**Training Coordination Proxy Agents**

Abramson, Myriam; Chao, William; Mittu, Ranjeev; Jul 2006; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466512; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466512>

Delegating the coordination role to proxy agents can improve the overall outcome of the task at the expense of cognitive overload due to switching subtasks. Stability and commitment are characteristics of human teamwork but must not prevent the detection of better opportunities. In addition, coordination proxy agents must be trained from examples as a single agent but must interact with multiple agents. We apply machine learning techniques to the task of learning team preferences from mixed-initiative interactions and compare the outcome results of different simulated user patterns. This paper introduces a novel approach for the adjustable autonomy of coordination proxies based on the reinforcement learning of abstract actions.

DTIC

*Adaptation; Coordination; Decision Making; Education; Pattern Recognition*

**20070026591** Defence Science and Technology Organisation, Canberra, Australia

**Sense Making - Underpinning Concepts and Relation to Military Decision-Making**

Burnett, Mark; Wooding, Pete; Prekop, Paul; Sep 2004; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466530; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466530>

Decision makers at all echelons go through a process of goal-directed sense making when dealing with complex and dynamic problems involving, for instance, ambiguous or poor information, changing circumstances and multiple players. In this paper we argue that the key to sense making is understanding the nature of and the nexus between the knowledge that humans bring to the process and the way in which that knowledge is applied in a creative thinking framework to build meaning and to provide judgements, insights and conclusions. In this respect, there are three main concepts in this paper: \*Knowledge as a cognitive process that is key to sense making; \*Philosophy and epistemology as a framework in which knowledge is applied, refuted, tested and grown; \*The recognition that sense making deals with complex systems underpins new ways of perceiving the world and generating conjectures that can be tested within an epistemological framework. The relationship between sense making and decision-making for military operations is illustrated with respect to two decision-making doctrines OODA and the newly proposed CECA (Critique-Explore-Compare-Adapt). The ideas in this paper resonate more with CECA than OODA, and could be further developed in an experimental environment that looks at different sense and decision-making approaches.

DTIC

*Decision Making; Information Management*

**20070026598** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**An Efficient Metaheuristic for Dynamic Network Design and Message Routing**

Hartlage, Robert B; Feb 2007; 118 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466537; AFIT/GOR/ENS/07-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466537>

The implementation of Net-centric warfare presents major challenges in terms of effectively and efficiently delivering critical information across the Global Information Grid. In many cases, the amount of information requested will exceed the capabilities of the network. One challenge is to dynamically design the network (assign transceivers) to maximize the amount of required information that can be transmitted and the quality of service for those transmissions - to best implement the communications tasking order. The problem is as follows: given a list of required message traffic, to include source, destination, size, and priority, design the network to maximize the delivery of the message traffic based on message priority and quality of service. Once the network is designed, the routing for the messages must be determined. Due to the dynamic nature of the problem and the combinatorial explosion in size as new network nodes are added, a quick-running heuristic approach is needed. In this research, metaheuristic to dynamically design the network based on the projected message traffic requirements and to efficiently route the required messages on the network to maximize priority of messages successfully delivered and the quality of service of the delivery. The meta-heuristic is tested against previous efforts and is shown to generate high quality solutions in a very short amount of time.

DTIC

*Communication Networks; Messages; Traffic; Warfare*

**20070026603** ElanTech, Inc., Greenbelt, MD USA

**Focused Knowledge to the Warfighter**

Emmerman, Philip J; Woodson, Randy; Sep 2004; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466548; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466548>

The future dismounted battlespace will require an unprecedented level of automation (software and physical agents) to ensure situational awareness. Soldier directed information management agents, organic autonomous, and semi-autonomous ground and air sensor platforms along with dismounted soldiers must function as a tightly coupled team. These information management functions include operations on global information sources, in particular the fusion of relevant local and global information. Physical agents, such as robotic sensor platforms, will be ubiquitous in the future battlefield, significantly lowering the risks to our warfighters. These physical agents are to complement future manned systems and therefore they must be able to collaborate not only amongst themselves but also with their manned partners. The information from local organic sensor platforms and human assets must be fused to provide enhanced situational understanding. This situational understanding will be further enhanced with the fusion of global information and provided to the dismounted warfighter in



a highly intuitive form for rapid assimilation and action. The Army Research Laboratory has recently demonstrated this concept of real time fused information supporting the dismounted infantry. This paper will present the Warrior's Edge information fusion concept, architecture, and demonstration results.

DTIC

*Data Management; Multisensor Fusion; Robotics*

**20070026630** Library of Congress, Washington, DC USA

**Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues**

Wilson, Clay; Mar 20, 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466599; CRS-RL31787; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466599>

This report describes the emerging areas of information operations, electronic warfare, and cyberwar in the context of U.S. national security. It also suggests related policy issues of potential interest to Congress. For military planners, the control of information is critical to military success, and communications networks and computers are of vital operational importance. The use of technology to both control and disrupt the flow of information has been generally referred to by several names: information warfare, electronic warfare, cyberwar, netwar, and Information Operations (IO). Currently, IO activities are grouped by the Department of Defense (DoD) into five core capabilities: (1) Psychological Operations, (2) Military Deception, (3) Operational Security, (4) Computer Network Operations, and (5) Electronic Warfare. Current U.S. military doctrine for IO now places increased emphasis on Psychological Operations, Computer Network Operations, and Electronic Warfare, which includes the use of non-kinetic electromagnetic pulse (EMP) weapons, and nonlethal weapons for crowd control. However, as high technology is increasingly incorporated into military functions, the boundaries between all five IO core capabilities are becoming blurred. DoD has noted that military functions involving the electromagnetic spectrum take place in what is now called the cyber domain, similar to air, land, and sea. This cyber domain is the responsibility of the new Air Force Cyber Command and includes cyberwarfare, electronic warfare, and protection of U.S. critical infrastructure networks that support telecommunications systems, utilities, and transportation. This report will be updated to accommodate significant changes.

DTIC

*Defense Program; Electronic Warfare; Policies; Security; Warfare*

**20070026672** University of Southern California, Los Angeles, CA USA

**The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq**

Clark, Richard E; Sep 2005; 17 pp.; In English

Contract(s)/Grant(s): W81XWH-04-C-0093

Report No.(s): AD-A466686; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466686>

Prior attempts to use standard interview protocols to extract After Action Review (AAR) descriptions of emergency event decision making and problem solving strategies generated by participants are problematical. Cognitive psychological studies suggest that the resulting information often contains significant errors and omissions (Glaser et al., 1985; Besnard, 2000). These errors are often not recognized by participants who have solved important problems in emergency situations because the knowledge they are describing is largely automated and unconscious (Wheatley & Wegner, 2001). The problem is further complicated because experienced medical personnel mistakenly believe that their reports are complete and accurate and that they have solved the problems they are describing in a conscious, willful, and deliberate manner (Wegner, 2002). These reporting errors most likely increase in number and severity under time pressure battlefield situations (Hunt & Joslyn, 2000). This research attempts to improve medical AAR with a novel combination of Cognitive Task Analysis (CTA) conducted while interviewees moulage simulators (Clark & Estes, 2002; Clark & Estes, 1996; Velmahos et al., 2002). In this study, three medical experts who have experienced and solved the same type of medical problem in Iraq will be interviewed separately and together. It is hypothesized that interview protocols employing a novel combination of medical CTA combined with the moulage of simulators will more accurately capture the mix of automated and conscious decisions used to solve critical medical problems on the battlefield in Iraq. Each expert will be interviewed separately and, after reviewing the results, the other two experts will be asked to correct and improve on the information gathered from the 'other' experts. This process has been found to identify and eliminate errors as well as provide accurate and efficient descriptions of medical decisions and actions that solved battlefield problems.

DTIC

*Decision Making; Emergencies; Errors; Iraq; Mental Performance; Problem Solving; Simulators; Tasks*

**20070026674** Mitre Corp., Bedford, MA USA

**A Reference Architecture for Network-Centric Information Systems**

Renner, Scott; Schaefer, Ronald; Jun 2003; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466692; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466692>

This paper presents the 'C2 Enterprise Reference Architecture' (C2ERA), which is a new technical concept of operations for building information systems better suited to the Network-Centric Warfare (NCW) environment. The C2ERA is the technical architecture mandated by the Designated Acquisition Commander for C4ISR Enterprise Integration in the U.S. Air Force. The C2ERA contains two key ideas. Related activities and functions are gathered into a C2 Node, with a designated node manager responsible for delivering and sustaining an integrated capability to the user community. The development of mission functionality is separated from the system infrastructure. This infrastructure (and the responsibility for it) is divided into one part that must be the same across the enterprise, called the 'Common Integrated Infrastructure,' and another part that may vary between C2 Nodes, called the 'node platforms'. Thirty-one briefing charts summarize the presentation.

DTIC

*Command and Control; Information Systems; Interoperability; Systems Integration; Warfare*

**20070026676** Stanford Univ., Stanford, CA USA

**Simulation-Based Learning: Workshops for Researchers and Educators in the Western USA, and the Pacific Rim**

Dev, Parvati; Mar 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0898

Report No.(s): AD-A466695; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466695>

A series of eight workshops about Simulation and Game-based Learning were conducted during a two-year period. Speakers from the game industry academia and e-learning organizations discussed a wide range of topics. The programs and the attendee evaluations are summarized in this report. URL's are provided for individual presentations.

DTIC

*Computerized Simulation; Learning; Simulation; United States*

**20070026686** Naval Undersea Warfare Center, Newport, RI USA

**Coalition Interoperability Ontology: Sharing Situational Awareness with Allies and Agents**

Chaum, Erik; Tolk, Andreas; Jun 2003; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466713; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466713>

Coalition Interoperability Ontology: To achieve the information age transformation envisioned by DoD leadership will require sharing a broader range of information and context; Shared semantics and syntax make this more practical and affordable; To enable information systems to find and reason about the information on the GIG we will also need to carefully mark it up with meta-data that has known semantics and syntax; C2IEDM provides a well designed, international, generic, extensible core ontology for military operations.

DTIC

*Interoperability; Military Operations; Situational Awareness*

**20070026700** National Defense Univ., Washington, DC USA

**Defense Horizons. I-Power: The Information Revolution and Stability Operations. Number 55**

Kramer, Franklin D; Wentz, Larry; Starr, Stuart; Feb 2007; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466767; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466767>

Information and information technology (I/IT) can significantly increase the likelihood of success in stability operations if they are engaged as part of an overall strategy that coordinates the actions of outside intervenors and focuses on generating effective results for the host nation. Properly utilized, I/IT can help create a knowledgeable intervention, organize complex activities, and integrate stability operations with the host nation, making stability operations more effective. Key to these results is a strategy that requires that 1) the U.S. Government gives high priority to such an approach and ensures that the effort is a joint civilian-military activity; 2) the military makes I/IT part of the planning and execution of the stability operation; 3) preplanning and the establishment of I/IT partnerships are undertaken with key regular participants in stability operations, such

as the United Nations and the World Bank; 4) the focus of the intervention, including the use of I/IT, is on the host nation, supporting host-nation governmental, societal, and economic development; and 5) key information technology capabilities are harnessed to support the strategy. Implementing the strategy will include 1) development of an information business plan for the host nation so that I/IT is effectively used to support stabilization and reconstruction; 2) agreements among intervenors on data-sharing and collaboration, including data-sharing on a differentiated basis; and 3) use of commercial IT tools and data provided on an unclassified basis.

DTIC

*Horizon; Information Systems; Stability*

**20070026711** RAND Corp., Santa Monica, CA USA

**A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations**

Rhodes, Carl; Hagen, Jeff; Westergren, Mark; Jan 2007; 30 pp.; In English

Contract(s)/Grant(s): F49642-01-C-0003; FA7014-06-C-0001

Report No.(s): AD-A466789; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466789>

To assist in moving intelligence, surveillance, and reconnaissance (ISR) planning and execution forward from a fixed target and deliberate planning focus to one centered on emerging targets, the authors propose enhancing the collection management process with a strategies-to-tasks and utility framework. By linking collection targets to operational tasks, objectives, and the top-level commander's guidance with relative utilities, planning for the daily intelligence collections and real-time retasking for ad hoc ISR targets could be enhanced. When current tools are modified to provide this information, planners will be able to link collection targets to top-level objectives for better decision making and optimization of low-density, high-demand collection assets. Similarly, on the Air Operations Center (AOC) floor, intelligence officers will be better able to deal with time-sensitive, emerging targets by rapidly comparing the value of collecting an ad hoc collection with the value of collecting opportunities already planned. To handle the ISR demands posed by the rapidly changing battlefield of the future, this new, more-capable framework may be needed for making the best use of intelligence capabilities against emerging collection opportunities. Future research will focus on quantifying the advantages of this approach in comparison with the current process.

DTIC

*Aerial Reconnaissance; Command and Control; Data Acquisition; Intelligence; Management Planning; Reconnaissance; Sensitivity; Surveillance; Targets*

**20070026715** Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

**The Benefit of Ontologies for Interoperability of CCIS. (Easy, Quick and Cheap Solutions are Impossible, if Semantics of CCIS are Affected.)**

Wunder, Michael A; Jun 2003; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466798; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466798>

In spite of their efforts, no one has yet succeeded in making Command and Control Information Systems (CCIS) semantically interoperable. The harmonization of information systems is extremely expensive and, in many cases, it has not brought the expected improvements. Another approach to the problem of semantic harmonization may be necessary. According to the author, information exchange can be supported by knowledge-based linguistic algorithms that analyze incoming information and convert it according to the required semantic boundary conditions of the target database. These algorithms are based on ontologies, which are the formal descriptions of concepts and relationships of objects that are relevant for a domain. They describe how we see the world we are looking at. No changes to existing CCIS are necessary -- they may remain as they are.

DTIC

*Command and Control; Heterogeneity; Information Systems; Interoperability; Semantics*

**20070026717** QinetiQ Ltd., Worcestershire, UK

**Elicitation of British Army Commanders' Personal Constructs**

Turner, Paddy; Jun 2003; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466805; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466805>

The design of information systems to aid the attainment of Situation Awareness would benefit from an understanding of the mental models that commanders reference in assessing situations. This paper presents novel experimental research conducted to elicit the personal constructs that constitute the fabric of British Army commanders' mental models. For a given scenario, it is shown that four out of the twenty-one identified constructs accounted for the majority of individual situation assessments made; three of these four were, in fact, common to all ten participants. There were, however, individual differences: four of the participants referenced a specific pair of constructs in the majority of their assessments whilst the remainder used a far wider set. The constructs were mapped onto Endsley's three levels of Situation Awareness and a significant positive correlation was found between experience level and the mean Situation Awareness level of the constructs referenced. This suggests that experience influences the fabric of commanders mental models and indicates how this manifests itself in terms of constructs.

DTIC

*Information Systems; United Kingdom*

**20070026723** DMR Consulting, Sainte-Foy, Canada

**The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective**

Dube, Real; Thibault, Gaetan; Sep 2004; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466821; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466821>

Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) is an evolving information operations (IO) concept in the Canadian Land Force. ISTAR provides the commander with a system to collect and process required information for producing intelligence on the threat, and knowledge on the environment, during operations, as well as knowledge needed to identify, acquire and engage targets. The various processes used to collect and analyze the information are the result of numerous individual systems some of which have only been recently introduced in the field while many others are still in development as a result of advances in the information age. This compendium of systems makes ISTAR a 'System of systems', as opposed to a single system. These four papers present the new Canadian information centric collaborative workspace concept that provides a more coherent information management approach to better support the Commander in both its tactical intelligence and operations activities at brigade level. The info-centric collaborative workspace concept aims at offering a seamless collaborative environment enabling the ISTAR staff to perform their tasks using different applications/services through a standardized Human Computer Interface (HCI).

DTIC

*Canada; Intelligence; Multisensor Fusion; Reconnaissance; Surveillance; Target Acquisition*

**20070026724** Texas Univ., Austin, TX USA

**Preliminary Findings: Design of Experiments University XXI (FY05) Research and Support for the US Army**

Barnes, J W; Whilden, J N; Chahin, J T; Mar 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N61339-05-C-0127

Report No.(s): AD-A466832; 0477; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466832>

The Design of Experiments project is developing recommendations for a new TOPM for applying DOE Techniques to the US Army's complex operational testing environment. These recommendations are being based upon evaluations of existing event design plans and testing reports. The focus has been primarily upon small- to medium-scale testing scenarios in order to provide recommendations that are easy to understand. The inherent complexity of large-scale testing events also increases the difficulty of making clear recommendations for improvements in testing. It is hoped that through the development of case studies and leveraging AFOTEC's work, we will develop recommendations that tailor DOE techniques and exploit their benefits for use by operation research analysts with USAOTC scenarios. These statistical techniques are expected to afford opportunities for substantial savings in resources for conduct of operational testing as well as accommodate testing of complex large systems.

DTIC

*Data Bases; Experiment Design; Operations Research*

**20070026732** Vistology, Inc., Framingham, MA USA

**New Metrics for Blog Mining**

Ulicny, Brian; Baclawski, Ken; Magnus, Amy; Jan 2007; 13 pp.; In English

Contract(s)/Grant(s): FA9550-06-C-0023

Report No.(s): AD-A466875; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466875>

Blogs represent an important new arena for knowledge discovery in open source intelligence gathering. Bloggers are a vast network of human (and sometimes non-human) information sources monitoring important local and global events, and other blogs, for items of interest upon which they comment. Increasingly, issues erupt from the blog world and into the real world. In order to monitor blogging about important events, we must develop models and metrics that represent blogs correctly. The structure of blogs requires new techniques for evaluating such metrics as the relevance, specificity, credibility and timeliness of blog entries. Techniques that have been developed for standard information retrieval purposes (e.g. Google's PageRank) are suboptimal when applied to blogs because of their high degree of exophoricity, quotation, brevity, and rapidity of update. In this paper, we offer new metrics related for blog entry relevance, specificity, timeliness and credibility that we are implementing in a blog search and analysis tool for international blogs. This tool utilizes new blog-specific metrics and techniques for extracting the necessary information from blog entries automatically, using some shallow natural language processing techniques supported by background knowledge captured in domain-specific ontologies.

DTIC

*Information Retrieval; Mining; Natural Language (Computers); Pattern Recognition*

**20070026737** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**Content Based Retrieval Database Management System with Support for Similarity Searching and Query Refinement**

Ortega-Binderberger, Michael; Jan 2002; 184 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466965; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466965>

With the emergence of many application domains that require imprecise similarity based access to information, techniques to support such a retrieval paradigm over database systems have emerged as a critical area of research. This thesis explores how to enhance database systems with content based search over arbitrary abstract data types in a similarity based framework with query refinement. This scope opens a number of challenges previously not faced by databases, among them: \* Extension of abstract data types to support arbitrary similarity functions and support for query refinement. (Intra type similarity and feedback) \* Extension of the already developed query refinement models under the MARS system to a general multi table relational model. (Inter Type similarity and feedback) \* Extension of query processing models from a set based model where tuples either satisfy or not the query predicate to a result where the degree to which tuples satisfy a predicate is represented by their similarity values. (Similarity predicates) \* Based on the similarity values, return only the best k matches. This implies a sorting on the similarity values and ample optimizations are possible to use lazy evaluation and only compute those answers that the user will see. (Ranked Retrieval) \* Optimization of query execution under the similarity conditions which requires access to specialized indices. Optimized composite predicate merging is possible based on earlier work on the MARS project to compute the similarity value for a predicate based on independent streams rather than using the value directly. (Incremental top-k merging) We are building a prototype system that implements the proposed functionality in an efficient way and we evaluate the quality of the answers returned to the user.

DTIC

*Analogy; Data Base Management Systems; Data Bases; Information Retrieval*

**20070026738** Lockheed Martin Corp., Moorestown, NJ USA

**Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion**

Schuck, Tod M; Hunter, J B; Wilson, Daniel D; Sep 2004; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466968; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466968>

One of the greatest difficulties in developing a fusion process is determining the type, quantity, and quality of the information provided. Even when this is accomplished, the utility (relationship) of the information is often difficult to establish. For the problem of combat identification, or Combat ID, this is especially taxing. Often numerous sources provide information, but relationship guidelines are not well developed, or are ambiguous or inconsistent. This deficiency leads to poorly constructed fusion architectures and methodologies because information is either ignored or improperly combined in the fusion process. Using the Joint Directors of Laboratories (JDL) information fusion model as a guide, this paper will address

the movement of attribute information across multiple hypothesis classes as it relates to developing the identification of different objects, and how it can be combined both within and between JDL fusion levels. The result of this analysis will lead to an information architecture that is naturally adaptive to information regardless of quality, level, or specificity. Such a full Combat ID architecture must be able to facilitate a broad range of information at various levels. In this paper, the authors provide examples for taxonomies, multiple hypotheses, and the recognition of tactical elements to illustrate the relevant issues. They also present an architectural model. Implementation of such an architecture may facilitate a 'power to the edge' approach to decision-making when edge units are provided with Combat ID information at the level of recognizable 'tactical elements' for which decisions are made. Seventeen briefing charts summarize the presentation.

DTIC

*Combat; Hypotheses; Mapping; Multisensor Fusion; Taxonomy*

**20070026741** DMR Consulting, Sainte-Foy, Canada

**The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective**

Thibault, Gaetan; Le May, Francois; Sep 2004; 30 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466981; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466981>

Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) is an evolving information operations (IO) concept in the Canadian Land Force. ISTAR provides the commander with a system to collect and process required information for producing intelligence on the threat and knowledge on the environment during operations, as well as knowledge needed to identify, acquire and engage targets. The various processes used to collect and analyze the information are the result of numerous individual systems some of which have only been recently introduced in the field while many others are still in development as a result of advances in the information age. This compendium of systems makes ISTAR a 'System of systems', as opposed to a single system. These four papers present the new Canadian information centric collaborative workspace concept that provides a more coherent information management approach to better support the Commander in both its tactical intelligence and operations activities at brigade level. The info-centric collaborative workspace concept aims at offering a seamless collaborative environment enabling the ISTAR staff to perform their tasks using different applications/services through a standardized Human Computer Interface (HCI).

DTIC

*Canada; Intelligence; Multisensor Fusion; Reconnaissance; Surveillance; Target Acquisition*

**20070026742** DMR Consulting, Sainte-Foy, Canada

**The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective**

Cantin, Marco; Thibault, Gaetan; Sep 2004; 46 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466982; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466982>

Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) is an evolving information operations (IO) concept in the Canadian Land Force. ISTAR provides the commander with a system to collect and process required information for producing intelligence on the threat and knowledge on the environment during operations, as well as knowledge needed to identify, acquire and engage targets. The various processes used to collect and analyze the information are the result of numerous individual systems some of which have only been recently introduced in the field while many others are still in development as a result of advances in the information age. This compendium of systems makes ISTAR a 'System of systems', as opposed to a single system. These four papers present the new Canadian information centric collaborative workspace concept that provides a more coherent information management approach to better support the Commander in both its tactical intelligence and operations activities at brigade level. The info-centric collaborative workspace concept aims at offering a seamless collaborative environment enabling the ISTAR staff to perform their tasks using different applications/services through a standardized Human Computer Interface (HCI).

DTIC

*Canada; Intelligence; Multisensor Fusion; Reconnaissance; Surveillance; Target Acquisition*

**20070026751** California Univ., Los Angeles, CA USA

**Optimizing Parallel Execution of Detailed Wireless Network Simulation**

Ji, Zhengrong; Zhou, Junlan; Takai, Mineo; Martin, Jay; Bagrodia, Rajive; Jan 2004; 9 pp.; In English

Contract(s)/Grant(s): N66001-00-2-8937

Report No.(s): AD-A467039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467039>

With Parallel and Discrete Event Simulation (PDES) techniques, the runtime performance of detailed wireless network simulation can be improved significantly without compromising fidelity of the simulation results. However, modelling characteristics of wireless communications such as signal propagation and interference may severely hinder the potential speedup yielded by PDES. This paper proposes various optimization techniques to address three major concerns in achieving efficient parallel execution of wireless network simulation: i.e., (1) reducing communication and computation overhead of simulating signal propagation across multiple logical processes; (2) reducing synchronization overhead among logical processes; (3) minimizing event scheduling overhead within individual logical processes. These techniques have been implemented in a parallel version of GloMoSim and QualNet. The experimental results with mobile ad hoc networking scenarios demonstrate that the proposed optimization techniques can improve the performance of parallel wireless network simulation by up to an order of magnitude.

DTIC

*Simulation; Software Development Tools*

**20070026752** Hawaii Univ., Honolulu, HI USA

**UH-USA Agreement - A Telemedicine Research Proposal**

Burgess, Lawrence P; Birkmire-Peters, Deborah P; Nov 2004; 451 pp.; In English

Contract(s)/Grant(s): DAMD17-99-2-9003

Report No.(s): AD-A467058; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467058>

The purpose of the University of Hawaii Telemedicine Curriculum Research Project is to develop an effective web-based curriculum for training military healthcare personnel in the use of contemporary communication, automation, and informatics technology in the delivery of healthcare. The overall curriculum is generic in nature, while specific modules can be tailored to the needs of the military healthcare provider (HCP). The goal of the telemedicine curriculum is to impart both the necessary knowledge and practice skills to the HCP. The HCP will learn the various clinical uses of telemedicine and will also understand the clinical and organizational barriers of the successful utilization of telemedicine. The telemedicine curriculum has been designed to address the communication and automation tools available to the military healthcare system. This advanced toolkit of telemedicine curriculum modules will support the efforts of the DoD to efficiently and effectively apply the latest technological advances in communication and data transfer to improving healthcare delivery.

DTIC

*Clinical Medicine; Education; Information Transfer; Proposals; Telemedicine*

**20070026754** Pacific Science and Engineering Group, Inc., San Diego, CA USA

**Understanding and Improving Knowledge Transactions in Command and Control**

Moore, Ronald A; Schermerhorn, Janel H; Oonk, Heather M; Morrison, Jeffrey G; Jun 2003; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467096; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467096>

Numerous factors impact the efficient and effective exchange of information and knowledge in modern command and control. One factor in particular is the extent to which those who create and share information and knowledge understand the tasks and information requirements of those who will use the shared information. Efficient and effective information exchange requires that two classes of users, referred to as information consumers and information producers, develop a shared understanding of tasks, resources, and information requirements. This shared understanding serves as a framework for the intricate series of 'knowledge transactions' collaboration, inherent to planning, and decision support. This paper will 1) introduce some of the current work associated with military command and control knowledge transactions, 2) provide examples of real-world knowledge transaction characteristics and limitations, and 3) discuss recent, ongoing, and planned research efforts to better understand and improve such transactions.

DTIC

*Command and Control; Information Management*

**20070026764** Teleplan AS, Lysakar, Norway

**Information Grid in Support of Crisis Management**

Aarhold, Eldar; Berg, Olav; Jun 2002; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467178; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467178>

This paper deals with information availability related to crisis management, an area that has become a prioritized national and international concern. The paper looks into two different scenarios with a view to identify some shortcomings and possibilities inherent in a national information infrastructure. By fairly simple means it is possible to obtain significant improvement of data availability, which in turn will give a substantial contribution to improved emergency preparedness through the availability of a national crisis information grid. A network centric solution is suggested, where the limitations inherent in today's information grid are overcome, and where information is dynamically made available as required.

DTIC

*Emergencies; Information Management; Information Systems; Management Methods*

**20070026767** Defence Research Establishment Atlantic, Dartmouth, Nova Scotia Canada

**The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory**

Hazen, Mark G; Burton, Robert; Klingbeil, Ralph; Sullivan, Keith; Fewell, Matthew; Grivell, Ian; Philp, Chris; Marland, Peter; Jun 2003; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467314; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467314>

In 2001 the Maritime Systems Group of The Technical Cooperation Program (TTCP) set-up an Action Group (AG-1) to examine the exponential increases in warfighting capability claimed for Network-Centric Maritime Warfare (NCMW). Analysis of NCMW is a two-stage process of finding analysis processes for estimating the NCMW effects on the scenario parameters and then applying appropriate warfare models to relate NCMW-sensitive scenario parameters to force effectiveness. This paper will report on the results of a modeling workshop held by AG-1 in November 2002. The workshop's focus was to investigate the usefulness of applying a queueing model to Maritime Interdiction Operations (MIO) within the context of the NCMW concept of tactical collaborative planning. Both analytical and simulation-based queueing models were examined, and the theoretical model was applied parametrically to two MIO scenarios. Using the steady-state probability of target vessel interdiction (i.e., service) as the primary measure of effectiveness, the workshop was able to demonstrate the usefulness of queueing to relate NCMW application measures to force effectiveness. In addition, the queueing models provided valuable insight into the aspects of the MIO task where NCMW concepts might be applied. Thus, queueing is directly applicable to the second stage of analysis for operations that can be viewed as a demand for service, and provides direction in the process of refining NCMW concepts into testable applications. The parametric results from the workshop provide general bounds on expected improvements in effectiveness; however, specific results will depend upon the particular NCMW applications and how they are used.

DTIC

*Models; Queueing Theory; Warfare*

**20070026771** Pennsylvania Univ., Philadelphia, PA USA

**Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS)**

Badler, Norman I; Allbeck, Jan M; Dec 2006; 39 pp.; In English

Contract(s)/Grant(s): FA8650-05-2-6649; Proj-1710

Report No.(s): AD-A467336; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467336>

Complexity, customization, and packaging of military platforms and systems increase maintenance difficulty at the same time as the available pool of skilled technical personnel may be shrinking. In this environment maintenance training, technical order presentation, and flight-line operational practice may need to adopt 'just-in-time' procedural aids. Moreover, the realities of real-world maintenance may not permit the hardware indulgences and rigid controls of laboratory settings for visualization and training systems, and at the same time the actual activities of maintainers will challenge requirements for portable or wearable devices. This project has investigated technologies that may be used by Air Force maintainers for training or job aids.

DTIC

*Computer Assisted Instruction; Education; Expert Systems; Maintenance; Semantics; Virtual Reality*



**20070026784** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Advancing Software Security - The Software Protection Initiative**

Hughes, Jeff; Stytz, Martin R; Jun 2003; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467435; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467435>

In December 2001, the Software Protection Initiative (SPI) was established to prevent the unauthorized distribution and exploitation of national security application software by our adversaries. To achieve this, the SPI has several goals, which are to institutionalize software protection within the software development life-cycle, educate and train the community, develop user-friendly protection techniques, and ensure that protection technology and policy are appropriately applied, balancing mission requirements with security. The focus of the SPI is to improve protections for critical scientific, engineering, and modeling and simulation software running on desktops through supercomputers. Not only does software of this nature represent a significant portion of DoD's intellectual property (IP), it also enables the development of next generation weapon systems. In addition to the traditional two components of information assurance, namely network security and operating system integrity, SPI adds a new component, a 'third leg' to the information assurance triad, based on an application-centric approach to protecting important DoD software. The SPI program is accomplishing these goals by providing military-strength application protection, focused investigation, research and development of advanced technologies for software protection across the entire spectrum of computational hardware.

DTIC

*Computer Information Security; Intellectual Property; Networks; Protection; Security; Supercomputers; Weapon Systems*

**20070026796** Naval Research Lab., Washington, DC USA

**Multi-Agent Systems in Mobile Ad hoc Networks**

Macker, Joseph P; Chao, William; Mittu, Ranjeev; Abramson, Myriam; Jan 2005; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467463; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467463>

A number of technologies are evolving that will help formulate more adaptive and robust network architectures intended to operate in dynamic, mobile environments. One technology area, mobile ad hoc networking (MANET) enables self organizing, multi-hop heterogeneous network routing services and organization. Such technology is important in future DoD networking, especially in the forward edge of the battlespace where self-organizing, robust networking is needed. A second technology area, Multi-Agent Systems (MAS) can enable autonomous, team based problem solving under varying environmental conditions. Previous work done in MAS has assumed relatively benign wired network behavior and inter-agent communications characteristics that may not be well supported in MANET environments. In addition, the resource costs associated with performing inter-agent communications have a more profound impact in a mobile wireless environment. The combined operation of these technology areas, including cross-layer design considerations, has largely been unexplored to date. This paper describes ongoing research to improve the ability of these technologies to work in concert. An outline of various design and system architecture issues is first presented. We then describe models, agent systems, MANET protocols, and additional components that are being applied in our research. We present an analysis method to measure agent effectiveness and early evaluations of working prototypes within MANET environments. We conclude by outlining some open issues and areas of further work.

DTIC

*Local Area Networks; Problem Solving*

**20070026799** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Modeling the Structure and Effectiveness of Intelligence Organizations: Dynamic Information Flow Simulation**

Behrman, Robert; Carley, Kathleen; Jun 2003; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467468; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467468>

This paper describes the Dynamic Information Flow Simulation (DIFS), an abstract model for analyzing the structure and function of intelligence support organizations and the activities of entities within them. In order to do so, DIFS simulates the flow of tasks and reports between various units (decision makers, collectors, processors (analysts), databases, etc.) and agencies within an intelligence organization. DIFS is a dynamic, discrete, multi-agent, networked simulation. The structure of the simulation i.e., the types and properties of entities, communication ties, agencies, and operating procedures - is described. The performance metrics used in, equations used in, and assumptions behind its design are discussed. Methods of

conducting a virtual experiment using the simulation, output generated, and a strategy for validating the results is given. DIFS is intended to provide a method of analysis of intelligence support effectiveness abstracted from sources, methods, and content. Using this analysis, marginal performance change caused by change in organization structure or policy can be quantitatively modeled. Over- and under-loaded units, units that are not re-tasked when intelligence requirements change, and changes in information flow can be identified and modeled. Finally, the weaknesses, benefits, and additional applications of DIFS and areas where further research is desired are discussed.

DTIC

*Computerized Simulation; Information Flow; Information Management; Intelligence; Simulation*

**20070026802** Defence Research and Development Canada, Valcartier, Quebec Canada

**Coalition CINC 21 - Leading-Edge Information Technologies to Support Coalition Operations**

Gouin, Denis; Woodliffe, Elizabeth; Sep 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467477; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467477>

Over the last decade, the number of coalition operations has significantly increased, necessitating greater interoperability with our Allies. Several organizational, cultural, system and technological issues need to be addressed to enable synchronization of operations and shared coalition situation awareness. In order to address Coalition Situation Awareness requirements and contribute to interoperability in future coalition operations, a four-nation collaboration known as Coalition CINC 21 (C-CINC 21) has been established between the USA, Australia, Canada and UK. C-CINC 21 participated in Joint Warrior Interoperability Demonstrations (JWID) in 2001 and 2002, to demonstrate the use of portal technology and distributed collaborative services to share coalition information and to experiment with a coalition-shared infrastructure for geospatial access and with a number of collaborative planning and decision-support tools. This paper addresses a number of interoperability issues associated with coalition operations, describes the C-CINC 21 activities, draws lessons from the collaboration and outlines a way ahead for further collaboration.

DTIC

*Information Systems; Leading Edges; Military Operations*

**20070026803** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Information Technology and Knowledge Distribution in C3I teams**

Carley, Kathleen M; Schreiber, Craig; Jun 2002; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-97-1-0037

Report No.(s): AD-A467479; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467479>

This paper lays out a computational model for analyzing the relative efficacy of different C3I architectures for teams with access to different types of databases (ITT). Then using this model, a virtual experiment is conducted. Aspects of this virtual experiment are patterned off of behavior and technology surrounding the knowledge wall. Results suggest that bringing ITT in to traditionally structured teams may reduce their efficiency. Some guidance is provided for how to design C3I architectures for high performance and adaptive teams who are ITT enabled. Implications of these results for the knowledge wall are provided. This study, although preliminary, provides guidance for how to reason about team design in a network centric context.

DTIC

*Command and Control; Data Bases; Information Systems*

**20070026804** 21st Century Systems, Inc., Herndon, VA USA

**Consolidated Situational Awareness for Aircraft Carrier Decision Centers**

Hicks, Jeffrey D; Petrov, Plamen V; Stoyen, Alexander D; Zhu, Quiming; Jun 2002; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467481; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467481>

As the Naval Forces progress toward the network-centric environment envisioned by JV 2010 and JV2020, their dependency upon decision-making aids will grow exponentially as the warfighter's thirst for knowledge from the flood of information rises. As noted from Joint Vision 2020, we '...must be able to take advantage of superior information converted to superior knowledge to achieve 'decision superiority' - better decisions arrived at and implemented faster....'. Particularly

of concern are the shortfalls in the consolidated situational awareness available to the decision makers in the Tactical Flag Command Center (TFCCs) and Combat Direction Center (CDCs) onboard aircraft carriers. The existing CDC and TFCC systems do not provide integrated and fused information which requires more people to glean information out of multiple, stove-piped systems. The current systems are not designed to enhance decision-making and information is not presented in an integrated, graphically based manner that facilitates communications and decision support. This increases response times, resulting in reduced mission effectiveness. 21st Century Systems, Inc. is proposing a unique solution to this issue, the Advanced Battlestation with Decision Support System (ABS/DSS) that utilizes an Agent-based Decision Support System coupled with a 2D/3D Battlespace Visualization Tool. The ABS/DSS utilizes 21CSI's Agent Enhanced Decision Guide Environment (AEDGE(TradeMark)) Architecture which expedites generation of Agent-based systems.

DTIC

*Aircraft Carriers; Combat; Decision Support Systems; Information Systems; Situational Awareness; Warfare*

**20070026809** Foreign Military Studies Office (Army), Fort Leavenworth, KS USA

**Russian and Chinese Information Warfare: Theory and Practice**

Thomas, Timothy L; Elliot, Cathy; Jun 2004; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467510; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467510>

Russian and China have developed concepts of information operations (IO) and information superiority (IS) that differ from US concepts. Russia divides IO theory into information-technical and information-psychological aspects. According to Rastorguyev, 'an information weapon can be any technical, biological, or social means or system that is used for the purposeful production, processing, transmitting, presenting or blocking of data and or processes that work with the data.' Effectiveness of disorganizing an enemy's control system determines who will win or lose, even in wars of a limited nature. Chinese General Dai states that 'Information operations are a series of operations with an information environment as the basic battlefield condition, with military information and an information system as the direct operational targets, and with electronic warfare and a computer network war as the principal forms; focus is on strength of forces and knowledge.' China's focus is on stratagems and control; its IW thinking is evolving away from Western thinking.

DTIC

*China; Information Theory; Russian Federation; Warfare*

**20070026815** Air Force Research Lab., Rome, NY USA

**Data Fusion 'Cube': A Multi-Dimensional Perspective**

Phister, Paul W; Plonisch, Igor; Jun 2002; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467519; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467519>

In the classical sense, data fusion can be viewed as a one-dimensional entity having five distinct levels. However, this view does not convey the multi-dimensional aspect of data fusion. This paper argues that data fusion is not one-dimensional, but rather a three-dimensional entity. These three attributes are sensor fusion, system fusion and information fusion. Sensor fusion can be thought of as taking the raw sensor data and fusing it together so it seems to have come from a single sensor. System fusion can be thought of as combining the output of various heterogeneous systems together into a single fused output. Information fusion can be thought of as taking information gathered from various sources and fusing it into a single output. This paper provides an overview and discussion of this three-dimensional perspective of data fusion in order to illustrate its multi-faceted capabilities and applications. For each of the three dimensions, a definition and possible application, along with a discussion and comparison to the classical Level-0 to Level-4 levels of data fusion, is presented. Finally, this new data fusion 'cube' is offered for consideration in which each axis (Sensor, System, Information) has a corresponding relationship to the classical aspects of data fusion.

DTIC

*Multisensor Fusion; Situational Awareness*

**20070026818** Evidence Based Research, Inc., Vienna, VA USA

**Lessons Learned from War Room Designs and Implementations**

Shaker, Steven M; Jun 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467523; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467523>

Maximizing the flow and control of information is key to competitiveness, whether it be on the battlefield, the campaign

trail or in the boardroom. Both government and commercial organizations have set up 'war rooms' as a means to handle and enhance decision making and planning. There have been both failures and successes from which worthwhile lessons have been learned and can be applied to future war room developmental efforts. Successful war rooms are innovative tools used to manage information in a time-sensitive environment. They are dynamic facilities, which channel the collection, analysis and dissemination of information. They foster collaboration and team based decision making. Command Posts and other optimized facilities supporting military and business decision making (war rooms) can benefit from the experiences and lessons learned from war room designs and implementations developed for government, industry and political campaigns. This paper describes some of the author's most recent and relevant developments and experiences in 'analog', 'digital' and 'virtual' war rooms. Case studies include: a counter-proliferation war room used by DARPA to influence their investment decision making; an advocacy campaign war room used to support a CEO of a major utility in his efforts to slow the pace of deregulation; and a war room supporting a large telecommunication firm's decision making.

DTIC

*Decision Making; Warfare*

**20070026823** Naval Research Lab., Washington, DC USA

**A Case Study for the Naval Training Meta-FOM (NTMF): Analyzing the Requirements from MAGTF FOM**

Mittu, Ranjeev; Clark, Doug; Jun 2002; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467612; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467612>

An analysis of a representative cross section of Naval simulation/stimulation & training systems highlighted that the battle-spaces represented in these systems differ in both content and resolution. These differences currently preclude Naval training systems from operating together in a meaningful way. In response, the Navy Modeling and Simulation Office (NAVMSMO) together with NAVSEA PMS430 has sponsored the development of a Naval Training Meta-Federation Object Model (FOM) (NTMF). The NTMF is being developed by inputs from the Navy M&S trainer experts in response to the DoD M&S vision of interoperability and consistency. The NTMF is focused on providing the mechanism to deliver a synthetic battlespace representation that is interoperable and consistent for use by Navy and Marine Corps trainers. The NTMF will contribute to the DoD vision through interaction and communication between participating simulations/stimulations, and it will be the basis for the creation of a common synthetic battle-space representation. This paper will begin with an overview of the NTMF. Next we will discuss recent developments within the Marine Air Ground Task Force (MAGTF) FOM. Lastly, we will analyze the MAGTF FOM requirements and their impact to the development of the NTMF, as well as additional topics for inclusion within the NTMF.

DTIC

*Education; Interoperability*

**20070026826** Auburn Univ., AL USA

**C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security**

Hamilton, Jr , John A; Sanders, Pamela A; Melear, John; Endicott, George; Jun 2002; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467617; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467617>

The intensity and frequency of joint and combined operations, including operations other than war (OOTW) as well as the accelerating technological advances in command and control have highlighted C2 interoperability issues. The Command and Control Research Program continues to provide an important intellectual forum for military C2 interoperability problems. This forum has been particularly useful for members of the three service C2 acquisition commands and their major interoperability initiative. The commanders of the service C2 acquisition centers, Communications and Electronics Command, Fort Monmouth (CECOM), Space and Naval Warfare Systems Command, San Diego (SPAWAR), Electronic Systems Center, Hanscom, AFB (ESC), formed the Joint Command and Control Integration Interoperability Group (JC2I2G). The JC2I2G exists to promote joint interoperability and change processes and structures by initiating 'bottom up' change to implement Joint C2 integration and interoperability, and by supporting the unified commands in resolving interoperability issues of service specific systems. Recognizing the pivotal role the US Joint Forces Command (USJFCOM) as the Joint Force Integrator, the Director, J6 of USJFCOM serves as principal member of the JC2I2G.

DTIC

*Interoperability; Military Operations; Military Technology; Protocol (Computers); Security*

**20070026835** Army Communications Research and Development Command, Fort Monmouth, NJ USA

**Intelligent Nodes in Coalition Warfare**

Dawidowicz, Edward; Langston, John; Sep 2002; 11 pp.; In English

Report No.(s): AD-A467672; XA-CERDEC/C2/NJ; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467672>

Just the recognition that 'knowledge is power' is not sufficient to utilize available information and transform this information into the powerful asset we call 'knowledge.' With a continuous increase in the complexity and tempo on the modern battlefield; new demands are placed on rapid and precise information dissemination. The volume of information available to the user becomes larger while the time necessary to correctly interpret and understand this information becomes prohibitively smaller. Cognitive processing of information at the receiving nodes is a potential solution to this information overflow problem. These nodes we will call Intelligent Nodes [Dawidowicz, 2001]. This paper will introduce the architecture of an Intelligent Node and will demonstrate its hierarchical scalability across all echelons and Battlefield Functional Areas. This technology is also directly applicable to the Objective Force and Future Combat Systems.

DTIC

*Data Processing; Warfare*

**20070026846** Lockheed Martin Management and Data Systems, Fairfax, VA USA

**Improving Analysis with Information Extraction Technology**

Taylor, Sarah M; Jun 2003; 53 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467926; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467926>

Information Extraction is an emerging technology with the potential to transform the way textual information is analyzed and used for many information analysis tasks. However, as a relatively new technology, its best uses have not yet necessarily been discovered. This paper provides some background on Information Extraction and discusses several effective uses of the technology from recent Lockheed Martin experience in applications of its AeroText(TM) software. The paper provides examples of the ways in which different visual organizations of extracted information can improve analysis. Information Extraction enables better analysis by allowing the analyst access to a far greater depth of information than he could read on his own, and by providing the analyst with the capability to view the data in multiple organizations and formats, thus increasing his ability to see trends and to discover the unexpected.

DTIC

*Data Processing; Extraction; Information Systems*

**20070027245** Army Research Lab., Aberdeen Proving Ground, MD USA

**Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems**

Weatherless, Rachel A; Wilson, Rhoda M; Garrett, Lamar; Letowski, Tomasz R; Binseel, Mary S; Apr 2007; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-AH70

Report No.(s): AD-A466837; ARL-TR-4078; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Communication in military settings must be clear and understandable to avoid possible fatal accidents and mistakes. Speech intelligibility is the overall quality of speech that makes it comprehensible. Intelligibility of speech depends on the properties of the talker, transmission channel, and the listener. The purpose of the reported study was to evaluate intelligibility of speech provided by five communication and hearing protection systems (C&HPSs) operating in talk-through mode. The systems evaluated in this study were the Product Improved-Combat Vehicle Crewman's (PI-CVC) helmet, Bose Improved Tactical Headset (ITH), Mine Safety Appliances-Sordin Gen II headset (Gen II), Communications Enhancement and Protection System (CEPS), and Combat Arms Earplugs (CAE). All systems except for the first one were worn with the Advanced Combat Helmet (ACH). The baseline conditions for assessing the communication data were bare head and the ACH worn alone. Results show that the ACH only, PI-CVC, and Gen II conditions provided significantly better speech intelligibility than the CAE and CEPS for the listeners participating in the study. Performance data for the ITH condition fell between the two groupings. Overall, the earplug-based communication systems (CAE and CEPS) resulted in lower performance and larger data variability than the earmuff-based systems. This larger variability could be attributed to poor repeatability in earplug insertion, which may be limited through more extensive training.

DTIC

*Combat; Ear Protectors; Earphones; Hearing; Helmets; Intelligibility; Telecommunication; Voice Communication*

**20070027261** Interior Dept., Washington, DC USA

**Database Dictionary for Ethiopian National Ground-Water Database (ENGDA) Data Fields**

Kuniansky, Eve L; Litke, David W; Tucci, Patrick; Jan 2007; 141 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466896; OFR-2007-1099; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document describes the data fields that are used for both field forms and the Ethiopian National Ground-water Database (ENGDA) tables associated with information stored about production wells, springs, test holes, test wells, and water level or water-quality observation wells. Several different words are used in this database dictionary and in the ENGDA database to describe a narrow shaft constructed in the ground. The most general term is borehole, which is applicable to any type of hole. A well is a borehole specifically constructed to extract water from the ground; however, for this data dictionary and for the ENGDA database, the words well and borehole are used interchangeably. A production well is defined as any well used for water supply and includes hand-dug wells, small-diameter bored wells equipped with hand pumps, or large-diameter bored wells equipped with large-capacity motorized pumps. Test holes are borings made to collect information about the subsurface with continuous core or non-continuous core and/or where geophysical logs are collected. Test holes are not converted into wells. A test well is a well constructed for hydraulic testing of an aquifer in order to plan a larger groundwater production system. A water-level or water-quality observation well is a well that is used to collect information about an aquifer and not used for water supply. A spring is any naturally flowing, local, ground-water discharge site.

DTIC

*Data Bases; Dictionaries; Ethiopia; Ground Water*

**20070027268** General Accounting Office, Washington, DC USA

**Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities**

Hutton, John P; Neumann, John; Candon, Sharron; Harmon, Gregory; Holguin, Arturo; Thomas, Angela; Moore, Sandra; Ahearn, Marie; Sloan, Karen; Dec 2006; 36 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466913; GAO-07-70; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Foreign students and scholars have made substantial contributions to U.S. research efforts and technology development. However, according to a federal government intelligence assessment, foreign access to sensitive U.S. technology has imposed a significant but unquantifiable cost to the USA. Given this risk, GAO was asked to do the following: (1) describe the nature of the research at universities and identify steps they take to comply with export controls, and (2) assess efforts by the Departments of Commerce and State -- the key export control agencies -- to determine the risk of export violations in university research. GAO reviewed Commerce and State export control programs and met with officials from 13 universities, selected based on their foreign student populations, applications for export licenses, and federal grants and contracts. GAO recommends that Commerce and State use available information to assess potential vulnerabilities and based on this assessment improve outreach, guidance, and interagency coordination. The agencies generally concurred, but State disagreed with GAO's recommendation on assessing vulnerabilities. Broader assessments would increase State's knowledge of risks and help improve its guidance to universities.

DTIC

*Control; International Trade; Military Technology; Risk; Universities; Vulnerability*

**20070027275** Lockheed Martin Canada, Montreal, Quebec Canada

**Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery**

Jouan, Alexandre; Allard, Yannick; Allen, Steve; Sep 2002; 17 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467018; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As part of the Earth Observation Application Development Program (EOADP) program sponsored by the Canada Space Agency, Lockheed Martin Canada has developed the Intelligent Data Fusion System (IDFS) for evidential fusion of features extracted from polarimetric SAR and Hyperspectral imagery. This paper presents the use of IDFS for land use mapping. IDFS is made of three modules. The polarimetric SAR module contains polarimetric classifiers (Cloude decomposition, polarization response parameters), textural classifiers (GLCM, backscattering coefficient) that provide hypotheses about the likelihood that some object of interest may be present in the scene based on textural and scattering properties of the analysed surface. The Hyperspectral module contains the Iterative Error Analysis endmembers selection technique proposed by the Canada Center for Remote Sensing to provide a set of pixel-based hypotheses reflecting the likelihood that some typical material may be present in the scene based on the spectral properties of the analysed surface. Hypotheses provided by each module represent an incomplete, inaccurate and imprecise description of the reality. The data fusion module combines PolSAR and HSI hypotheses using the evidence theory proposed by Dempster-Shafer. This paper presents an overview of the current

functionality of IDFS. Results of evidential fusion are shown for land use mapping. The data-sets acquired over Indian-Head (Saskatchewan) with an airborne C-Band CV-580 PolSAR sensor and HSI Probe-1 imagery were provided by the Canada Center for Remote Sensing.

DTIC

*Land Use; Multisensor Fusion; Polarimetry; Radar Imagery; Synthetic Aperture Radar; Thematic Mapping*

**20070027281** Defence Research and Development Canada, Valcartier, Quebec Canada

**Sensor Management in Command & Control**

Benaskeur, Abder; Sep 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467042; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The sensing resources represent an important source of information on which the Command & Control (C2) process bases most of its reasoning. Therefore, a major prerequisite to the success of the whole C2 process is the effective use of these scarce and costly resources. This is the problem of sensor management that has to do with how best to manage and coordinate the use of sensing resources to improve data acquisition and ultimately perception and comprehension. Conscious of the important role sensor management has to play in modern C2 systems, the Decision Support Systems (DSS) Section at Defense Research & Development Canada - Valcartier (DRDC-V) is currently studying advanced sensor management concepts and applications, to increase the survivability of the current Halifax and Iroquois Class ships, as well as their possible future upgrades. The objective of the reported part of this study is twofold i) to present the sensor management problem and the requirements for its solution ii) to demonstrate, through a tracking application, the benefits that can be gained by the closed-loop management of the sensors.

DTIC

*Command and Control; Resources Management*

**20070027291** Naval Postgraduate School, Monterey, CA USA

**Automated Run-Time Mission and Dialog Generation**

Kelly, John D; Mar 2007; 75 pp.; In English

Report No.(s): AD-A467074; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Current mission driven systems, be they games or training simulations, are generally restricted to using a set of training missions that are hard coded into the system. This has the unfortunate effect of limiting the number of times a person or team can be sent through a simulator before it begins to lose its training value or the number of times a person can replay a game without it becoming predictable and somewhat boring. The fact that all of the mission parameters must be hard coded also increases the time required for scenario development. This study defines an architecture for automating the creation of missions at run time allowing much larger variety in the number and content of missions in a given system. Our architecture also allows for the creation of varied and more believable dialog with minimal scenario creation time required. We also explore an alternate method for determining agents attitudes towards the users avatar which is more robust than the more commonly used system and which can be used as an input to dialog generation further improving the realism of the dialog. A commercial game, Neverwinter Nights by Bioware, has been used to produce a proof of concept.

DTIC

*Artificial Intelligence; Data Processing; Game Theory; Natural Language (Computers); Simulation*

**20070027306** Naval Postgraduate School, Monterey, CA USA

**Requirements and Information Metadata System**

Beckman, Erin M; Mar 2007; 87 pp.; In English

Report No.(s): AD-A467106; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis proposes an adoption of a data schema called RIMS (Requirements and Information Metadata System) developed as a pilot project in the Pittsburgh Field Office of the FBI and sets out to determine if RIMS could be an effective and efficient method to capture, catalogue and retrieve intelligence information within the Federal Bureau of Investigation (FBI). RIMS would enhance the search platform used by FBI analysts and investigators who gather or data mine existing information in furtherance of the FBI's priorities. The use of this coding system can be adapted for use by other U.S. intelligence and law enforcement communities for commonality and uniformity in retrieval, cataloguing, and collecting of intelligence information. The use of this system can be manipulated into a non-classified code for use by state, local, and tribal law enforcement and intelligence entities. Finally, the use of the coding system within the intelligence community will

consolidate and integrate information and intelligence and reduce delays in detecting and retrieving pertinent intelligence obtained and shared within the intelligence community.

DTIC

*Information Systems; Intelligence; Law (Jurisprudence); Metadata*

**20070027311** Naval Postgraduate School, Monterey, CA USA

**Service Oriented Architecture for Coast Guard Command and Control**

Dash, Russell E; Creigh, Robert H; Mar 2007; 151 pp.; In English

Report No.(s): AD-A467111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Coast Guard's software architecture does not meet the organization's needs for information sharing or command and control. The Commandant of the Coast Guard recently mandated the implementation of a Service Oriented Architecture (SOA) to address this problem. This thesis describes a Service Oriented Architecture for Coast Guard Command and Control that integrates legacy applications and provides new capabilities. Traditional software architecture descriptions make it difficult to identify and understand the trade-offs between quality attributes that are inherent in the design. We clarify these critical issues by using multiple scenarios and use cases, in addition to diagrams and functionality requirements. Defining the architecture in this manner enables an auditor to determine the architecture's validity. The Coast Guard also needs a plan to implement this SOA. This thesis defines a process that will deliver value in the form of usable capabilities in an incremental manner. It recognizes the constantly changing nature of both the problem and the necessary solution, and evolves accordingly. It continually plans for, adapts to, and exploits predictable advances in technology to deliver more value. The iterative method we propose includes cyclical evaluation of the system requirements, architecture, and implementation to provide continuous improvement.

DTIC

*Architecture (Computers); Coasts; Command and Control; Service Oriented Architecture*

**20070027328** Library of Congress, Washington, DC USA

**The USA PATRIOT Act: A Sketch**

Doyle, Charles; Apr 18, 2002; 6 pp.; In English

Report No.(s): AD-A467148; CRS-RS21203; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Congress passed the USA PATRIOT Act in response to the terrorist attacks of September 11, 2001. The Act gives federal officials greater authority to track and intercept communications, both for law enforcement and foreign intelligence gathering purposes. It vests the Secretary of the Treasury with regulatory powers to combat corruption of U.S. financial institutions for foreign money laundering purposes. It seeks to further close U.S. borders to foreign terrorists and to detain and remove those within its borders. It creates new crimes, new penalties, and new procedural efficiencies for use against domestic and international terrorists. Although it is not without safeguards, critics contend some of its provisions go too far. Although it grants many of the enhancements sought by the Department of Justice, others are concerned that it does not go far enough. The Act originated as H.R. 2975 (the PATRIOT Act) in the House and S.1510 in the Senate (the USA Act). S.1510 passed the Senate on October 11, 2001, 147 Cong. Rec. S10604 (daily ed.). The House Judiciary Committee reported out an amended version of H.R. 2975 on the same day, H.R.Rep.No. 107-236. The House passed H.R. 2975 the following day after substituting the text of H.R. 3108, 147 Cong. Rec. H6775-776 (daily ed. Oct. 12, 2001). The House version incorporated most of the money laundering provisions found in an earlier House bill, H.R. 3004, many of which had counterparts in S.1510 as approved by the Senate. The House subsequently passed a clean bill, H.R. 3162 (under suspension of the rules), which resolved the differences between H.R. 2975 and S.1510, 147 Cong. Rec. H7224 (daily ed. Oct. 24, 2001). The Senate agreed to the changes, 147 Cong. Rec. S10969 (daily ed. Oct. 24, 2001), and H.R. 3162 was sent to the President who signed it on October 26, 2001. This is an abbreviated version of 'The USA PATRIOT Act: A Legal Analysis,' CRS Report RL31377, stripped of its citations and footnotes.

DTIC

*Interprocessor Communication; Law (Jurisprudence); Surveillance; Telecommunication*

**20070027343** Library of Congress, Washington, DC USA

**National Security Letters in Foreign Intelligence Investigations: A Glimpse of the Legal Background and Recent Amendments**

Doyle, Charles; Mar 21, 2006; 6 pp.; In English

Report No.(s): AD-A467194; CRS-RS22406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Five statutory provisions vest government agencies responsible for certain foreign intelligence investigations (principally



the Federal Bureau of Investigation [FBI]) with authority to issue written commands comparable to administrative subpoenas. These National Security Letters (NSLs) seek customer and consumer transaction information in national security investigations from communications providers, financial institutions, and credit agencies. Section 505 of the USA PATRIOT Act expanded the circumstances under which an NSL could be used. Subsequent press accounts suggested that their use had become widespread. Two lower federal courts, however, found the uncertainties, practices, and policies associated with the use of NSL authority contrary to the First Amendment right of freedom of speech, and thus brought into question the extent to which NSL authority could be used in the future. The USA PATRIOT Improvement and Reauthorization Act, P.L. 109-177, 120 Stat. 192 (2006) (H.R. 3199), and P.L. 109-178, 120 Stat. 278 (2006) (S. 2271), amend the NSL statutes and related law to address some of the concerns raised by critics and the courts. This is an abridged version of CRS Report RL33320, 'National Security Letters in Foreign Intelligence Investigations: Legal Background and Recent Amendments,' without the footnotes, appendices, and most of the citations to authority found in the longer report.

DTIC

*Intelligence; Law (Jurisprudence); Security; United States*

**20070027344** Library of Congress, Washington, DC USA

**National Security Letters in Foreign Intelligence Investigations: Legal Background and Recent Amendments**

Doyle, Charles; Mar 20, 2007; 34 pp.; In English

Report No.(s): AD-A467195; CRS-RL33320; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Five federal statutes authorize intelligence officials to request certain business records in connection with national security investigations. The authority to issue these national security letters (NSLs) is comparable to the authority to issue administrative subpoenas. The USA PATRIOT Act expanded the authority under four of the NSL statutes and created the fifth. Thereafter, the authority has been reported to have been widely used. But prospects of its continued use dimmed after two lower federal courts held that the lack of judicial review and the absolute confidentiality requirements in one of the statutes rendered it constitutionally suspect. The USA PATRIOT Improvement and Reauthorization Act (H.R. 3199), P.L. 109-177, and its companion P.L. 109-178, amended the five NSL sections to expressly provide for judicial review of both the NSLs and the confidentiality requirements that attend them. The sections also have been made explicitly judicially enforceable and sanctions recognized for failure to comply with an NSL request or to breach NSL confidentiality requirements with the intent to obstruct justice. The use of the authority has been made subject to greater Congressional oversight. The text of the five provisions -- section 1114(a)(5) of the Right to Financial Privacy Act (12 U.S.C. 3414(a)(5)); sections 626 and 627 of the Fair Credit Reporting Act (15 U.S.C. 1681u, 1681v); section 2709 of title 18 of the USA Code; and section 802 of the National Security Act (50 U.S.C. 436) -- in their amended form are appended. A Dept. of Justice report found that in its early use of its expanded USA PATRIOT Act authority the FBI had 'used NSLs in violation of applicable NSL statutes, Attorney General Guidelines, and internal FBI policies,' but that no criminal laws had been broken. This report is available abridged as CRS Report RS22406, 'National Security Letters in Foreign Intelligence Investigations: A Glimpse of the Legal Background and Recent Amendments.'

DTIC

*Intelligence; Law (Jurisprudence); Security; United States*

**20070027350** Naval Postgraduate School, Monterey, CA USA

**Terrorism Information Management Within the New York City Fire Department: Past, Present and Future**

Flynn, John P; Mar 2007; 156 pp.; In English

Report No.(s): AD-A467227; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The New York City Fire Department, like the entire fire service, has been proven to be a primary stakeholder in Homeland Security. The mindset of firefighters is influenced by traditional and expected roles that are not fully considerate of the challenges accompanying the new enemy of terrorism. A fundamental deficiency is herein identified as the manner in which information is managed. The FDNY must adapt so as to recognize information as an entity that must be collected, saved and utilized holistically for greater preventative and response capabilities. It must adopt lessons learned by others in the pursuit of better information management. These needs also exist, to a great extent, within the national fire service. This thesis will use a detailed analysis of existing FDNY information systems, a review of the criticality of information to past events, and the perspectives of FDNY firefighters to identify common denominators of deficiency. It will examine the manner in which others have confronted the issue of information management with an eye toward extracting salient lessons. The operational

and psychological ramifications of poor information management will be explored. Finally, concepts that hold promise for the underpinning of practical solutions to the information management problem are presented.

DTIC

*Fires; Information Management; Information Systems; New York City (NY); Security; Terrorism*

**20070027353** Naval Postgraduate School, Monterey, CA USA

**Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics**

Goodson, Christopher J; Knutson, Richard D; Mar 2007; 55 pp.; In English

Report No.(s): AD-A467243; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The general area of research is Maritime Domain Awareness, where we will be looking at the ship tracking process in prevention and interdiction functions. The objective of this research is to demonstrate that the Knowledge Value Added (KVA) and Real Options (RO) methodologies can be used to assess the current performance of core Maritime Domain Awareness (MDA) processes. This type of approach will help with identification and valuation of future options for an MDA process. The results of this research will assist MDA managers, and operational leaders, in making portfolio management decisions for allocating resources to create the correct support tools for MDA processes and support systems. The research will provide a proof of concept test of a set of decision support tools to support managers in the MDA ship tracking process. We also explored a new methodology for determining value added of management.

DTIC

*Decision Support Systems; Decision Theory; Information Management; Leadership; Management Analysis; Personnel*

**20070027357** Library of Congress, Washington, DC USA

**'Sensitive But Unclassified' Information and Other Controls: Policy and Options for Scientific and Technical Information**

Knezo, Genevieve J; Dec 29, 2006; 94 pp.; In English

Report No.(s): AD-A467255; CRS-RL33303; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the September 11, 2001 terrorist attacks, controls increasingly have been placed on some unclassified research and S&T information, including that used to inform decision making and citizen oversight. These controls include 'sensitive but unclassified' (SBU) labels; restrictive contract clauses; visa controls; controlled laboratories; and wider legal restrictions on access to some federal biological, transportation, critical infrastructure, geospatial, environmental impact, and nuclear information. Federal agencies do not have uniform definitions of SBU or consistent policies to safeguard or release it. Following the 2001 terrorist attacks, the Bush Administration issued guidance that reversed the Clinton Administration's 'presumption of disclosure' approach to releasing information under Freedom of Information Act (FOIA) and cautioned agencies to consider withholding SBU information if there was a 'sound legal basis' to do so. Some agencies contend that SBU information is exempt from disclosure under FOIA, even though such information per se is not exempt under FOIA. During the 109th Congress, P.L. 109-90 and P.L. 109-295 focused on management, oversight, and appropriate use of the sensitive security information (SSI) category. Legislative proposals focused on standardizing concepts of 'sensitive' information; modifying penalties for disclosure; and clarifying FOIA. During the 110th Congress, additional topics likely to be controversial include limiting the number of persons who can designate SBU; widening the use of risk-based approaches to control; centralizing review, handling, and appeals; and evaluating the impact of federal policies on nongovernmental professional groups' prepublication review and self-policing of sensitive research.

DTIC

*Policies; Security; Sensitivity; United States*

**20070027358** Library of Congress, Washington, DC USA

**Libraries and the USA PATRIOT Act**

Doyle, Charles; Jul 6, 2005; 7 pp.; In English

Report No.(s): AD-A467257; CRS-RS21441; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA PATRIOT Act, P.L. 107-56, enacted to help track down and punish terrorists and to prevent further terrorism, contains no provisions specifically directed at libraries or their patrons. It has several provisions, however, that might apply in a library context. The most frequently mentioned of these is Section 215 that amends the business record sections of the Foreign Surveillance Intelligence Act (FISA). Before the USA PATRIOT Act, federal authorities, engaged in gathering foreign intelligence information or conducting an investigation of international terrorism, could seek a FISA court order for access to hotel, airline, storage locker, or car rental business records. The businesses to whom the orders were addressed were bound

to silence. Section 215 amended the procedure so that in a foreign intelligence or international terrorism investigation federal authorities may obtain a FISA order for access to 'any tangible item no matter who holds it,' including by implication library loan records and the records of library computer use. Although past practices have apparently made the library community apprehensive, the extent to which the authority of Section 215 has been used, if at all, is unclear. Media accounts of federal investigations involving library patrons ordinarily do not distinguish between simple inquiries, grand jury subpoenas, criminal search warrants, FISA physical search orders, and FISA tangible item orders. Moreover, the Justice Department has indicated that as of March 30, 2005 the authority under Section 215 had been exercised on 35 occasions, but had not been used in any instance to secure library, bookstore, gun sale, or medical records. The House-passed Commerce, State, Justice appropriations bill for FY2006 contains an amendment that bars the expenditure of funds to use Section 215 to acquire library or book store records; the amendment does not appear in the Senate committee-reported version of the bill.

DTIC

*Intelligence; Law (Jurisprudence); Libraries; Surveillance; United States*

**20070027360** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Comparative Assessment of Knowledge Management Education Across the USA Department of Defense**

Wright, Gary L; Mar 2007; 69 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467272; AFIT/GIR/ENV/07-M17; No Copyright; Avail.: Defense Technical Information Center

(DTIC)

Knowledge is a critical resource for organizations today, especially to the DoD. When organizations understand what knowledge is, they can begin to draw value from it. Drawing value from knowledge is best accomplished through the processes of knowledge management: knowledge creation, knowledge storage and retrieval, knowledge transfer, and knowledge application (Alavi and Leidner, 2001). Organizations can create an environment in which these processes flourish by ensuring the organization has the elements of a supportive leadership, structure to control and optimize knowledge sharing, technology to facilitate the KM processes, and a commitment to maximize knowledge sharing and continuously improve (Stankosky et al, 1999). KM education is the means by which organizations can successfully develop an understanding of KM, and those organizational elements required to implement and institutionalize KM. Statistical evidence shows that those organizations that do not adequately address KM education are more likely to fail with their KM systems (Koenig, 2004). Organizations desiring to capitalize on knowledge should then ensure that their KM education efforts are effective by establishing education goals, developing a curriculum to meet these goals, and continuously evaluating goal attainment. This case study research documents how the DoD is addressing knowledge management education.

DTIC

*Defense Program; Education; Information Management; Leadership; United States*

**20070027362** Naval Postgraduate School, Monterey, CA USA

**From the Battlefield to the Homeland: Building the Case for Network-Centric Response**

Peterson, Michael C; Mar 2007; 217 pp.; In English

Report No.(s): AD-A467280; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our nation's ability to respond to natural or man-made disasters has remained relatively unchanged since the attacks of 9/11. Current response operations are characterized by the inability to efficiently produce a collaborative and effective response to incidents of national significance and address the challenges of the Information Age. The military has adapted network-centric tenants and principles from business applications to effectively operate in the Information Age and increase mission effectiveness. These tenants and principles can be adapted by responders to address current deficiencies and increase mission effectiveness. Implementation of network centric response is both technologically and organizationally feasible. Network-centric response operations would allow responders to meet the challenges and leverage the opportunities of the Information Age, resulting in increased mission effectiveness.

DTIC

*Decision Making; Interoperability; Situational Awareness; Warfare*

**20070027373** Naval Postgraduate School, Monterey, CA USA

**A Correlation Between Quality Management Metrics and Technical Performance Measurement**

Turner, Jeffrey L; Mar 2007; 153 pp.; In English

Report No.(s): AD-A467303; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The quality of software management has an affect on the degree of success or failure of a software development program,

this statement has been argued successfully by Martin J. Machniak in his thesis Development of a Quality Management Metric (QMM) Measuring Software Program Management Quality. The QMM metrics can be used both to characterize the quality of software management and provide a template for improving software management performance. Technical Performance Measurement (TPM) in the most basic form is a plan of expected technical achievement in which the actual progress is compared with periodic measurements. However, the difference between the plan and the actual measures is a technical variance which can be considered good or bad, depending on the level of tolerance given in the requirements. TPM is breaking new ground in the development of various techniques for TPM where planning is integrated with cost, schedule, and program impact assessment. The author administered the QMM questionnaire to measure the perceptions of program managers that have the responsibility for software development programs within the U.S. Army. The author then gathered TPM data using an informal verification and validation of the same programs used for the QMM questionnaire, and compared the results and found an inconclusive correlation between them.

DTIC

*Command and Control; Risk*

**20070027375** Library of Congress, Washington, DC USA

**China: Possible Missile Technology Transfers from U.S. Satellite Export Policy - Actions and Chronology**

Kan, Shirley A; Sep 5, 2001; 62 pp.; In English

Report No.(s): AD-A467313; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Congress has been concerned about whether U.S. firms, in exporting satellites, provided expertise to China for use in its ballistic missile and space programs and whether the Administration's policies might facilitate transfers of military-related technology to China. This CRS Report discusses security concerns, policy changes, congressional action, and a chronology of major developments since 1988. Some critics opposed satellite exports to China, while others were concerned that the Clinton Administration relaxed export controls and monitoring of commercial satellites in moving the licensing authority from the State Department to Commerce in 1996. A range of concerns were prompted by New York Times reports in April 1998 that the Justice Department began a criminal investigation into whether Loral Space and Communications Ltd. and Hughes Electronics Corp. violated export control laws. The firms allegedly shared their findings with China on the cause of a rocket's explosion while launching a U.S.-origin satellite in February 1996. The companies are said to have provided expertise that China could use to improve the accuracy and reliability of its future ballistic missiles, including their guidance systems. At least three classified studies reportedly found that U.S. national security was harmed. In the fall of 1998, Congress passed the FY1999 National Defense Authorization Act that transferred licensing authority over satellites back to the State Department (effective March 15, 1999). On October 5, 1999, the President signed into law the FY2000 National Defense Authorization Act (P.L. 106-65) in which Congress addressed export controls relating to missile technology, satellites, and other issues.

DTIC

*China; Chronology; International Trade; Missiles; Policies; Technology Transfer*

**20070027377** Navy Technology Center for Safety and Survivability, Washington, DC, DC USA

**Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report**

Rose-Pehrsson, Susan L; Johnson, Kevin; Minor, Christian; Guthrie, Verner; Apr 20, 2007; 69 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MIPR-W74RDV53203308; Proj-MM-1510

Report No.(s): AD-A467324; NRL/MR/6180--07-9039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Intelligent data fusion techniques are being developed and optimized for use in enhancing wide-area assessment UXO remediation efforts. A data fusion framework will be created to provide a cohesive data management and decision-making utility that will capture all available data and more efficiently direct the expenditure of time, labor, and resources. The objectives of the first year are to determine the feasibility of feature selection methods for data fusion. The first year of project MM-1510 successfully demonstrated the feasibility of feature extraction from wide-area assessment survey data. In contrast to the individual data sources, feature extraction yielded enhanced data for the Pueblo PBR #2 that was well-suited for data fusion. Preliminary combination of feature maps from the various data sources yielded a map for the Pueblo site that was more accurate than any one data source alone. Probability densities were generated from the feature maps and make possible the combination of estimates of data quality, UXO-related features, non-UXO backgrounds, and correlations among the data sets in a Bayesian-based approach to data fusion.

DTIC

*Ammunition; Contamination; Multisensor Fusion; Ordnance; Pattern Recognition*

**20070027380** Naval Postgraduate School, Monterey, CA USA

**Building Collaborative Capacity for Biosecurity at the Georgia Seaports**

Neu, Annette L; Mar 2007; 89 pp.; In English

Report No.(s): AD-A467339; No Copyright; Avail.: Defense Technical Information Center (DTIC)

When public health interventions are incorporated into a comprehensive seaport security strategy, they can effectively prevent and reduce morbidity and mortality, resulting from natural or man-made disasters. The challenge is to build collaborative capacities through new and renewed seaport surveillance activities among government agencies and private companies to strengthen the role of public health to detect, intercept, and mitigate the potential effects of the intentional or unintentional introduction of diseases. Currently, effective collaborative processes between public health agencies and other local, state and federal partners in seaport security are weak and primarily the result of informal activities. Although seaport security receives considerable policy attention in other areas of risk management, such as radiological detection, public health investments are relatively neglected. Effective, sustainable approaches to building interagency collaboration could prove to be an indispensable homeland security initiative to prepare for a bioterrorism attack or other infectious disease incidents.

DTIC

*Infectious Diseases; Public Health; Radiology; Risk; Security; Terrorism*

**20070027387** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Comparative Assessment of Knowledge Management Leadership Approaches within the Department of Defense**

Marshall, II, Tommy V; Mar 2007; 70 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467369; AFIT/GIR/ENV/07-M12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Knowledge has superseded traditional corporate assets and has become the strategic resource for competitive advantage. To reap the benefits of knowledge, organizations must harvest and leverage the collective knowledge of the entire workforce. This is achieved through effective knowledge management. KM involves processes to create, to store, and transfer knowledge to accomplish business objectives and to achieve a competitive advantage. The Department of Defense has also recognized the importance of KM and has since mandated the acquiring, refining, and sharing of knowledge. The Departments of the Army, Air Force, and Navy have each undertaken individual KM efforts. This research, guided by Dr. Michael Stankosky's Four Pillar Framework, used a case study methodology to investigate each of the department's KM leadership and described how they compare and contrast (Stankosky, 1999). This study identified evidence of each KM leadership element for all three departments. Additionally, this research revealed that each department approaches KM leadership uniquely.

DTIC

*Defense Program; Information Management; Leadership*

**20070027393** Library of Congress, Washington, DC USA

**The USA PATRIOT Act: A Legal Analysis**

Doyle, Charles; Apr 15, 2002; 79 pp.; In English

Report No.(s): AD-A467389; CRS-RL31377; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA PATRIOT Act passed in the wake of the September 11 terrorist attacks. It flows from a consultation draft circulated by the Department of Justice, to which Congress made substantial modifications and additions. The stated purpose of the Act is to enable law enforcement officials to track down and punish those responsible for the attacks and to protect against any similar attacks. The Act grants federal officials greater powers to trace and intercept terrorists' communications both for law enforcement and foreign intelligence purposes. It re-enforces federal anti-money laundering laws and regulations in an effort to deny terrorists the resources necessary for future attacks. It tightens immigration laws to close U.S. borders to foreign terrorists and to expel those who are here. Finally, it creates a few new federal crimes, such as the one outlawing terrorists attacks on mass transit; increases the penalties for many others; and institutes several procedural changes, such as a longer statute of limitations for crimes of terrorism. Critics have suggested that it may go too far. The authority to monitor e-mail traffic, to share grand jury information with intelligence and immigration officers, to confiscate property, and to impose new book-keeping requirements on financial institutions, are among the features troubling to some. The Act itself responds to some of these reservations. Many of the wiretapping and foreign intelligence amendments sunset on December 31, 2005. The Act creates judicial safeguards for e-mail monitoring and grand jury disclosures; recognizes innocent owner defenses to forfeiture; and entrusts enhanced anti-money laundering powers to those regulatory authorities whose concerns include the well-being of U.S. financial institutions. This report, stripped of its citations and footnotes, is available in an abbreviated form as 'The USA PATRIOT Act: A Sketch,' CRS report RS21203.

DTIC

*Interprocessor Communication; Law (Jurisprudence); Surveillance; Telecommunication*

**20070027397** Naval Postgraduate School, Monterey, CA USA

**Client Location in 802.11 Networks**

Dang, Tuan Q; Bangalan, Rolan T; Mar 2007; 91 pp.; In English

Report No.(s): AD-A467416; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Location awareness is invaluable to the military commander. Any application that can accurately deliver this service is highly desirable. Being able to extract accurate distances is the first step towards developing a proposed 802.11 local area positioning system. This thesis explores a number of different methods of using 802.11 to capture physical distance separation between mobile stations. The first method of measuring distance, involves using 802.11 round trip signal times. Round trip signal times are determined from a transmitter to a receiver and back, and are used with the speed of light to measure distance between the nodes. Another method of using 802.11 to measure distance involves using signal strength measurements and a client-server arrangement. Distances can be extracted by extrapolating through a range of signal strength measurements. Because signal strength is a measurement of power, its behavior is governed by the inverse-square law. If environmental variables, such as humidity and RF interference do not significantly change, a line graph of signal strength measurements versus distance can be used to determine positions under these constant conditions.

DTIC

*Command and Control; Computer Networks; Data Management; Position (Location); Radio Frequency Interference*

**20070027405** Library of Congress, Washington, DC USA

**Homeland Security Act of 2002: Critical Infrastructure Information Act**

Stevens, Gina M; Feb 28, 2003; 20 pp.; In English

Report No.(s): AD-A467446; CRS-RL31762; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Critical Infrastructure Information Act of 2002 ('CIIA'), to be codified at 6 U.S.C. 131 - 134, was passed on November 25, 2002 as subtitle B of Title II of the Homeland Security Act (P.L. 107-296, 116 Stat. 2135, sections 211 - 215), and regulates the use and disclosure of information submitted to the Department of Homeland Security (DHS) about vulnerabilities and threats to critical infrastructure. This report examines the CIIA. For further information, see CRS Report RL30153, 'Critical Infrastructures: Background, Policy, and Implementation,' by John Moteff. This report will be updated as warranted.

DTIC

*Law (Jurisprudence); Security; Vulnerability*

**20070027410** Australian Defence Industries Ltd., Canberra, Australia

**Interoperability -- An Australian View**

Warner, Neil; Sep 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467489; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Australia's traditional allies have been New Zealand, the UK (UK), and the USA (U.S.). Before the advent of digital C3I Systems, interoperability among Australian, British, and American forces was maintained through the use of common communications equipment and procedures but also by people, training, and doctrine. Australia has traditionally procured its major military equipment, including C3I systems, from the USA and the UK. This tradition has assured the Australian Defence Force (ADF) some level of interoperability with U.S. and UK forces. Australia also has a long history of training with military forces in the UK and the USA and participating in exchanges of personnel. Looking over the past decade, it is clear that the majority of future operations conducted by the ADF will be Operations Other Than War (OOTW). This will require the ADF to operate in coalitions or alliances. The partners within these coalitions or alliances may not have common doctrine, training, or operating procedures. Security also will be a major issue. In addition, the operational environment within these partnerships will need to take into account civil and national influences, as well as influence from United Nations participation or control and from Non-Governmental Organizations (NGOs). Interoperability can be defined as the ability of systems, units, or forces to provide to and accept services from other systems, units, or forces, and to use the services so exchanged to enable them to operate effectively together. Interoperability cannot be thought of solely on an information systems level; it must include doctrine, people, procedures, and training. This paper will examine the interoperability of Command and Control Systems (C3I) with reference to the ADF. The paper includes a discussion of the technical concepts of interoperability, as well as an examination of ADF requirements and its current status.

DTIC

*Australia; Command and Control; Information Systems; Interoperability; Military Operations*

**20070027413** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans**

Scurlock, Antonio J; Mar 2007; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467507; AFIT/GIR/ENV/07-M18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Within the joint force network operations environment, war fighters will treat net centric adversaries and global information grid defense in depth situations as complex, adaptive enclaves that are the product of the dynamic interactions between connected entities and processes. Because of net centrality, no entity or process of the enclave can be considered in isolation; no singular engagement methodology will accurately capture the enclave's complexity, and an alignment of DoD combatant commanders, services, and agencies strategic planning is pivotal. To achieve and maintain information dominance, Joint Network Operations (NETOPS) organizations need to be strategically aligned. As result, to enhance the capabilities-based effects of NETOPS and reduce our NETOP infrastructures susceptibility to compromise. Once the key organizations were identified, their strategic plans were analyzed using a structured content analysis framework. The results illustrated that the strategic plans were aligned with the community of interests tasking to conduct NETOPS. Further research is required into the strategic alignment beyond the strategic (national/theater) and operational levels to determine if the developed NETOPS strategic alignment construct is applicable to all levels of war.

DTIC

*Alignment; Management Planning; Military Operations; Network Analysis; Organizations; Planning; Strategy*

**20070027418** California Univ., Santa Cruz, CA USA

**A Distributed Approach for Multi-Constrained Path Selection and Routing Optimization**

Li, Zhenjiang; Garcia-Luna-Aceves, J J; Jan 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-05-1-0246; CNS-0435522

Report No.(s): AD-A467530; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Multi-constrained path (MCP) selection, in which the key objective is to search for feasible paths satisfying multiple routing constraints simultaneously, is known to be an NP-Complete problem. Multi-constrained path optimization (MCPO) is different from MCP mainly in that, the feasible paths selected should also be optimal with regard to an optimization metric, which makes path computation in MCPO even harder. We propose a fully distributed multi-constrained path optimization routing (MPOR) protocol that solves the general -constrained path selection and routing optimization problems. MPOR computes paths using distance vectors exchanged only amongst neighboring nodes and does not require the maintenance of global network state about the topology or resources; supports hop-by-hop, connectionless routing of data packets, and implements constrained path optimization by distributively constructing an x-optimal path set (i.e., the shortest, the second shortest and up to the xth shortest path in terms of the optimization metric) for each destination at each node. Simulations show that MPOR has satisfactory routing success ratios for multiconstrained path selection, and performs consistently with varying number of constraints. For constrained path optimization, MPOR has high probabilities of finding feasible paths that are also optimal or near-optimal for the given optimization metric.

DTIC

*Optimization; Protocol (Computers); Trajectory Optimization*

**20070027422** Naval Postgraduate School, Monterey, CA USA

**Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations**

Rauch, Travis M; Mar 2006; 264 pp.; In English

Report No.(s): AD-A467546; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Visualizing operations environments in three-dimensions is in keeping with the military's drive to increase the speed and accuracy with which warfighters make decisions in the command center and in the field. Three-dimensional (3D) environments support speed in decision-making by presenting complex systems in an integrated, naturalistic display format. Constructing these environments is a time-consuming task requiring specific expertise not typically available in the command center. The future use of 3D visualization in military operations depends on the ability to create virtual environments quickly and accurately by personnel with minimal graphics experience leveraging data available in the command center. It depends on autogeneration. Assembling and making sense of data necessary to autogenerate a 3D environment requires context and good documentation, best-accomplished using metadata. Metadata supports data-centric, component-based design; key philosophies in promoting interoperability of networked applications. This thesis proposes an XML metadata standard to collect and organize the information necessary to create and populate a 3D virtual environment. The logical extension of a well-designed

standard is the ability to cross the boundaries of usage, allowing simulators to share data with command and control suites and mission planning tools based on the construction of a virtual scene.

DTIC

*Command and Control; Document Markup Languages; Interoperability; Metadata; Military Operations; Simulation; Virtual Reality*

**20070027424** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Refinement of an Instrument to Assess Readiness for Knowledge Management**

Bailey, Landon C; Mar 2007; 85 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467548; AFIT/GIR/ENV/07-M2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Academics and practitioners have described knowledge as a primary source for competitive advantage for organizations; however, many attempts at instituting knowledge management programs to increase organizational competitiveness do not succeed. Instituting knowledge management programs generally requires organizations to make significant changes and the concept of readiness has long been believed to be an important precondition for successful organizational change. By linking previous research in enablers for knowledge management and organizational change, it is possible to adapt an established organizational change readiness instrument to measure readiness for knowledge management. This study culminates in the development and field-testing of the resultant knowledge management readiness instrument, filling in an important gap in contemporary literature.

DTIC

*Information Management; Instruments; Knowledge Based Systems; Maintainability*

**20070027425** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Towards the Development of a Defensive Cyber Damage and Mission Impact Methodology**

Fortson, Jr, Larry W; Mar 2007; 254 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-07-376

Report No.(s): AD-A467549; AFIT/GIR/ENV/07-M9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research is to establish a conceptual methodological framework that will facilitate effective cyber damage and mission impact assessment and reporting following a cyber-based information incidents. Joint and service guidance requires mission impact reporting, but current efforts to implement such reporting have proven ineffective. This research seeks to understand the impediments existing in the current implementation and to propose an improved methodology. The research employed a hybrid historical analysis and case study methodology for data collection through extensive literature review, examination of existing case study research and interviews with Air Force members and civilian personnel employed as experts in cyber damage and mission impact assessment of Air Force networks. Nine respondents provided valuable first hand information about the current implementation cyber damage and mission impact assessment. This research identified several critical impediments to current mission impact assessment efforts on Air Force networks. Based upon these findings, a proposal is made for a new operations-focused defensive cyber damage and mission impact methodology. The methodology will address the critical impediments identified and will result in profound benefits in other areas of cyber asset protection. Recommendations for conceptual implementation and operationalization are presented and related future research topics are discussed.

DTIC

*Damage Assessment; Impact Damage; Security; Warfare*

**20070027426** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node**

Roehl, John M; Mar 2007; 184 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467550; AFIT/GIR/ENV/07-M15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Internet Protocol Geolocation (IP Geolocation), the process of determining the approximate geographic location of an IP addressable node, has proven useful in a wide variety of commercial applications. Commercial applications of IP Geolocation include market research, redirection for performance enhancement, restricting content, and combating fraud. The potential for military applications include securing remote access via geographic authentication, intelligence collection, and cyber attack attribution. IP Geolocation methods can be divided into three basic categories based upon which information is used to



determine the geographic location of the given IP address: 1) Information contained in databases, 2) information that is leaked during connections with the IP of interest, and 3) network-based routing and timing information. This thesis focused upon an analysis in the third category: delay-based methods for IP Geolocation. Specifically, a comparative analysis of three existing delay-based IP Geolocation methods: Upper-bound Multilateration (UBM), Constraint Based Geolocation (CBG), and Time to Location Heuristic (TTLH) is conducted using a simulated network. Based upon analysis of the results, a new hybrid methodology is proposed to improve the accuracy when conducting IP Geolocation. Simulations of the new hybrid methodology show that the hybrid methodology is superior to all existing delay-based methods for IP Geolocation.

DTIC

*Data Acquisition; Geography; Heuristic Methods; Internets; Networks; Position (Location); Protocol (Computers)*

**20070027445** Space and Naval Warfare Systems Command, San Diego, CA USA

**C2 Interoperability: Simulation, Architecture and Information Security**

Hamilton, Jr , John A; Melear, John; Endicott, George; Sep 2002; 11 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467579; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The intensity and frequency of joint and combined operations, including Operations Other Than War (OOTW), and the accelerating technological advances in Command and Control (C2) have highlighted C2 interoperability issues. Communications are increasingly software-driven, which makes the role of software architecture increasingly important in the design of interoperable communications systems. Simulation has an important role to play in defining and resolving interoperability issues stemming from requirements, policies, and procedures. Interoperability is such a challenge that the security implications of enhanced interoperability are often not considered. This paper suggests that the CCRP consider publishing a volume on C2 interoperability that codifies the body of knowledge developed by the JC2I2G offices. The paper is divided into the following sections: formation of the Joint Command and Control Integration Interoperability Group (JC2I2G) and the CINC Interoperability Program Offices (CIPOs), the software-driven interoperability domain, simulation and interoperability, software architecture, and interoperability and information security.

DTIC

*Command and Control; Communication Networks; Computer Programming; Interoperability; Military Operations; Security; Simulation; Software Engineering*

**20070027464** Department of Defence, Canberra, Australia

**Models of Jointness: Infrastructure Issues for Inter-Organisational Working**

O'Neill, John; O'Brien, Fergus; Sep 2002; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467629; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper examines seven models of jointness and the difficulties in defining a transformation framework for transitioning between models. A key issue that arises in the transformation framework is that there are multiple discontinuities that must be navigated as we move from platform-centric to network-enabled warfare.

DTIC

*Command and Control; Decision Making; Interoperability; Situational Awareness*

**20070027469** Defence Research and Development Canada, Valcartier, Quebec Canada

**HUMINT Communication Information Systems for Complex Warfare**

Pigeon, Luc; Beamish, Clark J; Zybala, Michel; Sep 2002; 16 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A467646; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Human intelligence (HUMINT) is one of the most versatile and powerful information sources available for situation awareness and decision-making. Its low cost and ready availability could make it the silver bullet of intelligence. This is particularly true within urban operations and operations in complex terrain, where technically acquired information may be degraded by that particular environment. Unfortunately, there are several drawbacks to HUMINT, in that it can be time-consuming; it may take several months to initially set up effective contacts in a particular environment; and it can be susceptible to deception. This paper proposes a framework for HUMINT and counter-HUMINT communication information system (CIS) development. The proposed framework is built to include both legacy HUMINT analytical processes/systems and to define new criteria for future HUMINT operations regarding information collection and information management. Objectives and accuracy achievements are proposed through the DITE (detection, identification, track, and estimate of future state) sequence of events. Data is structured by five-dimensions based on space, time and possible worlds. Processing is proposed with respect to common ontology, data merging and data fusion, resources management and learning capabilities.

Examples illustrate the CIS design for C-HUMINT, social networks, and urban operations human intelligence assessment.  
DTIC

*Cities; Decision Making; Information Systems; Multisensor Fusion; Situational Awareness; Telecommunication; Warfare*

**20070027472** National Defense Univ., Taipei, Taiwan, Province of China

**An Agent-Based Dynamic Information Security Model in Information Warfare**

Kuo, M H; Sep 2002; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467655; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, the author proposes an agent-based Dynamic Information Security Decision Model (DISDM) that automatically integrates all distributed information security systems to achieve efficient defense information warfare (IW-D). The proposed DISDM can automatically drive intrusion inspection by dynamically executing sound security strategies (e.g., firewalls, high-assurance guards, authentication, intrusion detection, encryption, and security management, etc.) 24 hours a day. It also can repair the damage when systems have been under attack. Thus, it is expected to yield IW-D cost-effective solutions.

DTIC

*Artificial Intelligence; Client Server Systems; Computer Information Security; Cryptography; Dynamic Models; Security; Warfare*

**20070027481** RAND Corp., Santa Monica, CA USA

**Sharing the Dragon's Teeth: Terrorist Groups and the Exchange of New Technologies**

Cragin, Kim; Chalk, Peter; Daly, Sara A; Jackson, Brian A; Jan 2007; 131 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467696; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Operation Enduring Freedom and the global war on terrorism forced many members of al Qaeda to disperse, as the U.S. Government and its allies removed safe havens and arrested a number of key leaders. As a result, the nature of the terrorist threat against the USA appears to have changed. For example, some like-minded terrorist groups that perhaps do not have the global reach of a pre-9/11 al Qaeda nevertheless have formed regional alliances. Similarly, other events have caused terrorist groups that are not linked ideologically to form mutually beneficial partnerships. These partnerships have provided otherwise less capable terrorist groups with the opportunity to improve their skills and their reach. In each circumstance, emerging alliances could increase the threat that terrorism will pose to the USA in the next 3-15 years. Understanding these interactions, therefore, is essential to ongoing and future efforts in the U.S. global war on terrorism. Terrorist groups in three areas -- Mindanao, the West Bank and Gaza Strip, and southwest Colombia -- have exchanged technologies and knowledge in an effort to improve their operational capabilities. Studying these situations can provide the Department of Homeland Security (DHS) with examples of why and how terrorists might share new technologies in the future, as well as the degree to which these exchanges might be successful. The authors chose these case studies because the terrorist groups active in these regions are highly capable. This book examines a variety of different technologies and exchange processes, ranging from remote-detonation devices to converted field ordnance to katyusha rockets. In some instances, terrorists successfully obtained and deployed the technologies involved. Counterterrorism forces disrupted other technology exchanges. In total, the authors examined 11 terrorist groups that operate in these three regions.

DTIC

*Organizations; Technology Transfer; Threat Evaluation*

**20070027502** General Accounting Office, Washington, DC USA

**DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel**

Stewart, Derek B; May 17, 2007; 25 pp.; In English

Report No.(s): AD-A467747; GAO-07-842T; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Individuals working for private industry are playing a larger role in national security work conducted by Department of Defense (DoD) and other federal agencies. As of May 2006, private industry personnel held about 34 percent of DoD-maintained personnel security clearances. The damage that the unauthorized disclosure of classified information can cause to national security necessitates the prompt and careful consideration of who is granted a security clearance. Long-standing delays in determining clearance eligibility and other challenges led GAO to designate the DoD personnel security clearance program as a high-risk area in January 2005 and again in GAO's January 2007 update of high-risk areas. In February 2005, DoD transferred its security clearance investigation functions to the Office of Personnel Management (OPM) and now obtains almost all of its clearance investigations from OPM. The Office of Management and Budget (OMB)

is responsible for effective implementation of policy relating to determinations of eligibility for access to classified information. This testimony addresses the timeliness of the process and completeness of documentation used to determine eligibility of industry personnel for top secret clearances in January and February 2006. This statement relies primarily on GAO's September 2006 report (GAO-06-1070).

DTIC

*Clearances; Contractors; Defense Program; Industries; Organizations; Personnel; Risk; Security*

**20070027511** Philco-Ford Corp., Palo Alto, CA USA

**Generic Organisation Data Integration Solution: The Fast and Convenient Way to Integrate Data**

d'Anjou, Richard; Martel, Francois; Sep 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467761; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The best solution to making tactical and strategic decisions at a coalition level would be to completely integrate information systems in a seamless manner without considering the various participating countries. Various technological solutions offer the required functionality to accomplish this. Unfortunately, even though considerable efforts are currently being deployed to make this possible, presently it is impossible to rapidly integrate information systems that would allow the existence of C2 applications to manage coalitions formed by any NATO member country. Given the requirements of countries to rapidly intervene in theatres of operation, often jointly with many countries, many army corps, it would be important to have a transitory solution that would allow the rapid integration of the various C2 applications that are used by the various involved countries, until all countries can standardize their respective applications. The Operational Data Store (ODS), is the data structure that integrates heterogeneous data coming from various sources into a coherent set of data and serve as a data source for C2 applications. In this paper, we will present a solution that uses an ODS to rapidly integrate C2 applications from various countries in order to provide C2 functions to a coalition.

DTIC

*Command and Control; Data Integration; Decision Making; Information Systems*

**20070027536** Air Force Research Lab., Rome, NY USA

**Modeling the Joint Battlespace Infosphere**

Hillman, Robert G; Hanna, James P; Walter, Martin J; Jun 2001; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467815; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force is developing a concept known as the Joint Battlespace Infosphere (JBI) in order to achieve information superiority. The JBI builds on the Global Information Grid and will move the state-of-the-art in information management into information-centric warfare. JBI will address more than five million information objects, thousands of users and provide scalability challenges for currently available information management hardware and software systems and drive design requirements to create systems that are more capable. JBI concepts will initially be created working with prototypes and will eventually culminate in fielded implementations. Important issues, such as bandwidth, connectivity, computational requirements and storage, information protection and assurance, must be addressed. Significant efforts will be required to implement JBI resources, such as network technologies and topologies, required to achieve JBI's stated objective to achieve warfare information superiority. Key JBI resources are being modeled and simulated to identify, quantify, and resolve technology and topology issues influencing the prototyping, development, and deployment of an operational JBI. This simulation research will allow JBI developers to identify and mitigate programmatic risk early enough within the JBI seven-year development window to allow successful development and deployment of JBI. This paper will discuss the proof of concept assessment performed and the resulting development.

DTIC

*Computer Programs; Information Systems*

**20070027546** Tech Med, Inc., Annapolis, MD USA

**Mapping of WDMET in AIS 2005 and AIS 2005 Military**

Champion, Howard R; Apr 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-C-0365

Report No.(s): AD-A467831; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prior to current efforts to document combat casualty care and outcome in OEF/OIF, the WDMET was the largest collection of detailed combat casualty injuries available to guide military medical planners. The WDMET database collected in the later half of the Vietnam War remains a valuable research tool. This project has mapped some 7832 patient's injuries

from over 3,000 combat incidents that are recorded in the WDMET into contemporary injury severity taxonomies including injury severity scoring. The IECC is a collection of other combat casualty injury data (American, British and Israeli) also mapped from AIS-98 to AIS 2005 Civilian and Military. The result is that the WDMET and IECC databases are now usable in a fashion that can relate to contemporary injury databases, particularly the datasets that are being developed from the contemporary conflicts in Iraq and Afghanistan. This project has executed a fundamental step in furthering the understanding of the nature and severity of combat injury. It provides an analyzable database to combine or contrast with OEF/OIF data.

DTIC  
*Casualties; Combat; Data Bases; Medical Services; Military Operations; Scoring*

**20070027562** Army Research Lab., Aberdeen Proving Ground, MD USA

**Multinational Interoperability Requirements -- A Core Competency**

Hartel, Robert; Chamberlain, Sam; Oct 2000; 7 pp.; In English

Report No.(s): AD-A467857; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Multinational coalitions are the standard for land forces in the full spectrum of land warfighting from operations other than war to armed conflict. Recent events in Bosnia, Kosovo, and East Timor necessitated interaction among the peacekeeping participants, most notably through their liaison channels. Automation of routine liaison tasks could result in a significant improvement in accurate command and control (C2) information exchange. Routine tasks handled through automation will complement the tasks of the liaison officer or cell, especially when the cooperating armies speak different languages. Multinational requirements in support of liaison and defined in the C2 information system (CCIS) are vital to gaining interoperability among multinational coalitions. However, the current process of defining multinational C2 requirements is flawed. The service tradition of working service requirements first, then joint requirements, and finally multinational requirements is a long-standing sequential process that mimics the implementation process. Funding also reflects this sequence. This paper makes the case that this sequence is backwards, and although it may be unrealistic to expect to change this order for the implementation process, there are no technical impediments that prevent reversing the order for the requirements definition process.

DTIC

*Command and Control; Interoperability; Military Operations; Requirements*

**20070027563** Science Applications International Corp., McLean, VA USA

**New Approaches C4I Data Warehousing for Crisis Action - Synchronization, Replication, Sustainment Design Implications**

Babiskin, Robert; Jun 1999; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467859; No Copyright; Avail.: Defense Technical Information Center (DTIC)

C4IFTW (Command, Control, Communication and Intelligence For the Warrior) automated information systems (AIS) provide the planning and executing of military operations requiring mobilization, deployment, employment, sustainment, reconstitution, redeployment, and demobilization of U.S. Armed Forces. At the heart of C4IFTW AISs are highly distributed replicated decision support databases. These systems are often characterized as like a Walmart's data warehouse that goes to war, as the sensitivities to the decision support recognition of need- for-action and timeliness of decisions are acute and similar in approach.

DTIC

*Command and Control; Decision Support Systems; Information Systems; Synchronism*

**20070027612** Naval Undersea Warfare Center, New London, CT USA

**The Quest for Effective Interoperability - Issues in Achieving a Naval Coalition Force Virtual Combat System**

Looney, Michael J; Conrad, Thomas P; Jun 2001; 10 pp.; In English

Report No.(s): AD-A467949; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over the last few years, experiences in naval coalition force activities have indicated a considerable shortfall in interoperability between participants. This has been detrimental to their overall capability and reduced their effectiveness. The problems are associated not only with the technical differences between the participating platforms but also with the lack of understanding of how to function as a network centric coalition task force. The latter being caused by the limited experience of working in such an environment, due to their limited occurrence, and also the cost of running any large scale exercises to address the basic problems. A collaborative venture has been underway for 18 months between UK and US naval research groups where an encrypted link is being used for the network connectivity to provide a suitable research environment to

investigate the problems. The objective is to address such areas as data requirements, management and filtering along with the necessary control strategies essential for effective interoperability in a networked coalition force. As well as gaining experience in areas that can be transferred onto operational systems, the four year program should provide some yardstick for measurement of interoperability and whether there is an improvement in technical capability or, perhaps, show that coalition force activity is primarily a political requirement.

DTIC

*Combat; Information Systems; Interoperability; Military Operations*

**20070027613** Space and Naval Warfare Systems Command, San Diego, CA USA

#### **Evolution of a Mission Plan**

Heacox, Nancy J; Quinn, Michael L; Smillie, Robert J; Hayes, James A; Jensen, Jens A; Jun 2001; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467951; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A prototype Decision Support System for Coalition Operations (DSSCO) is being developed by the Space and Naval Warfare Systems Center, San Diego, to support the Operations Planning Team (OPT) of the Commander in Chief, USA Pacific Command (CINCPAC). The goal of DSSCO is to apply and integrate organizational design concepts and decision support technologies in planning and executing multinational coalition operations. Employing a user-centered design approach, DSSCO researchers have developed a multi-component toolset. The Planning Module functions as a surrogate expert planner and guides OPT personnel through the evolution of a mission plan using the Crisis Action Planning process. DSSCO's supporting resources include a Coalition Planning Guide and access to relevant information regarding coalition partners and other organizations with whom the U.S. military must interface during a coalition operation. The Task Visualization Module presents the plan. It provides a collaborative display that enables distributed coalition forces to maintain shared situation awareness in real-time of their own activities in relation to those of other organizations. This paper describes the DSSCO toolset and the functional support it will provide to the OPT.

DTIC

*Decision Support Systems; Military Operations; Navy; Prototypes; Warfare*

**20070027615** Lockheed Missiles and Space Co., Inc., Fairfax, VA USA

#### **Levels of Interoperability in Coalition Systems**

Handley, Holly A; Levis, Alexander H; Bares, Michel; Jun 2001; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0267

Report No.(s): AD-A467953; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Systems of different command centers that are brought together in a coalition operation must have some level of interoperability in order to work together. Bares [2000] has introduced a formalism of three interoperability domains that describe the ability of the systems to define their own level of interoperability within the coalition by assessing their own and the other systems ability to interact on actions of the coalition. The lowest domain, interconnectivity, reflects the ability to exchange messages; this level must already have been achieved in order for the systems to participate in the coalition. The second domain, interoperability, reflects a system's ability to identify what tasks it is able to interoperate on. The third level, intercooperability, indicates that all systems have the ability to evaluate all other systems in the coalition. By describing the interoperability domains in this manner, the domains represent increasing levels of awareness of each system's own capabilities and those of the other systems; it represents the transition from exchanging data to exchanging knowledge. This research looks particularly at the interoperability level and the ability of systems to evaluate their own interoperability on the coalition's actions by using Bares' formalism of interoperability to assign actions to systems participating in the coalition.

DTIC

*Command and Control; Interoperability*

**20070027617** Naval Postgraduate School, Monterey, CA USA

#### **Toward an Interoperability Architecture**

Buddenberg, Rex; Jun 2001; 12 pp.; In English

Report No.(s): AD-A467957; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In moving toward an interoperability architecture, the concept of network centric is a step in the right direction - all modules connect to the network, not to each other. And a handful of good network citizenship rules provide a syntactical guide for attachment. From the point of view of the network designer this is sufficient - we have enough to build internetworks for

the common good. The continued burgeoning of the Internet constitutes an existence proof. But a common networking base is insufficient to reach a goal of cross-system interoperability - the large information system. Many standardization efforts have attempted to solve this problem, but appear to have lacked the necessary scope. For instance, there have been many efforts aimed at standardizing data elements; these efforts, if followed through, yield some gains, but never seem to quite reach the interoperability goal. If we are to truly erect an interoperability architecture, we need to broaden the scope. This problem of cross-program, cross-service and cross-ally interoperability requires that we agree on the what of modularization, not just the how. This paper is aimed at framing the interoperability architecture problem.

DTIC

*Command and Control; Information Systems; Interoperability; Warfare*

**20070027653** Library of Congress, Washington, DC USA

**Data Mining and Homeland Security: An Overview**

Seifert, Jeffrey W; Mar 28, 2007; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468032; CRS-RL31798; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Data mining has become one of the key features of many homeland security initiatives. Often used as a means for detecting fraud, assessing risk, and product retailing, data mining involves the use of data analysis tools to discover previously unknown, valid patterns and relationships in large data sets. In the context of homeland security, data mining can be a potential means to identify terrorist activities, such as money transfers and communications, and to identify and track individual terrorists themselves, such as through travel and immigration records. While data mining represents a significant advance in the type of analytical tools currently available, there are limitations to its capability. One limitation is that although data mining can help reveal patterns and relationships, it does not tell the user the value or significance of these patterns. These types of determinations must be made by the user. A second limitation is that while data mining can identify connections between behaviors and/or variables, it does not necessarily identify a causal relationship. Successful data mining still requires skilled technical and analytical specialists who can structure the analysis and interpret the output.

DTIC

*Data Mining; Information Retrieval; Security*

**20070027674** Diabetes Technology Society, Foster City, CA USA

**Third Annual Clinical Diabetes Technology Meeting**

Klonoff, David D; May 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0793

Report No.(s): AD-A468075; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Third Annual Clinical Diabetes Technology Meeting was presented by the Diabetes Technology Society at the San Diego California Marriott Mission Valley Hotel on April 20-21 2007. The attendance was 378 healthcare providers and scientists. The first day of the meeting covered Technologies for Diabetes Monitoring and the second day covered Technologies for Diabetes Therapy. On April 20 2007 which was the Technologies for Diabetes Monitoring day, the first presentation was made by Christopher Saudek, M.D. on the topic 'The Impact of Self Monitoring of Blood Glucose on Glycemic Control'. This clinician emphasized the benefits of glucose monitoring to achieve glycemic targets. Bruce Buckingham, M.D. presented an overview on Continuous Glucose Monitoring. He described how metabolic monitoring with continuous glucose monitoring can provide information about nutritional and metabolic status that is unavailable with spot glucose testing. William Clarke, M.D. discussed the concept of 'Glycemic Variability' which means that acute fluctuations in blood glucose levels can be as harmful for the circulation as prolonged severe hyperglycemia. Glycemic variability can be best measured through continuous glucose monitoring technology. Howard Wolpert, M.D. discussed 'Establishing a CGM Program' and pointed out how important it is to utilize the data provided by continuous glucose monitoring to determine therapy of diabetes. He provided examples of glycemic patterns that can be discerned through this monitoring technology. Darrell Wilson, M.D. spoke on the use of CGM to Improve Control and Prevent hypoglycemia: Case Studies' and gave examples of how continuous glucose monitoring can provide insight into patient behavior and assist in determining drug and diet therapy. He described the work of the multicenter research group DirectNET.

DTIC

*Glucose; Metabolic Diseases; Metabolism; Nutrition*

**20070027687** Library of Congress, Washington, DC USA

**Data Mining and Homeland Security: An Overview**

Seifert, Jeffrey W; Jan 18, 2007; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468120; CRS-RL31798; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Data mining has become one of the key features of many homeland security initiatives. Often used to detect fraud and assess risk, data mining involves the use of data analysis tools to discover previously unknown, valid patterns and relationships in large data sets. In the context of homeland security, data mining can be a potential means to identify terrorist activities, such as money transfers and communications, and to identify and track individual terrorists themselves, such as through travel and immigration records. While data mining represents a significant advance in the type of analytical tools currently available, there are limitations to its capability. One limitation is that although data mining can help reveal patterns and relationships, it does not tell the user the value or significance of these patterns. These types of determinations must be made by the user. A second limitation is that while data mining can identify connections between behaviors and/or variables, it does not necessarily identify a causal relationship. Successful data mining still requires skilled technical and analytical specialists who can structure the analysis and interpret the output. Some homeland security data mining initiatives that have attracted congressional interest include the Terrorism Information Awareness (TIA) Program, (now-discontinued); the Computer-Assisted Passenger Prescreening System II (CAPPS II, now canceled and replaced by Secure Flight); the Multi-State Anti-Terrorism Information Exchange (MATRIX) pilot project; the Able Danger program; the Automated Targeting System (ATS); and data collection and analysis projects being conducted by the National Security Agency (NSA). While technological capabilities are important, there are other implementation and oversight issues that can influence the success of a project's outcome: data quality, software interoperability, mission creep, and privacy.

DTIC

*Data Bases; Data Mining; Data Processing; Information Retrieval; Intelligence; Security*

**20070027698** Mitre Corp., Norfolk, VA USA

**Developing an Information Superiority-Command and Control Joint Experimentation Strategy**

Richards, Russell; Curtis, Keith; Paradiso, Rick; Oct 2000; 5 pp.; In English

Report No.(s): AD-A468154; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes the rationale, development, and intended outcome of a joint experimentation strategy that will be used to investigate three concepts under study at the Joint Experimentation Directorate (J9) of the U.S. Joint Forces Command (USJFCOM). The concepts are Common Relevant Operational Picture (CROP), Joint Interactive Planning (JIP), and Adaptive Joint Command and Control (AJC2). USJFCOM J9 defines an experimentation strategy as a systematic and detailed plan of action encompassing methods to be adopted from beginning to end for evaluating a concept. In contrast to an experimental design, which is a plan for the conduct of an experimental study, an experimentation strategy is a plan for investigating a concept. This distinction is critical, as concept-based experimentation, the USJFCOM J9 approach to experimentation, is still so new that there is little agreement on definitions and terms among the many organizations involved. This paper presents the roadmap of how J9 plans to address the investigation of these three concepts. Initial efforts by the CROP, JIP, and AJC2 Integrated Concept Teams (ICTs) focused on developing a separate experimentation strategy for each concept. But after much study, the ICT members found that there were so many similarities and interrelationships among the concepts, it made more sense to combine the ICTs and develop a single strategy for concept investigation. For clarity and consistency, the experimentation strategy for the three information-related concepts is being called the Information Superiority - Command and Control (IS-C2) Experimentation Strategy. The IS-C2 concepts are the enablers that will allow the U.S. military to transform traditional operational warfighting by making changes in weapon systems, doctrine, culture, and organization.

DTIC

*Command and Control; Information Systems; Military Operations*

**20070027712** George Mason Univ., Fairfax, VA USA

**Integration of Information Operations into Effects-Based Operations: Some Observations**

Wentz, Larry K; Wagenhals, Lee W; Jun 2003; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0267; F49620-02-1-0332

Report No.(s): AD-A468338; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information Operations (IO) has become a primary war fighting capability and is now considered a military core competency. The military Services are establishing IO as a military career field equivalent to other war fighting fields and they are developing supporting education and training programs to create a pipeline of trained and experienced information operations warriors. Transforming doctrine into an operational reality has, however, proven to be a challenge and the training

programs and operational planning and assessment tools have been slow to materialize. Operations in the Balkan's and Afghanistan have afforded the military the opportunity to conduct IO and to document experiences and lessons from these real world operations. A number of experiments and exercises also have explored new military concepts that included the use of non-kinetic IO means of national power to influence adversary behavior and actions. This paper explores some of the challenges of executing and assessing IO courses of action including some observations regarding integration of IO into EBO. The insights and observations offered are based on the authors multiple experiences. Operationalizing IO is work in progress and much remains to be done to bridge policy, doctrine, applications and tools.

DTIC

*Information Systems; Military Technology*

**20070027716** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Assessing Perceptions of Knowledge Management Maturity/Capabilities: A Case Study of SAF/FM**

Blair, Aaron M; Mar 2007; 118 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468368; AFIT/GIR/ENV/07-M3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Knowledge is an essential organizational resource that is required at all echelons to accomplish processes, to make decisions, and to improve efficiency and effectiveness. In order to take advantage of the benefits of knowledge, organizations must harvest and leverage the collective knowledge of the entire workforce through effective knowledge management (KM). The Air Force Center of Excellence for Knowledge Management recognized SAF/FM as having an exemplar KM program within the Air Force. This research used the Knowledge Management Capability Assessment (KMCA) framework to assess the overall KM maturity and capabilities of the seemingly mature SAF/FM KM program. The results indicate that the SAF/FM KM program is at an overall KM maturity of level 2; the organization recognizes the value of knowledge assets, its culture encourages activities associated with knowledge sharing, and the senior leadership communicates the value of and shows commitment to knowledge sharing. The organization's KM maturity is inhibited by its lack of a KM strategy and lack of formal mechanisms and processes to acquire and store its knowledge assets.

DTIC

*Information Management; Knowledge Based Systems; Leadership; Perception*

**20070027734** Army Intelligence and Security Command, Fort Belvoir, VA USA

**The Challenge of New and Emerging Information Operations**

Heath, James E; Woodcock, Alexander E; Jun 1999; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468421; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information operations as defined in Joint Publication 3-13 of the Joint Staff (1998) are aimed at influencing the information and information systems of an adversary and defending one's own information and information systems. Such operations require the continuous and close integration of offensive and defensive activities; the design, integration, and interaction of C2 procedures with supporting intelligence; and may involve public and civil affairs-related actions. Offensive IO involve the use of supporting information and intelligence capabilities and assets to influence adversarial decision-makers and to achieve specific objectives. Defensive IO are aimed at protecting and defending friendly information assets through information assurance, operations security, physical security, counter-deception, and electronic warfare. IO in support of civil-military interactions is becoming increasingly more important as non-kinetic courses-of-action are required. Incorporating IO into military operations up until now has been extremely difficult due to the lack of doctrine and operational or technological support. However, Joint Publication 3-13 has addressed the doctrinal requirements while innovative operational sites such as the Army's INSCOM Information Dominance Center (IDC) are addressing the operational and technological needs. The IDC serves as a model for the DoD and a proposed virtual hearing room for Congress. As the IDC and its supporting technologies mature, individuals will be able to freely enter, navigate, plan, and execute operations within Perceptual and Knowledge Landscapes. This capability begins the transition from Information Dominance to Knowledge Dominance. The IDC is instantiating such entities as smart rooms, avatars, square pixel displays, polymorphic views, and other technologies for directly interacting in virtual domains. This will take us to the next paradigm of human-machine interaction within the multi-dimensional spaces required for IO.

DTIC

*Man Machine Systems; Prototypes; Warfare*



**20070027752** Center for Army Analysis, Fort Belvoir, VA USA

**Industrial Base Model Data Requirements (IBMDR)**

Leake, Charles R; Apr 2003; 27 pp.; In English

Report No.(s): AD-A468467; CAA-R-03-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The project determined if a data base existed that could be used in analysis of the organic Department of Defense (DOD) industrial base. This data base, although suitable for numerous analyses, did not contain all the data elements required for the, 'Optimizing the Capacity and Operation of U.S. Army Ammunition Production Facilities' model, developed by Vedat Bayram at the Naval Postgraduate School. A new model would have to be developed or the current model changed to conduct an optimization study using the DOD data base presently available.

DTIC

*Data Bases; Defense Industry; Requirements*

**20070027796** Library of Congress, Washington, DC USA

**Security Classification Policy and Procedure: E.O. 12958, as Amended**

Relyea, Harold C; Apr 23, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468540; CRS-97-771-GOV; No Copyright; Avail.: Defense Technical Information Center (DTIC)

After two years of preparation, Executive Order 12958, prescribing security classification policy and procedure, was signed by President William Clinton in mid-April 1995. The order was prompted by changing security conditions in the aftermath of the end of the Cold War and a desire for more economical and effective management of classified information. The directive was modified in late March 2003 by Executive Order 13292, issued by President George W. Bush. Largely prescribed in a series of successive presidential executive orders issued over the past 50 years, security classification policy and procedure provide the rationale and arrangements for designating information officially secret for reasons of national security, and for its declassification as well.

DTIC

*Classifications; Policies; Security*

**20070027797** Library of Congress, Washington, DC USA

**Access to Government Information in the USA**

Relyea, Harold C; Kolakowski, Michael W; Apr 23, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468541; CRS-97-71-GOV; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Constitution of the USA makes no specific allowance for any one of the co-equal branches to have access to information held by the others and contains no provision expressly establishing a procedure for, or a right of, public access to government information. Nonetheless, Congress has legislated various public access laws. These include two records access statutes -- the Freedom of Information Act (FOI Act or FOIA; 5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a) -- and two meetings access statutes -- the Federal Advisory Committee Act (FACA; 5 U.S.C. App.) and the Government in the Sunshine Act (5 U.S.C. 552b). Moreover, due to the American separation of powers model of government, interbranch conflicts over the accessibility of information are neither unexpected nor necessarily destructive. The federal courts, historically, have been reluctant to review and resolve 'political questions' involving information disputes between Congress and the executive branch. Although there is considerable interbranch cooperation, such conflicts probably will continue to occur on occasion.

DTIC

*Law (Jurisprudence); Public Law; United States*

**20070027824** Human Resources Research Organization, Fort Knox, KY USA

**Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III**

Campbell, Charlotte H; Deatz, Richard C; Quinkert, Kathleen A; Jun 2000; 17 pp.; In English

Report No.(s): AD-A468588; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The transition to the digital Army of Force XXI and beyond is characterized by challenges to how the Army will train, maintain, and operate as an information age force. In response to the concerns and issues resulting from digitization, the U. S. Army Research Institute for the Behavioral and Social Sciences (ARI), Armored Forces Research Unit, is engaged in the design and development of training and performance evaluation techniques to support Force XXI digital capabilities. This paper summarizes an ARI project that addressed training for leaders and staffs of future digital environments. Based on learning and performance research on team training and operations in digital environments, a training support package for a future-battlefield experiment was constructed. Coordination between ARI and the Mounted Maneuver Battlespace Laboratory

(MMBL) at Fort Knox, Kentucky enabled the two organizations to work together as a team to accomplish multiple goals. Observations and data collection during implementation of the training led to formulation of a series of lessons learned on training content and training structure. These lessons are addressed to several audiences, including developers of future staff training and researchers conducting future systems experiments and training.

DTIC

*Digital Systems; Education; Information Retrieval; Information Systems; Reliability Analysis*

**20070028428** Office of the Secretary of Defense, Washington, DC USA

**Report to Congress on the Activities of the DoD Office of Technology Transition**

Aug 2006; 116 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466475; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466475>

The Office of Technology Transition (OTT) was established by the Secretary of Defense in response to 10 U.S.C. 2515 to serve as a focal point for the domestic technology transfer activities of the Department of Defense. This report, required by Section 2515 (See Appendix A), summarizes the accomplishments and highlights key technology transfer efforts throughout the Department for FY 2004 and FY 2005. This 11th report discusses our major efforts and successes in transferring technology. Appendix B displays specific data elements showing the trends in Cooperative Research and Development Agreements (CRADAs) and Patent License Agreements (PLAs), and the increase in royalty income as a result of licensing DoD developed technologies. Appendix C describes the DoD George F. Linsteadt Technology Transfer Achievement Award and provides information on the award winners. Appendix D highlights some of the technology transfers such as the Vein Viewer which is a system and method for enhancing visualization of veins, arteries, and other subcutaneous natural or foreign structure in the body. Appendices E and F provide the details of the Federal Laboratory Consortium (FLC) awards to DoD activities for FY 2004 and FY 2005, respectively.

DTIC

*Congressional Reports; Defense Program; Research Management; Technology Transfer*

**20070028431** Defence Science and Technology Organisation, Edinburgh, Australia

**Organisational Interoperability: Evaluation and Further Development of the OIM Model**

Fewell, Suzanne; Clark, Thea; Jun 2003; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466378; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466378>

The military imperative to achieve increased interoperability both within forces and with other nations is well recognized. DSTO previously developed an Organizational Interoperability Maturity Model (OIM) to evaluate interoperability at the organizational level. The OIM considers the human-activity aspects of military operations, which are not covered in other models. This paper describes how the model has been used to identify problems and to conduct evaluations in coalition operations such as INTERFET and the Australia US Interoperability Review. These assessments showed that the attributes of the OIM needed development and refinement. Further work on the model is presented. This model is then used to conduct a preliminary evaluation of interoperability between Australia and the US in the Multinational Limited Objective Experiment 2.

DTIC

*Interoperability; Military Operations; Models*

**20070028433** Joint C4ISR Battle Center, Suffolk , VA USA

**A Theory of Interoperability Failures**

McBeth, Michael S; Mar 2003; 64 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466372; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466372>

This paper develops a theory of interoperability failures. Interoperability in this paper refers to the exchange of information and the use of information, once exchanged, between two or more systems. The need for a theory of interoperability failures is introduced along with a discussion of the reinforcing relationship between theory and experiment. First, the interoperability of two systems over time is considered. The failure rate for electronic equipment as it ages over time often follows a life distribution model in the shape of the widely known Bathtub curve. By analogy, if one considers the interaction of two systems over time, a theory of interoperability failures can be developed by postulating a life distribution

model with three distinct time periods: early, mediate, and relative obsolescence. A causal analysis that focuses on intended functionality, requirements, design implementation, and developmental testing is used to explain the existence of these three time periods. Then, the relationship between interoperability and complexity in terms of interaction and coupling is discussed. Finally, the theory is used to develop criteria for selecting specific systems to study and collect data to refute or lend credence to the theory.

DTIC

*Failure; Interoperability*

**20070028444** President's Identity Theft Task Force, Washington, DC USA

**The President's Identity Theft Task Force: Combating Identity Theft a Strategic Plan**

Apr 11, 2007; 120 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467064; No Copyright; Avail.: Defense Technical Information Center (DTIC)

From Main Street to Wall Street, from the back porch to the front office, from the kitchen table to the conference room, Americans are talking about identity theft. The reason: millions of Americans each year suffer the financial and emotional trauma it causes. This crime takes many forms, but it invariably leaves victims with the task of repairing the damage to their lives. It is a problem with no single cause and no single solution. Eight years ago, Congress enacted the Identity Theft and Assumption Deterrence Act,<sup>1</sup> which created the federal crime of identity theft and charged the Federal Trade Commission (FTC) with taking complaints from identity theft victims, sharing these complaints with federal, state, and local law enforcement, and providing the victims with information to help them restore their good name. Since then, federal, state, and local agencies have taken strong action to combat identity theft. The FTC has developed the Identity Theft Data Clearinghouse into a vital resource for consumers and law enforcement agencies; the Department of Justice (DOJ) has prosecuted vigorously a wide range of identity theft schemes under the identity theft statutes and other laws; the federal financial regulatory agencies<sup>2</sup> have adopted and enforced robust data security standards for entities under their jurisdiction; Congress passed, and the Department of Homeland Security issued draft regulations on, the REAL ID Act of 2005; and numerous other federal agencies, such as the Social Security Administration (SSA), have educated consumers on avoiding and recovering from identity theft. Many private sector entities, too, have taken proactive and significant steps to protect data from identity thieves, educate consumers about how to prevent identity theft, assist law enforcement in apprehending identity thieves, and assist identity theft victims who suffer losses.

DTIC

*Computer Information Security; Crime; Identities; Law (Jurisprudence)*

**20070028456** Army Communications Research and Development Command, Fort Monmouth, NJ USA

**Army Intelligence Analysis and Interpretation: Assessing the Utility and Limitations of Computational Diagnostic Reasoning**

Powell, Gerald M; Jun 2004; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466043>

The U.S. Army's Future Force is critically dependent on information superiority levels that will support timely, quality decision-making during high tempo operations. The Future Force is anticipated to produce unprecedented levels of data requiring analysis. Data fusion is considered by some as the potential solution to handling this severe data overload. The Joint Directors of Laboratories Data Fusion model categorizes data fusion-related functions at a high level of generality. For fusion in the Army, little has been published reflecting an elaboration of functionality on levels 2 and 3 of this model, both of which are viewed as critical elements of intelligence analysis and interpretation. Walsh (2002) offered a first-level decomposition of functionality for Level 2. Powell and Broome (2002) and Powell (2002) indicated the complex set of interrelationships among problems within and between fusion levels characterizing Army intelligence analysis and interpretation suggests a user-centric, holistic approach addressing fusion levels 1 through 5. The present paper characterizes selected key aspects of analysis and interpretation problems and processes based on observations of Army intelligence analysis (in practice) associated with anticipated requirements for the Unit of Action. We analyze the utility and limitations of a computational model of diagnostic reasoning with respect to intelligence analysis and interpretation and identify classes of knowledge that appear to be essential to performing these tasks. The results are considered with respect to their implications for automated support to intelligence analysis and interpretation.

DTIC

*Decision Making; Hypotheses; Information Retrieval; Intelligence; Multisensor Fusion; Priorities*

**20070028458** Minnesota Univ., Minneapolis, MN USA

**Methods for Effective Virtual Screening and Scaffold-Hopping in Chemical Compounds**

Wale, Nikil; Karypis, George; Watson, Ian A; Apr 4, 2007; 12 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): DAAD19-01-2-0014; EIA-9986042; NSF ACI-01-33464; NSF IIS-04-31135; NIH-RLM008713A  
Report No.(s): AD-A467533; TR07-010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Methods that can screen large databases to retrieve a structurally diverse set of compounds with desirable bioactivity properties are critical in the drug discovery and development process. This paper presents a set of such methods, which are designed to find compounds that are structurally different to a certain query compound while retaining its bioactivity properties (scaffold hops). These methods utilize various indirect ways of measuring the similarity between the query and a compound that take into account additional information beyond their structure-based similarities. Two sets of techniques are presented that capture these indirect similarities using approaches based on automatic relevance feedback and on analyzing the similarity network formed by the query and the database compounds. Experimental evaluation shows that many of these methods substantially outperform previously developed approaches both in terms of their ability to identify structurally diverse active compounds as well as active compounds in general.

DTIC

*Chemical Composition; Data Bases; Network Analysis*

**20070028476** AB Technologies, Inc., Alexandria, VA USA

**Data Alignment between Army C4I Databases and Army Simulations**

Hieb, Michael R; Blalock, James; Jun 2001; 11 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468229; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA468229>

C4I Interfaces to Simulations are limited in functionality. One of the principle factors causing this is a lack of interface standards. While standards are a necessary condition, they are not sufficient. In order to have a complete interface, the data to be exchanged must be represented in both systems (C4I and Simulation). However, the current status is that C4I systems and simulations 1) do not contain the same data elements; 2) represent data differently, and 3) are often unaware of the other's data requirements. The Joint Technical Architecture-Army (JTA-Army) mandates use of specific data models for certain classes of information systems (such as tactical C4I systems). Simulation developers should be cognizant of these data models in the development of new Army Simulations. The Army is using a common data base, the Joint Common Data Base (JCDB,) in it's Army Battle Command Systems (ABCS). In order to interface effectively to Army C4I systems, simulations must represent the critical data elements that are 1) used to initialize the JCDB; and 2) sent between the simulations and C4I systems. However, often Army simulations do not contain these critical data elements which will result in functionality that must be provided by interfaces. Each data element that does not have an exact match on the simulation side causes a translation/transformation to occur, with resulting cost and complexity. Since any interface must align any differences, the interface can become quite complex. This paper compares an Army C4I Data Model of the JCDB to a simulation representation (an Army Modeling and Simulation Office proposed standard that is representative of current and future simulations) to identify areas which are not aligned. Results of this analysis show that current Army representations are not aware of the standard data models that will be used in future Army ABCS systems.

DTIC

*Alignment; Command and Control; Computers; Data Bases; Intelligence; Interoperability; Simulation*

**20070028519** National War Coll., Washington, DC USA

**Forecasting Complex Political and Military Events: The Application of Expected Utility to Crisis Situations**

Kugler, Jacek; Abdollahian, Mark A; Tammen, Ronald L; Jun 2000; 44 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A468439; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper introduces the C2 community to a new technology based process that permits the analyzing and forecasting of complex political and military issues, with particularly reference to crisis decision making. Traditional crisis decision making exercises and simulations constrain role playing and the inability to utilize current information effectively. Exercises usually contain dimensions of artificiality or designs based on future scenarios. There is a need to create 'real time' crisis decision-making environments where players can apply their current information base and manipulate hundreds of variables to achieve optimum outcomes. Our approach uses real world events and then forecasts their likely outcome allowing players

to engage in real time policy manipulation. In addition, we provide a means to alter policy actions to maximize national security gains. We demonstrate this analytical technology by offering the results of an experiment conducted during February/March 2000 at the National War College using the Chechnya crisis as a model.

DTIC

*Emergencies; Forecasting; Management Methods*

**20070028529** Veridian Information Solutions, Oakton, VA, USA

**Building a Deterrence Policy Against Strategic Information Warfare**

French, Geoffrey S; Jun 2002; 14 pp.; In English

Report No.(s): AD-A467493; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467493>

As the USA continues as the sole nation with a vested interest in every region of the world, it is increasingly sensitive to asymmetric threats that neutralize or circumvent its ability to defend against or respond to hostile activity. One of these areas is broadly described as information warfare. One specific aspect of this refers to strategic information warfare (SIW) attack against the information technology base of the nation's critical infrastructures. Defending those infrastructures is problematic for the U.S. government. Although the military relies on the civilian infrastructure, it does not control it. Neither is the civilian government in a position to dictate to the private infrastructure organizations. Any attempts to defend the national information infrastructure may be based largely, therefore, on deterring an attack, rather than detecting and thwarting it. Although deterrence may be most commonly associated with nuclear warfare, the USA still relies to a large extent on deterring aggressive foreign activity to protect its interests worldwide. This paper assesses the threat from SIW attacks and reviews the theories of deterrence, focusing on deterrence in the post-Cold War era. It then describes some strategies the USA can build to deter SIW most effectively.

DTIC

*Computer Techniques; Policies; Warfare*

**20070028544** Purdue Univ., West Lafayette, IN USA

**Task Adaptable Display of Information for Training, Maintenance, and Emergency Response**

Ebert, David S; Huang, Jingshu; Dec 2006; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-2-6648

Report No.(s): AD-A468494; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project has developed techniques for effective display of information for environments ranging from job training, to maintaining and repairing equipment, to responding to critical situations. The techniques developed allow the adaptable display of digital model data (e.g., mechanical parts, buildings) from the desktop to mobile devices. The project also performed an evaluation of the effectiveness of rendering methods for mobile devices for the task of locating a specific mechanical part in an assembly for training or maintenance.

DTIC

*Computer Programming; Display Devices; Emergencies; Information Systems; Maintenance Training; Software Engineering*

**20070028597** Defence Science Technology Lab., Farnborough, UK

**Modelling Information Age Warfare: Work In Progress**

Moffat, James; Jun 2002; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467503; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467503>

The uncertainties of future scenarios require us to carefully investigate the real problems and issues to be addressed in modelling and analysis of Command and Control. This problem formulation process then needs to be supported by new tools for problem solution. In consequence, a new generation of Command and Control center constructive simulation models of conflict is being developed by Dstl in the UK. These have a coherent approach to the representation of Command and Control which is described in the paper. This baseline approach is then complemented by mathematical models of such processes (metamodels) which give insight into the likely modes of emergent behavior.

DTIC

*Warfare; Mathematical Models; Computer Information Security*

**20070028598** Mitre Corp., McLean, VA USA

**Multinational Information Sharing and Collaborative Planning Limited Objective Experiments**

Curtis, Keith P; Jun 2002; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467502; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467502>

This paper describes Multinational Collaboration and Information Sharing Limited Objective Experiment (LOEs) that examine multinational aspects of joint command and control concepts at the US Joint Forces Command (USJFCOM). LOEs are designed to be both exploratory and structured, so there is an element of discovery that is extremely useful. LOEs also examine assertions made by joint concepts. The LOE was completed in November 2001 and focused on collaborative planning with multinational partners planning a rapid decisive operation when planning time is short. The LOE compared courses of action (COAs) developed using traditional planning with COAs developed using integrated planning. Australia, Germany, UK, and USA formed traditional and integrated planning staffs, which were formed into independent planning teams linked through a secure global network. The two planning teams were presented with identical situations and background information, and using identical collaboration software asked to develop COAs in the allotted time. Senior subject matter experts from participating nations evaluated COAs for suitability, completeness, and accuracy to determine which process, traditional or integrated, produced a superior plan when planning time was short. Evaluations were blind since evaluators knew neither the process used nor the lead nation.

DTIC

*International Cooperation; Information Flow; Planning*

**20070028606** ADI Limited Fredericton, New Brunswick Canada

**Information Superiority through Data Warehousing**

Warner, Neil; Jun 2001; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468487; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The aim of a Command Support System is to achieve decision superiority by providing a knowledge edge to the Commander. A precursor to a knowledge edge is Information Superiority. Within most current Command Support Systems minimal integration and fusion of data is undertaken to provide the basis of information superiority. Most data remains in its island and any integration of data is provided by human intervention or through the use of specific and often limited applications. Despite the introduction of computer systems and communication networks, decision makers cannot readily access critical information that already exists in an organization. Data is locked up in a myriad of computer systems and is exceedingly difficult to get at - 'data in jail'. Only a small fraction of the data that is captured, processed and stored in the enterprise is actually available to decision makers. Data Warehousing provides technology that has evolved into a new technology making it possible to attack the problem of providing commanders with access to whatever level of information is needed to make decisions. This paper will address the concept of providing improved information superiority and therefore decision superiority by the use of the commercial information technology 'data warehousing' concepts and tools.

DTIC

*Information Systems; Command and Control*

**20070028672** Twenty-First Century Systems, Inc., Papillion, NE USA

**EyeKon: Distributed Augmented Reality for Soldier Teams**

Hicks, Jeffrey; Flanagan, Richard; Petrov, Plamen; Stoyen, Alexander; Jun 2003; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467774; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA467774>

The battlefield is a place of violence ruled by uncertainty. Timely knowledge of what's happening around a soldier can mean the difference between life and death. The goals of an enhanced mobile infantry are becoming a reality due, in part, to the U.S. Army's 21st Century Land Warrior (LW) program. However, the current system does not provide a head up display capability like that provided by today's avionics. When the soldier employs the weapon, he should see objects easily distinguishable as friendly or not, as well as enemy locations. The EyeKon project is an intelligent agent-based decision support system hosted on the soldier's wearable computer. EyeKon will use the soldier's private network to provide a perspective view in the weapon sight. This will naturally draw the warrior to the most desirable target. There are many performance and human factors issues to address before the concept can be used in lethal situations.

DTIC

*Military Personnel; Human Factors Engineering; Decision Support Systems*

**20070028682** Space and Naval Warfare Systems Command, San Diego, CA USA

**Communication of Context in Multi-Echelon Information Exchange Environments**

Oonk, Heather M; Moore, Ronald A; Morrison, Jeffrey G; Jun 2004; 44 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A466497; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466497>

In fast-paced, distributed, multi-echelon, collaborative environments such as those experienced by the USA military during Operations Enduring Freedom and Iraqi Freedom, task performance very often depends on effective and efficient information exchange. One way to facilitate information exchange is to ensure that information producers and consumers develop a thorough shared situation context. Unfortunately, developing such a shared understanding of situation context is extremely difficult in these types of environments. This paper discusses a series of experiments that investigated methods of communicating context to information producers, and the impact this had on task performance. The results of these studies are intended to facilitate the design and development of tools to aid information producers and consumers in quickly and easily building shared situation context, and developing useful, usable information products based on this shared understanding. This paper reports the methods and results of the experiments conducted. The experiment results highlight important issues associated with building a shared situation context among information producers and consumers, and provide important insights necessary to develop tools to facilitate efficient and effective information exchange.

DTIC

*Telecommunication; Information Transfer*

**20070028687** Space and Naval Warfare Systems Center, San Diego, CA USA

**Active Conceptual Modeling of Learning Workshop 10-12 May 2006**

Wong, L Y; Mar 2007; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466351; SSC-TR-1955; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466351>

The Active Conceptual Modeling of Learning (ACM-L) Workshop convened to accomplish the following goals: Introduce the Science and Technology (S&T) challenge; Provide a forum for the exchange of ideas and research results of the proposed research and the impact in the Department of Defense (DoD) and commercial applications and Identify a research and development (R&D) agenda for a technology development investigation. A wide spectrum of research issues were identified and recommendations were made to address these issues.

DTIC

*Learning; Information Transfer; Information Management*

**20070028752** QinetiQ Ltd., Winfrith, UK

**An Open Architecture Approach to Network Enabled Capability**

Owen, Lyn; Flinn, Andrew; Sep 2004; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466567; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466567>

Research in the UK is currently being conducted to develop an open architecture solution for Network Enabled Capability (NEC). This paper outlines the current status of that research and discusses some key architectural issues.

DTIC

*Architecture (Computers); Computer Networks*

**20070028753** Library of Congress, Washington, DC USA

**Critical Infrastructure Information Disclosure and Homeland Security**

Moteff, John D; Stevens, Gina M; Jan 29, 2003; 23 pp.; In English

Report No.(s): AD-A467310; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Critical infrastructures have been defined as those systems and assets so vital to the USA that the incapacity of such systems and assets would have a debilitating impact on the USA. One of the findings of the President's Commission on Critical Infrastructure Protection, established by President Clinton in 1996, was the need for the federal government and owners and operators of the nation's critical infrastructures to share information on vulnerabilities and threats. However, the Commission noted that owners and operators are reluctant to share confidential business information, and the government is reluctant to share information that might compromise intelligence sources or investigations. Among the strategies to promote information sharing was a proposal to exempt critical infrastructure information from disclosure under the Freedom of

Information Act. The Freedom of Information Act (FOIA) was passed to ensure by citizen access to government information. Nine categories of information may be exempted from disclosure. Three of the nine exemptions provide possible protection against the release of critical infrastructure information: exemption 1 (national security information); exemption 3 (information exempted by statute); and exemption 4 (confidential business information). Congress has considered several proposals to exempt critical infrastructure information from FOIA. Generally, the legislation has created an exemption 3 statute, or adopted the exemption 4 D.C. Circuit standard.

DTIC

*Security; United States; Information Systems*

**20070028754** Naval Postgraduate School, Monterey, CA USA

#### **Degrees of Shared Awareness**

Kingston, Gina; Martell, Craig; Sep 2004; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A466511; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466511>

Shared awareness is not a simple construct; different levels of shared awareness arise when participants have access to information that is identical (common), consistent, conflicting or some combination of these. This paper discusses how individuals achieve awareness from information, and the impact for shared awareness. It identifies six levels of shared awareness that may exist between two individuals, which have distinct properties. The differences between three of these: Common Awareness, Potentially Shared Awareness and Fully Shared Awareness are discussed in the context of an Air-to-Air scenario where one set of planes is equipped with Link-16 and the other only has access to voice communications.

DTIC

*Information Transfer; Telecommunication*

**20070028760** Library of Congress, Washington, DC USA

#### **Journalists' Privilege: Overview of the Law and 109th Congress Legislation**

Cohen, Henry; Oct 3, 2006; 7 pp.; In English

Report No.(s): AD-A467237; CRS-RS22205; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Journalists, the Supreme Court has written, claim 'that to gather news it is often necessary to agree either not to identify the source of information published or to publish only part of the facts revealed, or both; that if the reporter is nevertheless forced to reveal these confidences to a grand jury the source so identified and other confidential sources of other reporters will be measurably deterred from furnishing publishable information, all to the detriment of the free flow of information protected by the First Amendment.' Though the Supreme Court concluded that the First Amendment does not provide a journalists' privilege, 49 states have adopted a journalists' privilege, and bills to adopt a journalists' privilege have been introduced in the 109th Congress, 1st session, in both the House and the Senate (S. 1419 and H.R. 3323) In addition, S. 2831 was introduced in the 109th Congress, 2d session.

DTIC

*Information Transfer; Law (Jurisprudence)*

**20070028813** General Accounting Office, Washington, DC USA

#### **Defense Infrastructure. Actions Needed to Guide DOD's Efforts to Identify, Prioritize, and Assess Its Critical Infrastructure**

May 2007; 49 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468295; GAO-07-461; No Copyright; Avail.: Defense Technical Information Center (DTIC)

While DOD has taken some important steps to implement DCIP, it has not developed a comprehensive management plan to guide its efforts. Our prior work,<sup>10</sup> as well as the Standards for Internal Control in the Federal Government,<sup>11</sup> emphasizes the importance of such a plan and management controls, respectively, to guide program implementation. Accordingly, this plan should include key elements, such as developing and issuing guidance, coordinating stakeholders efforts, and identifying resource requirements and sources. DOD's most recent effort to protect critical infrastructure began in September 2003 and, as of May 2007, most of DOD's DCIP guidance was either newly issued or still in draft form. In the absence of finalized guidance, DOD components have been pursuing Results in on established programs, such as the antiterrorism program, to implement DCIP, even though antiterrorism has not been formally linked to DCIP. Although DOD issued a DCIP directive in August 2005, the lead office ASD(HD&ASA) lacks a chartering directive that defines important roles, responsibilities, and relationships with other DOD organizations and missions. In March 2003, the Deputy Secretary of Defense required the



Director of Administration and Management within the Office of the Secretary of Defense to, among other things, define the relationship between the Directorates for HD&ASA and Special Operations and Low- Intensity Conflict and Interdependent Capabilities regarding several matters, including antiterrorism missions, in a chartering directive. However, as of May 2007, more than 4 years later, this task has not been accomplished. Similarly, because DOD s strategy on tracking and monitoring critical infrastructure was not issued until 2006, components have been collecting different information on their infrastructure, which, over the long term, could complicate information sharing and analysis across the DOD components and sector lead agents.

DTIC

*Management Planning; Information Management*

**20070029442** Florida International Univ., Miami, FL, USA

**Assessing an Automated, Information Sharing Technology in the Post ‘9-11’ Era: Do Local Law Enforcement Officers Think It Meets Their Needs**

Zaworski, M. J.; Feb. 2005; 218 pp.; In English

Report No.(s): PB2007-109803; Copyright; Avail.: National Technical Information Service (NTIS)

In the wake of the 9-11 terrorists attacks, the U.S. Government has turned to information technology (IT) to address a lack of information sharing among law enforcement agencies. This research determined if and how information-sharing technology helps law enforcement by examining the differences in perception of the value of IT between law enforcement officers who have access to automated regional information sharing and those who do not. It also examined the effect of potential intervening variables such as user characteristics, training, and experience, on the officers evaluation of IT. The sample was limited to 588 officers from two sheriffs offices; one of them (the study group) uses information sharing technology, the other (the comparison group) does not. Triangulated methodologies included surveys, interviews, direct observation, and a review of agency records. Data analysis involved the following statistical methods: descriptive statistics, Chi-Square, factor analysis, principal component analysis, Cronbach’s Alpha, Mann-Whitney tests, analysis of variance (ANOVA), and Scheffe post hoc analysis.

NTIS

*Information Systems; Law (Jurisprudence)*

**20070029466** National Library of Medicine, Bethesda, MD, USA

**Charting a Course for the 21st Century: NLM’s (National Library of Medicine’s) Long Range Plan, 2006-2016**

Sep. 2006; 77 pp.; In English

Report No.(s): PB2007-110365; No Copyright; Avail.: National Technical Information Service (NTIS)

In a world that is increasingly digital, the National Library of Medicine (NLM) already plays a pivotal role in enabling biomedical research, supporting health care and public health, and promoting healthy behavior. By connecting and making the results of research--from scientific data to published literature to patient and consumer health information--readily available, the Library magnifies the positive impact of the countrys investment in the creation of new knowledge. In the next ten years, NLMs programs and services will become even more central to scientific discovery, treatment, and prevention. Careful planning and visionary thinking are critical to the pursuit of that future. This Long Range Plan contains four overall goals: Goal 1. Seamless, Uninterrupted Access to Expanding Collections of Biomedical Data, Medical Knowledge, and Health Information; Goal 2. Trusted Information Services that Promote Health Literacy and the Reduction of Health Disparities Worldwide; Goal 3. Integrated Biomedical, Clinical, and Public Health Information Systems that Promote Scientific Discovery and Speed the Translation of Research into Practice; Goal 4. A Strong and Diverse Workforce for Biomedical Informatics Research, Systems Development, and Innovative Service Delivery.

NTIS

*Charts; Libraries; Medicine*

**20070029527** Library of Congress, Washington, DC USA

**Security Classified and Controlled Information: History, Status, and Emerging Management Issues**

Relyea, Harold C; Mar 8, 2007; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468627; CRS-RL33494; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468627>

The security classification regime in use within the federal executive branch traces its origins to armed forces information protection practices of the World War I era. The classification system designating information, according to prescribed criteria

and procedures, protected in accordance with one of three levels of sensitivity, based on the amount of harm to the national security that would result from its disclosure attained a presidential character in 1940 when President Franklin D. Roosevelt issued the initial executive order prescribing these information security arrangements. Refinements in the creation, management, and declassification of national security information followed over the succeeding decades, and continue today. In many regards, these developments represent attempts to narrow the bases and discretion for assigning official secrecy to executive branch documents and materials. Limiting the quantity of security classified information has been thought to be desirable for a variety of important reasons: (1) promoting an informed citizenry, (2) effectuating accountability for government policies and practices, (3) realizing oversight of government operations, and (4) achieving efficiency and economy in government management. Because security classification, however, was not possible for some kinds of information deemed in some quarters to be sensitive, other kinds of designations or markings came to be applied to alert federal employees regarding its privileged or potentially harmful character. Sometimes these markings derived from statutory provisions requiring the protection of a type of information; others were administratively authorized with little detail about their use. In the current environment, still affected by the long shadow of the terrorist attacks of September 11, 2001, several issues have arisen regarding security classified and controlled information.

DTIC

*Classifications; Policies; Security*

**20070029538** General Accounting Office, Washington, DC USA

**Defense Transportation. DOD Needs a Comprehensive Approach to Planning for Implementing Its New Personal Property Program**

May 2007; 56 pp.; In English

Report No.(s): AD-A468673; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468673>

What GAO Found DOD has taken some initial steps to achieve the goals and benefits of Families First, but delays in developing a new information management system have put the overall goals of improving the quality of service from moving companies and streamlining the claims process at risk. The information management system, the Defense Personal Property System (DPS), is now more than 2 years behind schedule. DOD has missed DPS milestones because of software development issues and is now working to address issues identified in recent software testing. Since DPS has been delayed, DOD is in the process of implementing a backup plan to meet a statutory mandate to provide service members with the full replacement value of goods lost or damaged during a move by March 1, 2008. However, there are risks and costs associated with DOD's backup plan because it relies on an increasingly unreliable legacy computer system; also, DOD's plan may not cover all moves by March 1, 2008. The Families First program could increase costs to DOD by \$1.4 billion over current program costs through fiscal year 2011 for two main reasons: (1) DOD estimates the program will increase costs to the services' household goods budgets by 13 percent and (2) DOD has significantly increased the cost estimate for a new information management system since GAO's last assessment. While DOD's estimate that the Families First program will increase costs by 13 percent has not changed since 2005, all of the services have not yet fully budgeted for this cost increase, which GAO analysis shows could be about \$1.2 billion. Additionally, DOD has increased its estimate for an information management system for Families First because it decided to develop DPS rather than upgrade the legacy system. DOD estimated that the upgrade would cost \$4 million to \$6 million, and the program office estimated that DPS will cost about \$180 million through fiscal year 2011.

DTIC

*Management Information Systems; Military Operations; Transportation*

**20070029581** National Defense Univ., Norfolk, VA USA

**The Department of Defense Net-Centric Data Strategy: Implementation Requires a Joint Community of Interest (COI) Working Group and Joint COI Oversight Council**

Bigger, Clinton R; May 17, 2007; 85 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468811; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468811>

In 2003, the ASD(NII) DoD CIO published the DoD Net-Centric Data Strategy providing guidance to DoD Components for the development of policies and practices to improve data sharing throughout the DoD. The objective of this strategy is to make data more visible, accessible, and understandable to users of the Global Information Grid (GIG). The stated goal of the strategy is to empower users through faster access to data by posting data prior to processing. The DoD Net-Centric Data Strategy provides a middle management approach to data management through Communities of Interest (COI), the reuse of discovery and content metadata, and use of GIG Enterprise Services (GES). COIs will be responsible for the development of

data sharing capabilities in developing Information Technology programs. COIs are encouraged to reuse metadata previously registered by other COIs. Commonly referred to as 'data tagging,' metadata is the technical link between data stored in the GIG and users searching for data. GES provides the enterprise services for the development of metadata and for data searches. The results of a 2006, Progress and Compliance Report, completed by the ASD(NII) DoD CIO document progress on the part of Mission Areas and DoD Components in creating COIs and establishing data sharing policies. However, in four key findings, the report documented areas that require attention by the DoD to achieve the goals of the DoD Net-Centric Data Strategy. Analysis of the report demonstrates a decentralized approach to developing data sharing policy has emerged and additional guidance is required to ensure DoD Net-Centric Data Strategy goals are met. To effectively implement the strategy, a Joint CIO Working Group and Joint CIO Oversight Council should be established to provide unity of effort to the creation of DoD data sharing policy and the development of discovery and content metadata standards.

DTIC

*Data Acquisition; Data Management; Defense Program; Military Operations*

**20070029595** New Mexico Univ., Albuquerque, NM USA

**Symposium on Nano- and Micro-Scale Mechanics of Engineering Materials**

Shen, Yu-Lin; Apr 30, 2007; 4 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0900

Report No.(s): AD-A468836; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468836>

Amidst the rapid advancement of nano-technologies, the key role played by mechanics and mechanical characterization techniques cannot be overemphasized. Research on experimental, theoretical and computational mechanics enables the bridging of science and technology of all engineering materials and devices. We thus organized this symposium encompassing a broad spectrum of application areas and yet focusing on the mechanics and mechanical characterization at the nano- and micro-scales. The basic venue of the symposium is on a mixture of keynote addresses and short lectures given by top-notch researchers in the fields. This symposium has forged a synergistic interaction among materials scientists and solid technicians working toward the advancement of nano-technologies.

DTIC

*Conferences; Engineering; Heterogeneity; Reinforcing Fibers*

**20070029600** Colorado State Univ., Fort Collins, CO USA

**A Model of Trust for Developing Trustworthy Systems From Untrustworthy Actors**

Ray, Indrajit; Ray, Indrakshi; Apr 2007; 91 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-03-1-0101; Proj-FAA6

Report No.(s): AD-A468853; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468853>

The objective of this effort is to develop a new model of trust that allowed one to reason about trust relationships in information systems with special emphasis on trust as it related to integrity and availability. The project has produced the following results. 1. It has proposed a formal model to assess multiple levels of trust that is more inclusive than the current binary models. A major strength of the model is that it is more in keeping with the social models of trust used by policy makers. 2. It has defined a notion of degrees of trust and proposed expressions and procedures to evaluate and establish the degree of trust of different systems. 3. It has defined procedures to compare information at different degrees of trust. 4. It has developed procedures to determine the trust level of composed information. 5. It has formulated processes and procedures to manage trust relationships.

DTIC

*Information Systems; Security*

**20070029602** Army War Coll., Carlisle Barracks, PA USA

**Dominating Cyberspace**

Radice, Richard A; Mar 12, 2007; 18 pp.; In English

Report No.(s): AD-A468855; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468855>

This paper explores how the military can establish 'cyber-dominance' in the battlespace of today and in the future. Cyberspace has its own challenges as an arena in which to conduct warfare just like land, sea, air and space do. This poses

common problems to each of the services and the future of joint warfare. This paper will discuss the elements of battlespace dominance as they relate to the cyberspace domain in the near future and recommends how the joint force can organize itself to remain preeminent.

DTIC

*Internets; Warfare*

**20070029685** Mitre Corp., Fort Hood, TX USA

**Army Digitization Operational Impacts**

Stein, Fred P; Jun 1999; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468423; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468423>

This paper analyzes the current and near-term state of digitization within the USA Army. The author discusses the overall effort the Army is making to coordinate the introduction of new and radically different Information Age material into its Doctrine, Organization, Training, Logistics, Leadership, and Personnel. The Army has committed to changing its basic command and control (C2) process through the introduction of Information Age technologies. These technologies will enable vastly better Situational Awareness (SA). The future battlefield will be one in which SA will spell the difference between a war of attrition and one that is determined very quickly, perhaps without bloodshed. The Army has already begun to change the basic organizational structure of its current active duty divisions and its combat service support structures. The Army will field over 70 new systems in direct support of the first digitized division, the 4th Infantry Division at Fort Hood, Texas, by 1 January 2000. The four major systems that make up the digitization effort are as follows: the new Abrams weapon system, the new Bradley weapon system, Future Battlefield Command and Control Brigade and Below (FBCB2), and the Army Battlefield Command System (ABCS). New communications systems and weapon systems will support these C2 systems. The Army created a Digital Force Coordination Cell (DFCC) at Fort Hood to ensure that the new weapon systems and information systems were coordinated with Doctrine, Training, Leader Development, Organization, Materiel, and Soldiers (DTLOM-S). This paper provides brief descriptions of these systems and discusses their impact on the operational and tactical levels of war. The discussion includes lessons learned from real-life applications of the new technologies.

DTIC

*Command and Control; Digital Systems; Digital Techniques; Information Systems; Weapon Systems*

**20070029688** National Defense Univ., Norfolk, VA USA

**Regaining the High Ground: The Challenges of Perception Management in National Strategy and Military Operations**

Martemucci, Matteo G; Jun 17, 2007; 86 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468873; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468873>

The informational element of power may be the most elusive for the U.S. Government to wield, but its importance is proportional to its difficulty. With the rise in global terrorist networks and a precipitous decline in world opinion of America's foreign policy, Perception Management is more critical now than at any time in America's history. This paper attempts to answer the question of why, in this time of conflict, it is so difficult for the U.S. Government to effectively leverage the informational element of power. It explores three friction-inducing elements that afflict the U.S. Government, including the military. The U.S. Government's politics and personalities, bureaucracy, and aversion to the use of mass media, even in time of war, have precluded an integrated Perception Management campaign. A historical review of Perception Management strategies since World War I reveals that this difficulty is based largely on individual personalities, an ever-growing bureaucracy, and an historical American concern about the perceived manipulation of the media by its government. To solve this problem, the President must clearly define lines of authority regarding the Government's Perception Management strategy. He also must give that authority to a strong leader capable of coordinating the disparate efforts of numerous Government agencies. Finally, the U.S. Government must take a more proactive approach to media engagement as part of an integrated strategic Perception Management campaign.

DTIC

*Management Planning; Military Operations; United States; Warfare*

**20070029697** Folchi (John S.), San Diego, CA USA

**RIDE vs. CLASP Comparison and Evaluation: Models and Parameters**

Folchi, John S; Apr 2007; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-D-0001

Report No.(s): AD-A468891; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468891>

CLASP, the Navy's enlisted personnel classification algorithm, has been used operationally since the early 1980s. The Navy is considering replacing it with the RIDE algorithm, as part of its transition from PRIDE to NRAMS. The purpose of this research was to evaluate and compare the algorithms, so classification policymakers could better judge the feasibility and wisdom of the proposed change. The RIDE algorithm was analyzed to identify and evaluate the assumptions upon which it is based. Particular attention was given to the First Pass Pipeline Success (FPPS) school performance criterion and the Point of Diminishing Returns (PDR) concept. RIDE school performance prediction models were compared with logistic regression prediction models to evaluate the RIDE mode development methodology. In addition, corresponding components of CLASP and RIDE were compared to better understand their similarities and differences. Sparsely documented aspects of the CLASP model were described in detail so policymakers could better understand the unique characteristics of CLASP and the methodology used to develop the CLASP utility functions.

DTIC

*Algorithms; Military Personnel; Ratings; Tasks*

**20070029732** Florida Univ., Gainesville, FL USA

**Development of a Geospatial Data-Sharing Method for Unmanned Vehicles Based on the Joint Architecture for Unmanned Systems (JAUS)**

Evans, III, Carl P; Aug 2005; 133 pp.; In English; Original contains color illustrations

Report No.(s): AD-A468989; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468989>

A task performed almost effortlessly by humans, perception is perhaps one of the most difficult tasks for autonomous vehicles. While substantial research has been done to develop these technologies, few studies have examined ways for multiple heterogeneous unmanned systems to cooperate in their perception tasks. Our study examined ways to model both perceived and a priori geospatial information, and formatting these data so that they can be used by the growing unmanned systems community. We introduce a perception system model, consisting of distributed smart sensors. This system of sensors was developed for the Team CIMAR entry into the inaugural DARPA Grand Challenge autonomous vehicle competition held in March 2004. The Smart Sensor Architecture proved to be a power method of distributing the possessing of sensor data to systems developed by engineers who best knew a particular sensor modality. By standardizing the logical, transport, and electrical interfaces, the smart sensor architecture developed into a powerful world modeling method. We also investigated current geospatial data-modeling methods used in the unmanned systems and geodetic information systems (GIS) communities. Our study determined the commonalities among current methods and resulted in a first-generation geospatial data-sharing standard for unmanned systems compliant with the Joint Architecture for Unmanned Systems (JAUS).

DTIC

*Data Systems; Geodesic Lines; Robotics*

**20070029961** Department of Health and Human Services, Washington, DC, USA

**Consumer Control of Electronic Personal Health Information: What Does It Mean. Why Is it Important. A Report on Three Consumer Focus Group Meetings Convened October 2005 by the Office of the Assistant Secretary for Planning and Evaluation**

Mar. 2006; 53 pp.; In English

Report No.(s): PB2007-110730; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Public and private health care sectors recognize that health information technology (HIT) plays a pivotal role for improving health care quality while reducing health care cost. Many new initiatives have created a momentum greater than in the past for adopting electronic health records (EHRs) and HIT in general. In the current environment, the principle that the patient and consumer control their personal health information (PHI) is frequently invoked and linked to the broader principle of patient-centricity. Surveys by the Markle Foundation and the California Health Care Foundation confirm that most consumers are concerned about the privacy and security of their PHI. While many consumers recognize the benefits of EHRs

and other forms of HIT, they want and expect to control access of their PHI who sees it, what they see and under what conditions.

NTIS

*Consumers; Health; Information Systems*

**20070029971** Office of the Assistant Secretary for Planning and Evaluation (HHS), Washington, DC, USA

**Health Information Exchange in Post-Acute and Long-Term Care**

Feb. 2007; 61 pp.; In English

Report No.(s): PB2007-110289; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Clinicians require accurate and timely data to provide high quality patient care (Institute of Medicine, 2001). Nowhere is this more important than at times of care transition, when patients are transferred from one health setting to another. Transfers among care settings are common. Twenty-three percent of hospitalized patients over the age of 65 are discharged to another institution, and 12% are discharged from hospital with skilled home care services (Agency for Healthcare Research & Quality HCUPnet, 1999). An estimated 19% of patients discharged from a hospital to a skilled nursing facility (SNF) are re-admitted to the hospital within 30 days (Kramer, Eilertsen, Lin & Hutt, 2000). One study tracked post-hospital transitions for 30 days in a large, nationally representative sample of Medicare beneficiaries. Transitions in this study were defined as transfers to or from an acute hospital, emergency department, skilled nursing or rehabilitation facility, or home with or without home healthcare. Overall, 46 unique care patterns were identified during this relatively brief time period (Coleman, Min, Chomiak & Kramer, 2004b).

NTIS

*Health; Patients; Data Processing*

**20070029989** NASA Johnson Space Center, Houston, TX, USA

**IMMR Phase 1 Prototyping Plan Inputs**

Vowell, C. W.; Johnson-Throop, Kathy; Smith, Bryon; Darcy, Jeannette; October 23, 2006; 10 pp.; In English; Medical Informatics and Technology working Group, 23-27 Oct. 2006, Cologne, Germany; Copyright; Avail.: CASI: [A02](#), Hardcopy

This viewgraph presentation reviews the phase I plan of the prototype of the IMMR by the Multilateral Medical Operations Panel (MMOP) Medical Informatics & Technology (MIT) Working Group. It reviews the Purpose of IMMR Prototype Phase 1 (IPP1); the IPP1 Plan Overview, the IMMR Prototype Phase 1 Plan for PDDs and MIC and MIC-DDs, Plan for MICs, and the IPP1 objectives

CASI

*Prototypes; Aerospace Medicine; Documentation*

**20070030010** Army War Coll., Carlisle Barracks, PA USA

**Information Technology: When is Enough?**

Talkington, Darin; Mar 22, 2007; 18 pp.; In English

Report No.(s): AD-A469129; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469129>

When does one have enough information technology? When do we cross the point of diminishing return? At what point in time do information planners and program managers provide too much information access? Will the vast Army investments in information technology, high speed data networking, and robust beyond line-of-sight telecommunications at the brigade and below level enable the tactical war fight? Or, will this investment in technology at the tactical level overtax already weary staffs and further inhibit their ability to focus their commanders on the most relevant information necessary to make sound timely decisions? As part of this research I plan to present an understanding of the challenges currently facing tactical commanders with regard to information overload. I will provide examples that underscore the dangers inherent in tactical commanders having too much information or too much reliance on information technology. I will present the current year range of investments being made in information technology and attempt to present the merits of increased investment in information analysis and dissemination management. I will compare the capabilities of information technology enablers like tactical networking support against the anticipated threats over the upcoming decade.

DTIC

*Information Systems; Information Analysis*

**LAW, POLITICAL SCIENCE AND SPACE POLICY**

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

**20070028757** Library of Congress, Washington, DC USA

**Intelligence Reform and Terrorism Prevention Act of 2004: ‘Lone Wolf’ Amendment to the Foreign Intelligence Surveillance Act**

Bazan, Elizabeth B; Yeh, Brian T; Dec 19, 2006; 7 pp.; In English

Report No.(s): AD-A467266; CRS-RS22011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Section 6001 of the Intelligence Reform and Terrorism Prevention Act of 2004, P.L. 108-458, amended the definition of ‘agent of a foreign power’ in the Foreign Intelligence Surveillance Act (FISA), 50 U.S.C. 1801(b)(1), to add a new category of covered individuals. Under this lone wolf provision, a non-USA person who engages in international terrorism or activities in preparation for international terrorism is deemed to be an ‘agent of a foreign power’ under FISA. This provision does not change the procedures to be used to apply for a court order authorizing electronic surveillance or a physical search under FISA. If an order is sought under this definition of an ‘agent of a foreign power,’ however, the applicant is not required to demonstrate a connection between the target of the electronic surveillance or the physical search and a foreign nation, foreign group, or international terrorist group. Nor does the Foreign Intelligence Surveillance Court (FISC), in approving such an order, have to find probable cause to believe that such a connection existed. Rather, if the court authorizes such a surveillance or physical search using this definition of ‘agent of a foreign power,’ the FISC judge has to find, in pertinent part, that, based upon the information provided by the applicant for the order, the target had engaged in or was engaging in international terrorism or activities in preparation therefor. By operation of the sunset provision in Section 103 of the USA PATRIOT Improvement and Reauthorization Act, P.L. 109-177, the amendment to the definition of ‘agent of a foreign power’ in FISA will cease to have effect on December 31, 2009.

DTIC

*Electronic Warfare; Intelligence; Prevention; Terrorism*

**SPACE SCIENCES (GENERAL)**

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

**20070029342** NASA Johnson Space Center, Houston, TX, USA

**A Study of the Attraction Forces of Lunar Dust Simulant**

Bradley, Robert Kelley; Jeevarajan, Antony; Thomas, Valor; August 08, 2007; 1 pp.; In English; USRA CASS Summer Student Presentation, 8 Aug. 2007, Houston, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

In previous manned lunar missions little work was done on countermeasures to combat the spread of lunar dust onto equipment and into the habitat because the astronauts were not scheduled to stay on the lunar surface for extended periods of time. However, as NASA prepares to return to the moon for longer durations than before developing materials that can help in the fight against lunar dust is important. The purpose of this project is to examine the attraction forces between lunar dust and various materials in an effort to discover materials which have a low affinity for lunar dust. The adhesion forces present between individual grains of dust and various materials were analyzed using an atomic force microscope (AFM). The AFM probes were calibrated by the added-mass technique to find the spring constant of the cantilever. The probes were modified by attaching a particle of lunar dust stimulant to the cantilever arm. The adhesion force between the dust particle and various materials were determined by analysis of AFM force spectra.

Author

*Lunar Dust; Astronauts; Spectrum Analysis; Adhesion; Habitats; Manned Space Flight; Lunar Surface*

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

**20070026511** Naval Observatory, Washington, DC USA

**The Status and Future of the ICRF**

Fey, A L; Dec 2006; 7 pp.; In English

Report No.(s): AD-A466353; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466353>

The International Celestial Reference Frame (ICRF) is currently defined by the radio positions of 212 extragalactic objects. Since its inception there have been two extensions to the ICRF. These extensions included revised positions of ICRF candidate and 'other' sources, based on inclusion of additional observations, as well as positions of an additional 109 'new' sources. With continued applicable Very Long Baseline Interferometry (VLBI) observations and improvements in analysis a better realization of the ICRF is now possible and an even better realization is feasible in the foreseeable future. Planning for a second realization of the ICRF is currently underway with a projected completion date concurrent with the 2009 IAU General Assembly. Within the next decade, optical astrometric satellites will present serious competition to the radio-based ICRF. Reevaluation of the spectral regime at which the ICRF is defined will then be necessary.

DTIC

*Coordinates; Detection; Interferometry; Ion Cyclotron Radiation; Plasma Heating; Radio Frequency Heating; Spatial Distribution*

**20070026512** Naval Observatory, Washington, DC USA

**Progress Report of the IAU Working Group on Precession and the Ecliptic**

Hilton, J L; Capitaine, N; Chapront, J; Ferrandiz, J M; Fienga, A; Fukushima, T; Getino, J; Mathews, P; Simon, J-L; Soffel, M; Dec 2006; 6 pp.; In English

Report No.(s): AD-A466354; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466354>

The IAU Working group on Precession and the Ecliptic looked at several solutions for replacing the precession part of the IAU 2000A precession-nutation model, which is not dynamically consistent. These comparisons show that the Capitaine et al. (2003) precession theory, P03, is both dynamically consistent and the solution most compatible with the IAU 2000A nutation model. The two greatest sources of uncertainty in the precession theory are the rate of change of the Earth's dynamical flattening,  $\Delta J_2$ , and the precession rates (i.e., the constants of integration used in deriving the precession). The combined uncertainties limit the accuracy in the precession theory to approximately 2 mas cent(exp -2). Given that there are difficulties with the traditional angles used to parameterize the precession, the working group has decided that the choice of parameters should be left to the user. They shall provide a consistent set of parameters that may be used with either the traditional rotation matrix, or those rotation matrices described in Capitaine et al. (2003) and Fukushima (2003). They recommend that the ecliptic pole be explicitly defined by the mean orbital angular momentum vector of the Earth-Moon barycenter in an inertial reference frame, and explicitly state that this definition is being used to avoid confusion with previous definitions of the ecliptic. Finally, they recommend that the terms 'precession of the equator' and 'precession of the ecliptic' replace the terms 'lunisolar precession' and 'planetary precession,' respectively.

DTIC

*Ecliptic; Equators; Moon; Precession; Sun*

**20070026682** Naval Observatory, Washington, DC USA

**An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae**

Hajian, Arsen R; Movit, Steven M; Trofimov, Denis; Balick, Bruce; Terzian, Yervant; Knuth, Kevin H; Granquist-Fraser, Domhnull; Huyser, Karen A; Jalobeanu, Andre; McIntosh, Dawn; Apr 2007; 40 pp.; In English

Contract(s)/Grant(s): NASA-GO-7501; NASA-GO-8390

Report No.(s): AD-A466703; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466703>

We present an atlas of Hubble Space Telescope images and ground-based, long-slit, narrowband spectra centered on the 6584 Angstrom line of [N ii] and the 5007 Angstrom line of [O iii]. The spectra were obtained for a variety of slit positions across each target (as shown on the images) in an effort to account for nonspherical nebular geometries in a robust manner.



We have extended the prolate ellipsoidal shell model originally devised by Aaquist, Zhang, and Kwok to generate synthetic images, as well as long-slit spectra. Using this model, we have derived basic parameters for the subsample of PNe that present ellipsoidal appearances and regular kinematic patterns. We find differences between our parameters for the target PNe as compared to those of previous studies, which we attribute to increased spatial resolution for our image data and the inclusion of kinematic data in the model fits. The data and analysis presented in this paper can be combined with detections of nebular angular expansion rates to determine precise distances to the PN targets.

DTIC

*Nebulae; Planetary Nebulae; Spectra*

**20070028686** Naval Observatory, Washington, DC USA

#### **Evolution of Time Scales**

McCarthy, Dennis D; Dec 2006; 7 pp.; In English

Report No.(s): AD-A466355; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466355>

Time scales have continued to evolve to meet the developing needs of users in modern times. Fifty years ago time based on astronomical observations of the Earth's rotation was sufficient to meet the needs for time, both civil and technical. During that 50-year interval, however, not only have these scales been expanded, but the advent of practical atomic clocks has led to the development of time scales based on atomic frequency transitions. In addition, the development of modern space techniques and the improvement in observational accuracy by orders of magnitude have led to the improvement of the theoretical concepts of time and the resulting relativistic definitions of time scales. The following sections provide a brief description of the chronological development of time scales since the middle of the 20th century: Mean Solar Time, Universal Time (UT), Ephemeris Time (ET), Atomic Time, Coordinated Universal Time (UTC), Dynamical Time Scales, and the Future of Time Scales.

DTIC

*Measurement; Relativistic Effects; Universal Time; Chronology*

**20070028816** Northwestern Univ., Evanston, IL USA

#### **Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler**

Gentner, Dedre; Brem, Sarah; Ferguson, Ronald W; Markman, Arthur B; Levidow, Bjorn B; Wolff, Phillip; Forbus, Kenneth D; Jan 1997; 39 pp.; In English

Contract(s)/Grant(s): N00014-89-J-1272

Report No.(s): AD-A466820; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA466820>

The work of Johannes Kepler offers clear examples of conceptual change. In this article, using Kepler's work as a case study, we argue that analogical reasoning facilitates change of knowledge in four ways: (a) highlighting, (b) projection, (c) representation, and (d) restructuring. We present these four mechanisms within the context of structure-mapping theory and its computational implementation, the structure-mapping engine. We exemplify these mechanisms using the extended analogies Kepler used in developing a causal theory of planetary motion.

DTIC

*Analogies; Kepler Laws*

**20070029304** Lawrence Livermore National Lab., Livermore, CA USA

#### **High Contrast Imaging Using Adaptive Optics for Extrasolar Planet Detection**

Evans, J. W.; Aug. 31, 2006; 124 pp.; In English

Report No.(s): DE2007-900101; UCRL-TH-224123; No Copyright; Avail.: National Technical Information Service (NTIS)

Direct imaging of extrasolar planets is an important, but challenging, next step in planetary science. Most planets identified to date have been detected indirectly not by emitted or reflected light but through the effect of the planet on the parent star. For example, radial velocity techniques measure the doppler shift in the spectrum of the star produced by the presence of a planet. Indirect techniques only probe about 15% of the orbital parameter space of our solar system. Direct methods would probe new parameter space, and the detected light can be analyzed spectroscopically, providing new information about detected planets.

NTIS

*Adaptive Optics; Extrasolar Planets; Imaging Techniques; Planet Detection*

**20070029573** California Univ., Berkeley, CA USA

**Understanding Magnetic Eruptions in the Sun and Their Interplanetary Consequences**

Fisher, George H; Apr 30, 2006; 4 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-01-1-0360

Report No.(s): AD-A468802; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA468802>

A major goal of our MURI project was to develop a state-of-the-art, observationally- tested 3-d numerical modeling system for predicting magnetic eruptions on the Sun and their interplanetary consequences. This project is motivated by the fact that the Sun drives the most violent space weather events. The mechanisms that trigger and drive these eruptions are the least understood aspects of space weather. A better physical understanding of how magnetic eruptions occur and how these disturbances propagate will surely lead to more accurate and longer range forecasts.

DTIC

*Magnetic Fields; Sun*

**20070030039** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Exploring the High Energy Universe: GLAST Mission and Science**

McEnery, Julie; April 19, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

GLAST, the Gamma-Ray Large Area Space Telescope, is NASA's next-generation high-energy gamma-ray satellite scheduled for launch in Autumn 2007. GLAST will allow measurements of cosmic gamma-ray sources in the 10 MeV to 100 GeV energy band to be made with unprecedented sensitivity. Amongst its key scientific objectives are to understand particle acceleration in Active Galactic Nuclei, Pulsars and Supernovae Remnants, to provide high resolution measurements of unidentified gamma-ray sources, to study transient high energy emission from objects such as gamma-ray bursts, and to probe Dark Matter and the early Universe. Dr. McEnery will present an overview of the GLAST mission and its scientific goals.

Author

*Gamma Ray Bursts; Gamma Ray Telescopes; Gamma Rays; Spaceborne Telescopes; Gamma Ray Astronomy*

**20070030040** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Exploring the High Energy Universe: GLAST Mission and Science**

McEnery, Julie; April 16, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

GLAST, the Gamma-Ray Large Area Space Telescope, is NASA's next-generation high-energy gamma-ray satellite scheduled for launch in Autumn 2007. GLAST will allow measurements of cosmic gamma-ray sources in the 10 MeV to 100 GeV energy band to be made with unprecedented sensitivity. Amongst its key scientific objectives are to understand particle acceleration in Active Galactic Nuclei, Pulsars and Supernovae Remnants, to provide high resolution measurements of unidentified gamma-ray sources, to study transient high energy emission from objects such as gamma-ray bursts, and to probe Dark Matter and the early Universe. Dr. McEnery will present an overview of the GLAST mission and its scientific goals.

Author

*Gamma Ray Telescopes; Gamma Rays; Spaceborne Astronomy; Spaceborne Telescopes; Astronomical Observatories; Gamma Ray Astronomy*

**20070030041** Emergent Space Technologies, Inc., USA

**Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure**

Hur-Diaz, Sun; Wirzburger, John; Smith, Dan; Myslinski, Mike; August 19, 2007; 4 pp.; In English; 2007 AAS/AIAA Astrodynamics Specialist Conference, 19-23 Aug. 2007, Mackinac Island, MI, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS5-50000; Copyright; Avail.: CASI: [A01](#), Hardcopy

Typical implementation of Kalman filters for spacecraft attitude estimation involves the use of gyros for three-axis rate measurements. When there are less than three axes of information available, the accuracy of the Kalman filter depends highly on the accuracy of the dynamics model. This is particularly significant during the transient period when a reaction wheel with a high momentum fails, is taken off-line, and spins down. This paper looks at how a reaction wheel failure can affect the zero-gyro Kalman filter performance for the Hubble Space Telescope and what steps are taken to minimize its impact.

Author

*Failure; Gyroscopes; Kalman Filters; Reaction Wheels; Attitude Control; Hubble Space Telescope*

90  
**ASTROPHYSICS**

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

**20070027282** Air Force Research Lab., Hanscom AFB, MA USA

**Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events**

Kahler, S W; Vourlidas, A; Oct 5, 2005; 9 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A467051; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The search continues for coronal environmental factors that determine whether a fast coronal mass ejection (CME) results in a solar energetic particle (SEP) event at 1 AU. From a plot of peak 20 MeV SEP intensities versus associated CME speeds we select for comparison two groups of fast, wide, western hemisphere CMEs observed with the LASCO coronagraph from 1998 to 2002. The SEP-rich CME group produced the largest observed SEP events, and the SEP-poor CME group produced the smallest or no observed SEP events. The major differences are that the SEP-rich CMEs are brighter and more likely to be streamer blowouts and to follow colocated CMEs within 12 or 24 hours. The SEP-poor CMEs are fainter and less likely to interact with streamers or to follow preceding colocated CMEs. Thus we confirm the recent result that the SEP event peak intensities are higher when the associated driver CMEs are preceded within a day by wide CMEs at the same locations. However, the enhanced brightness, and therefore mass, of the SEP-rich CMEs appears to be their most dominant characteristic and suggests that either large longitudinal and latitudinal extents or higher densities are needed for fast CMEs to produce SEPs.

DTIC

*Coronal Mass Ejection; Coronas; Energetic Particles; Solar Corpuscular Radiation; Solar Flares; Solar Storms*

**20070027284** Air Force Research Lab., Hanscom AFB, MA USA

**Near-Relativistic Electron  $c/v$  Onset Plots**

Kahler, S; Ragot, B R; Jul 20, 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A467053; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is often assumed that the first arriving electrons of a near-relativistic ( $E > 30$  keV) electron event are injected at the Sun impulsively and simultaneously at all observed energies and propagate scatter-free to 1 AU. In that case, a plot of the onset times  $T$  versus  $c/v$  for various electron speeds  $v$  should yield the solar injection time  $T_{inj}$  and the propagation distance  $D$ . In some electron events  $D > 1.2$  AU, but the inferred injection times are characteristically delayed by 10 minutes after the start of metric/decametric type III radio bursts believed to be signatures of electron injection. The delays may indicate electron injections not directly associated with the type III bursts, but the delays could also result from gradual or energy-dependent injections or from significant coronal/interplanetary electron scattering, even for well-beamed events. These effects could invalidate the  $c/v$  plot analyses. We use Wind 3D Plasma and Energetic Particle (3DP) electron data to make  $c/v$  onset plots for 80 near-relativistic solar electron events to test for the consistency of the inferred values of  $D$ , which are found to be broadly distributed between 0.15 and 2.7 AU. In most cases  $D < 1$  AU, an unphysical result partially due to instrumental effects in the high-energy 3DP detector, but also clearly inconsistent with the assumptions of impulsive and energy-independent injection onsets and scatter-free propagation of the electrons. We also discuss how previous results from  $c/v$  plot analyses have yielded contradictory and/or challenging injection results for the near-relativistic electrons as well as for gradual and impulsive solar energetic ion events.

DTIC

*Interplanetary Magnetic Fields; Plotting; Radio Bursts; Radio Signals*

**20070027286** Air Force Research Lab., Hanscom AFB, MA USA

**Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology**

Ciaravella, A; Raymond, J C; Kahler, S W; Nov 20, 2006; 20 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A467055; AFRL-VS-HA-TR-2007-1050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present UV spectral information for 22 halo or partial halo CMEs observed by UVCs. The CME fronts show broad line profiles, while the line intensities are comparable to the background corona. The Doppler shifts of the front material are generally small, showing that the motion of gas in the fronts is mostly transverse to the line of sight. This indicates that, at

least in halo CMEs, the fronts generally correspond to coronal plasma swept up by a shock or compression wave, rather than plasma carried outward by magnetic loops. This favors an ice cream cone (or a spherical shell) model, as opposed to an expanding arcade of loops. We use the line widths to discriminate between shock heating and bulk expansion. Of 14 cases where we detected the CME front, the line broadening in 7 cases can be attributed to shock heating, while in 3 cases it is the line-of-sight component of the CME expansion. For the CME cores we determine the angles between the motion and the plane of the sky, along with the actual heliocentric distances, in order to provide quantitative estimates of projection effects.

DTIC

*Coronal Mass Ejection; Coronas; Doppler Effect; Halos; Morphology; Ultraviolet Radiation*

**20070027287** Air Force Research Lab., Hanscom AFB, MA USA

**Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections**

Kahler, S W; Aurass, H; Mann, G; Klassen, A; Feb 10, 2007; 11 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A467056; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The solar injections of near-relativistic (NR) electron events observed at 1 AU appear to be systematically delayed by 10 minutes from the associated flare impulsive phases. We compare inferred injection times of 80 electron events observed by the 3DP electron detector on the Wind spacecraft with 40-800 MHz solar observations by the AIP radio telescope in Potsdam-Tremsdoff, Germany. Other than preceding type III bursts, we find no single radio signature characteristic of the inferred electron injection times. The injection delays from the preceding type III bursts do not correlate with the 1 AU solar wind Beta Rho or Beta but do correlate with densities  $n_e$  and inversely with speeds  $V_{sw}$ , consistent with propagation effects. About half of the events are associated with metric or decametric-hectometric (dh) type II bursts, but most injections occur before or after those bursts. Electron events with long (greater than or equal to 2 hr) beaming times at 1 AU are preferentially associated with type II bursts, which supports the possibility of a class of shock-accelerated NR electron events.

DTIC

*Coronal Mass Ejection; Interplanetary Medium; Radio Telescopes; Solar Radio Bursts; Solar Wind*

**20070027376** Naval Research Lab., Washington, DC USA

**Naval Research Laboratory Space Science Division Newsletter: 01/2007**

Dahlburg, Jill P; Doschek, George A; Kurfess, James D; Lean, Judith L; Siskind, David E; Socker, Dennis G; Apr 20, 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A467316; NRL/MR/7600--07-9042; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Naval Research Laboratory (NRL) Space Science Division (SSD) conducts a broad-spectrum RDT&E program in solar-terrestrial physics, astrophysics, upper/middle atmospheric science, and astronomy. Instruments to be flown on satellites, sounding rockets and balloons, and ground-based facilities and mathematical models are conceived and developed. Division researchers apply these and other capabilities to the study of the atmospheres of the Sun and the Earth, including solar activity and its effects on the Earth's ionosphere, upper atmosphere and middle atmosphere, laboratory astrophysics, and the unique physics and properties of celestial sources. The program is important to orbital tracking, radio communications and navigation that affect the operation of ships and aircraft, utilization of the near-space and space environment of the Earth, and to the fundamental understanding of natural radiation and geophysical phenomena. This first quarterly newsletter provides highlights of SSD activities in January 2007, and a summary of SSD accomplishments in 2006.

DTIC

*Aerospace Environments; Astrophysics*

**20070027403** Air Force Research Lab., Hanscom AFB, MA USA

**Interplanetary CMEs Without Observed Coronagraph CMEs**

Simnett, G M; Kahler, S W; Jan 2005; 5 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A467442; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The SMEI has observed 88 interplanetary coronal mass ejections (ICMEs) in 2003. This work has established that most of those ICMEs, observed beyond  $\sim 30$  degrees elongation angles, are associated with bright CMEs with appropriate speeds and position angles observed out to  $30 R_0$ (solar) in the SOHO LASCO coronagraph. However, about one quarter of the ICMEs do not have obvious candidate CME associations despite good LASCO observational coverage. We examine the

characteristics of those SMEI ICMEs without LASCO CME associations to determine whether or how they differ from the other ICMEs. In particular we examine the speed profiles and brightness of those ICMEs. We discuss possible ways in which the ICMEs can arise as discrete observable structures in the interplanetary medium without being observed to any significant degree in coronagraph images.

DTIC

*Coronagraphs; Coronal Mass Ejection*

**20070027404** Air Force Research Lab., Hanscom AFB, MA USA

**Imaging Interplanetary Disturbances Causing Forbush Decreases**

Kahler, S W; Simnett, G M; Jan 2005; 5 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A467444; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Forbush decreases (FDs) in neutron monitor (NM) counting rates are caused by enhanced magnetic fields in interplanetary shocks and solar ejecta that shield the Earth from galactic cosmic rays (GCRs). The solar origins of those ejecta can be observed as coronal mass ejections (CMEs) in coronagraphs, but their propagation through interplanetary space near or past the Earth has not been previously observable. The Solar Mass Ejection Imager (SMEI), launched into polar Earth orbit in January 2003, now allows us to search for the white light signatures of interplanetary CMEs (ICMEs) responsible for FDs. SMEI is unique in that it can monitor the progress of CMEs through the inner heliosphere out to distances beyond 1 AU and distinguish those which hit the Earth from those that do not. For comparison with SMEI observations, we selected all FDs of greater than or equal 2% observed with the Oulu, Finland, NM. We find an excellent association of SMEI CMEs with those FDs and for each of the associated SMEI CMEs a good candidate associated LASCO CME was also found. The SMEI observations provide information on the approximate spatial locations and trajectories of large ICMEs that may result in FDs and hence can be useful as a space weather tool.

DTIC

*Coronal Mass Ejection; Forbush Decreases; Imaging Techniques; Interplanetary Space*

**20070027406** Air Force Research Lab., Hanscom AFB, MA USA

**Acceleration and Propagation in the Heliosphere**

Kahler, S W; Kecskemety, K; Kiraly, P; Jan 2005; 10 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A467447; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Heliospheric energetic particles represent a mixture of populations. Sites of original energization of those particles range from solar flares through coronal and interplanetary shocks to distant heliospheric and even galactic sources. Although increasingly sophisticated methods of measuring their energy spectra, composition, charge state, temporal variation and anisotropy help in distinguishing those populations, most studies on particle acceleration and propagation are based on measurements that cannot make such fine distinctions. The lack of clear-cut separation of populations is also reflected in the somewhat ambiguous classification of SN papers in ICRCs. 'Solar emissions' and 'Galactic cosmic rays in the heliosphere' appear reasonably well separated topics (although Galactic and Anomalous CR could be more appropriate, and space weather as part of the galactic CR topic could be questioned). Acceleration and propagation issues, however, can be only rather artificially separated from the above two. As it happened during this conference, the pre-assigned rapporteur for the 'Acceleration and propagation' topic was unable to participate, and the other two rapporteurs for SH topics kindly agreed to report on most papers in the borderline range. Thus we report here only on a relatively small number of papers that could be classified into three general topics: a) Shocks and solar energetic particles; b) Solar energetic particle propagation; c) Radiation environment at Mars.

DTIC

*Heliosphere; Solar Flares*

**20070027595** Whittier Coll., CA USA

**Relativistic Jets in the Radio Reference Frame Image Database. 1. Apparent Speeds From the First 5 Years of Data**

Piner, B G; Mahmud, M; Fey, A L; Gospodinova, K; Feb 11, 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NSF-0305475

Report No.(s): AD-A467929; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present the results of an analysis of relativistic jet apparent speeds from VLBI images in the Radio Reference Frame

Image Database (RRFID). The images are snapshot VLBI images at 8 and 2 GHz using the VLBA, plus up to 10 additional antennas that provide global VLBI coverage. We have analyzed the 8 GHz images from the first 5 years of the database (1994-1998), for all sources observed at three or more epochs during this time range. This subset comprises 966 images of 87 sources. The sources in this subset have an average of 11 epochs of observation over the years 1994-1998, with the best-observed sources having 19 epochs. About half of the sources in this RRFID kinematic survey have not been previously studied with multiepoch VLBI observations. We have measured apparent speeds for a total of 184 jet components in 77 sources, of which the best-measured 94 component speeds in 54 sources are used in the final analysis. The apparent speed distribution shows a peak at low apparent speeds (consistent with stationary components), a tail extending out to apparent speeds of about 30c, and a mean apparent speed of 3.6c. A total of 36 of the sources in this paper are also included in the 2 cm VLBA survey by Kellermann et al., with similar angular resolution, sensitivity, and time range. For those sources, we present a detailed component-by-component comparison of the apparent speeds measured by the 2 cm survey and those measured in this paper. Many of the independent apparent speed measurements agree very well, but for approximately 25% of the components we find significant differences in the apparent speeds measured by the two surveys. The leading cause of these discrepancies is differences in how the two surveys have identified jet components from epoch to epoch.

DTIC

*Astrophysics; Coordinates; Data Bases*

**20070028419** Stanford Linear Accelerator Center, CA, USA; California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA; Oregon Univ., Eugene, OR, USA

**Predicting the Cosmological Constant from the Causal Entropic Principle**

Bousoo, R.; Harnik, R.; Kribs, G. D.; Perez, G.; Feb. 2007; 38 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-899842; SLAC-PUB-12353; No Copyright; Avail.: Department of Energy Information Bridge

We compute the expected value of the cosmological constant in our universe from the Causal Entropic Principle. Since observers must obey the laws of thermodynamics and causality, it asserts that physical parameters are most likely to be found in the range of values for which the total entropy production within a causally connected region is maximized. Despite the absence of more explicit anthropic criteria, the resulting probability distribution turns out to be in excellent agreement with observation. In particular, we find that dust heated by stars dominates the entropy production, demonstrating the remarkable power of this thermodynamic selection criterion. The alternative approach weighting by the number of observers per baryon is less well-defined, requires problematic assumptions about the nature of observers, and yet prefers values larger than present experimental bounds.

NTIS

*Cosmology; Predictions; Universe*

**20070028764** Air Force Research Lab., Hanscom AFB, MA USA

**Observational Properties of Coronal Mass Ejections**

Kahler, S W; Jan 2006; 13 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A467052; AFRL-VS-HA-TR-2007-1047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Coronal mass ejections (CMEs) have been known and observed for over 30 years. The total number of observed CMEs is now approaching 10,000, most of them detected with the LASCO coronagraph on the SOHO spacecraft. We review statistical work on CME widths, latitudes, accelerations, speeds, masses, and rates of occurrence. Solar-cycle variations of these parameters are presented. Recent work has focused on CME internal properties and compositions and on CME dynamics, particularly at low (< 3 solar radii) altitudes. The challenges to understand the magnetic topology of narrow (< 20 deg width) CMEs, to determine the relationship of coronal holes to CMEs, and to observe magnetic reconnection that effects magnetic disconnections of CMEs from the Sun are discussed.

DTIC

*Coronal Mass Ejection; Magnetic Field Reconnection; Solar Cycles; Coronagraphs*

**20070028895** Lawrence Livermore National Lab., Livermore, CA USA

**Hypothesis of the Magnetostatic Turbulence and its Implications for Astrophysics**

Ryutov, D. D.; Remington, B. A.; Feb. 27, 2007; 11 pp.; In English

Report No.(s): DE2007-902294; UCRL-PROC-228382; No Copyright; Avail.: Department of Energy Information Bridge

Arguments are presented in favor of a possible existence of a random, force-free magnetic field. Ponderomotive forces

in such a field are small, and the evolutionary time is much longer than Alfvén crossing time over the vortex scale, whence the suggested term magnetostatic. The presence of this long-lived random magnetic field provides stiffness with respect to large-scale compressional motions. On the other hand, such a field cannot be detected by techniques involving line-of-sight averaging. It may therefore be a source of stiffness for various astrophysical objects, ranging from plasmas in clusters of galaxies to the interiors of molecular clouds in HII regions, and remaining at the same time undetectable. Analysis of large-scale motions on the background of the magnetostatic turbulence is presented; it is concluded that these large-scale motions can be roughly described by a usual hydrodynamics for the matter with an isotropic pressure; the adiabatic index is  $4/3$ .

NTIS

*Astrophysics; Hypotheses; Magnetostatics; Turbulence*

**20070028898** Lawrence Livermore National Lab., Livermore, CA USA

**Creating the Core Conditions of Extra-Solar and Solar Giant Planets**

Celliers, P. M.; Eggert, J. H.; Collins, G. W.; Brygoo, S.; Jeanloz, R.; Feb. 26, 2007; 12 pp.; In English

Report No.(s): DE2007-902290; UCRL-TR-228590; No Copyright; Avail.: National Technical Information Service (NTIS)

Materials can be experimentally characterized at high pressures and densities by sending a laser-induced shock wave through a sample that is pre-compressed inside a diamond-anvil cell. This combination of static- and dynamic-compression methods has been experimentally demonstrated, and ultimately provides access to the 10-100 TPa (0.1-1 Gbar) pressure range that is relevant to planetary science. We report on dynamical measurements of the high pressure compressibility of helium, hydrogen and helium/hydrogen mixtures up to 230 GPa by combining laser shocks and static compression in diamond anvil cells. The initial density of samples in these precompressed targets has been varied by a factor of 3. The measurements on the principal He Hugoniot, i.e with the initial density of cryo-helium, is extended above 100 GPa and a maximum of compression ratio of greater than 5-fold of the initial density is observed. Also, a strong decrease in compressibility is observed by increasing the initial density. A similar data set has been produced for precompressed H<sub>2</sub> and a mixture of He and H<sub>2</sub>.

NTIS

*Extrasolar Planets; Gas Giant Planets*

**20070028907** Lawrence Livermore National Lab., Livermore, CA USA

**FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere'**

Klein, R. I.; Remington, B.; Moon, S.; MacKinnon, A.; Patel, P.; Mar. 04, 2007; 35 pp.; In English

Report No.(s): DE2007-902271; UCRL-TR-228633; No Copyright; Avail.: National Technical Information Service (NTIS)

We have taken the initiative to examine whether experiments on HED facilities, present and future, could achieve the extreme scaled conditions relevant to accreting neutron star atmospheres and accretion disks around black holes. The preliminary conclusion from this detailed scaling assessment is that if an exact scaled version of the photon bubble instability physics is desired, this will require experiments with (simultaneously) spatial scales of order approx. 1 mm, temperatures of order approx. 5 keV, magnetic fields of order a hundred megaGauss, and time scales of order several hundred psec. Aspects (subsets) of this physics can be studied under less demanding conditions. To achieve the temperatures required in targets of order several optical depths, we come to the preliminary conclusion that we would require an energy source that delivers of order of a megajoule of energy into a high Z target. A conceptual design for such an experiment could be to use the energy from a high gain ignition NIF capsule as our principle source of heating and acceleration whereby the target is in close proximity to the ignition capsule and then use external petawatt lasers to develop the magnetic fields required.

NTIS

*Neutron Stars; Accretion Disks; Black Holes (Astronomy)*

**20070029227** Lawrence Livermore National Lab., Livermore, CA USA

**Adaptive Optics Views of the Hubble Deep Fields Final Report on LLNL LDRD Project 03-ERD-002**

Max, C. E.; Pennington, D.; Gibbard, S.; van Dam, M.; Larkin, J.; Feb. 26, 2007; 17 pp.; In English

Report No.(s): DE2007-902259; UCRL-TR-228357; No Copyright; Avail.: National Technical Information Service (NTIS)

We used laser guide star adaptive optics at the Lick and Keck Observatories to study active galactic nuclei and galaxies, with emphasis on those in the early Universe. The goals were to observe large galaxies like our own Milky Way in the process of their initial assembly from subcomponents, to identify central active galactic nuclei due to accreting black holes in galaxy cores, and to measure rates of star formation and evolution in galaxies. In the distant universe our focus was on the GOODS and GEMS fields (regions in the Northern and Southern sky that include the Hubble Deep Fields) as well as the Extended

Groth Strip and COSMOS fields. Each of these parts of the sky has been intensively studied at multiple wavelengths by the Hubble Space Telescope, the Chandra X-Ray Observatory, the XMM Space Telescope, the Spitzer Space Telescope, and several ground-based telescopes including the Very Large Array radio interferometer, in order to gain an unbiased view of a significant statistical sample of galaxies in the early universe.

NTIS

*Adaptive Optics; Telescopes*

**20070029243** Lawrence Livermore National Lab., Livermore, CA USA

**Progress on the Europium Neutron-Capture Study Using DANCE**

Agvaanluvsan, U.; Becker, J. A.; Macri, R. A.; Parker, W.; Wilk, P.; Oct. 17, 2006; 12 pp.; In English

Report No.(s): DE2007-900869; UCRL-PROC-225343; No Copyright; Avail.: National Technical Information Service (NTIS)

The accurate measurement of neutron-capture cross sections of the Eu isotopes is important for many reasons including nuclear astrophysics and nuclear diagnostics. Neutron capture excitation functions of  $^{151,153}\text{Eu}$  targets were measured recently using a 4 a-ray calorimeter array DANCE located at the Los Alamos Neutron Science Center for  $E_n = 0.1 - 100$  keV. The progress on the data analysis efforts is given in the present paper. The gamma-ray multiplicity distributions for the Eu targets and Be backing are significantly different. The gamma-ray multiplicity distribution is found to be the same for different neutron energies for both  $^{151}\text{Eu}$  and  $^{153}\text{Eu}$ . The statistical simulation to model the gamma-ray decay cascade is summarized.

NTIS

*Calorimeters; Capture Effect; Europium; Europium Isotopes; Neutrons*

**20070029363** Lawrence Livermore National Lab., Livermore, CA USA

**Large Synoptic Survey Telescope and Foundations for Data Exploitation of Petabyte Data Sets**

Cooke, K. H.; Nikolaev, S.; Huber, M. E.; Feb. 28, 2007; 9 pp.; In English

Report No.(s): DE2007-902312; UCRL-TR-228468; No Copyright; Avail.: Department of Energy Information Bridge

The next generation of imaging surveys in astronomy, such as the Large Synoptic Survey Telescope (LSST), will require multigigapixel cameras that can process enormous amounts of data read out every few seconds. This huge increase in data throughput (compared to megapixel cameras and minute- to hour-long integrations of today's instruments) calls for a new paradigm for extracting the knowledge content. We have developed foundations for this new approach. In this project, we have studied the necessary processes for extracting information from large time-domain databases--the systematics. In the process, we have produced significant scientific breakthroughs by developing new methods to probe both the elusive time and spatial variations in astrophysics data sets from the SuperMACHO (Massive Compact Halo Objects) survey, the Lowell Observatory Near-Earth Object Search (LONEOS), and the Taiwanese American Occultation Survey (TAOS). This project continues to contribute to the development of the scientific foundations for future wide-field, time-domain surveys. Our algorithm and pipeline development has provided the building blocks for the development of the LSST science software system. Our database design and performance measures have helped to size and constrain LSST database design. LLNL made significant contributions to the foundations of the LSST, which has applications for large-scale imaging and data-mining activities at LLNL.

NTIS

*Data Storage; Exploitation; Surveys; Telescopes*

**20070029501** Stanford Linear Accelerator Center, CA, USA; Pennsylvania State Univ., University Park, PA, USA

**Gravi-Leptogenesis: Leptogenesis from Gravity Waves in Pseudo-Scalar Driven Inflation Models**

Alexander, S.; Peskin, M.; Sheikh-Jabbari, M. M.; Feb. 2007; 7 pp.; In English

Report No.(s): DE2007-900238; SLAC-PUB-12371; No Copyright; Avail.: Department of Energy Information Bridge

In this talk we present a mechanism for leptogenesis which is based on gravity waves produced during inflation. We show that when inflation is driven by a pseudo-scalar field the metric perturbations generated during inflation can become birefringent, therefore giving a non-vanishing contribution to the gravitational triangle anomaly and sourcing lepton anti-lepton asymmetry. As this asymmetry is sourced by the fields which are active during inflation, it is not washed out or diluted by inflation. The amount of matter asymmetry generated in our model can be of realistic size for the parameters within the range of some inflationary scenarios and grand unified theories. This talk is based on (1) which has appeared on the arXiv as hep-th/0403069.

NTIS

*Gravity Waves; Leptons; Scalars*



**20070029788** Army War Coll., Carlisle Barracks, PA USA

**Critical Review of the U.S. Marine Corps' Space Cadre Strategy**

Deist, David W; Mar 30, 2007; 21 pp.; In English

Report No.(s): AD-A469109; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA469109>

The National Space Human Capital Resource Strategy of February 2004 required the services to develop and manage a service unique cadre of space professionals to support their unique mission requirements. To date, the Marine Corps space cadre consists of only active and reserve officers, with billets identified for only active duty officers. If the Marine Corps is going to effectively incorporate space power, it must develop a human capital resource strategy and plan that includes officers, enlisted, active duty, reservists, and civilians. Failure to develop and execute such a plan will put Marine Corps success on the 21st century battlefield at risk. The Army, Navy, and Air Force have developed Space Human Capital Resource Strategies and implemented plans with varying degrees of success. This research project reviews the national guidance for space professional development and each service's response and success. It then investigates the applicability of the other services successes to the Marine Corps and concludes with recommendations for a way ahead.

DTIC

*Aerospace Environments; Education; Reserves*

**20070029958** Stanford Linear Accelerator Center, CA, USA; California Univ., Berkeley, CA, USA; California Univ., Santa Cruz, CA, USA; California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets**

Davis, M.; Guhathakurta, P.; Konidaris, N. P.; Newman, J. A.; Ashby, M. L. N.; Jun. 23, 2006; 21 pp.; In English

Report No.(s): DE2007-887066; SLAC-PUB-11973; No Copyright; Avail.: National Technical Information Service (NTIS)

In this the first of a series of 'Letters', we present a description of the panchromatic data sets that have been acquired in the Extended Groth Strip region of the sky. Our survey, the All-wavelength Extended Groth Strip International Survey (AEGIS), is intended to study the physical properties and evolutionary processes of galaxies at  $z$  (approx) 1. It includes the following deep, wide-field imaging data sets: Chandra/ACIS(sup 30) X-ray (0.5-10 keV), GALEX(sup 31) ultraviolet (1200-2500 A), CFHT/MegaCam Legacy Survey(sup 32) optical (3600-9000 (angstrom)), CFHT/CFH12K optical (4500-9000 (angstrom)), Hubble Space Telescope/ACS(sup 33) optical (4400-8500 (angstrom)), Palomar/WIRC(sup 34) near-infrared (1.2-2.2 (micro)m), Spitzer/IRAC(sup 35) mid-infrared (3.6-8.0 (micro)m), Spitzer/MIPS far-infrared (24-70 (micro)m), and VLA(sup 36) radio continuum (6-20 cm). In addition, this region of the sky has been targeted for extensive spectroscopy using the DEIMOS spectrograph on the Keck II 10 m telescope(sup 37). Our survey is compared to other large multiwavelength surveys in terms of depth and sky coverage.

NTIS

*Galaxies; Spectroscopy; Surveys*

**20070030035** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Eta Carinae: Viewed from Multiple Vantage Points**

Gull, Theodore; June 18, 2007; 1 pp.; In English; International Workshop on CLUMPING in Hot-Star Winds, 18-22 Jun. 2007, Potsdam, Germany; No Copyright; Avail.: Other Sources; Abstract Only

The central source of Eta Carinae and its ejecta is a massive binary system buried within a massive interacting wind structure which envelops the two stars. However the hot, less massive companion blows a small cavity in the very massive primary wind, plus ionizes a portion of the massive wind just beyond the wind-wind boundary. We gain insight on this complex structure by examining the spatially-resolved Space Telescope Imaging Spectrograph (STIS) spectra of the central source (0.1') with the wind structure which extends out to nearly an arcsecond (2300AU) and the wind-blown boundaries, plus the ejecta of the Little Homunculus. Moreover, the spatially resolved Very Large Telescope/UltraViolet Echelle Spectrograph (VLT/UVES) stellar spectrum (one arcsecond) and spatially sampled spectra across the foreground lobe of the Homunculus provide us vantage points from different angles relative to line of sight. Examples of wind line profiles of Fe II, and the highly excited [Fe III], [Ne III], [Ar III] and [S III], plus other lines will be presented.

Author

*Stellar Winds; Binary Stars; Stellar Mass Ejection; Stellar Activity*

## LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

**20070029248** Lawrence Livermore National Lab., Livermore, CA USA

**Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging**

Carrano, C. J.; May 30, 2006; 14 pp.; In English

Report No.(s): DE2007-900853; UCRL-CONF-221713; No Copyright; Avail.: Department of Energy Information Bridge

Obtaining a high-resolution image of an object or scene from a long distance away can be very problematic, even with the best optical system. This is because atmospheric blurring and distortion will limit the resolution and contrast of high-resolution imaging systems with substantial sized apertures over horizontal and slant paths. Much of the horizontal and slant-path surveillance imagery we have previously collected and successfully enhanced has been collected at visible wavelengths where atmospheric effects are the strongest. Imaging at longer wavelengths has the benefit of seeing through obscurants or even at night, but even though the atmospheric effects are noticeably reduced, they are nevertheless present, especially near the ground. This paper will describe our recent work on enhanced infrared (IR) surveillance using bispectral speckle imaging. Bispectral speckle imaging in this context is an image postprocessing algorithm that aims to solve the atmospheric blurring and distortion problem of imaging through horizontal or slant path turbulence. A review of the algorithm as well as descriptions of the IR camera and optical systems used in our data collections will be given. Examples of horizontal and slant-path imagery before and after speckle processing will also be presented to demonstrate the resolution improvement gained by the processing. Comparisons of IR imagery to visible wavelength imagery of the same target under the same conditions will be shown to demonstrate the tradeoffs of going to longer wavelengths.

NTIS

*Adaptive Optics; Atmospheric Effects; High Resolution; Imagery; Imaging Techniques; Infrared Imagery; Surveillance; Telescopes*

**20070030011** NASA Johnson Space Center, Houston, TX, USA

**Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions**

Warmflash, David; Larios-Sanz, Maia; Jones, Jeffrey; Fox, George E.; McKay, David S.; [2007]; 24 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG5-12366; NNG05GN18G; Copyright; Avail.: CASI: [A03](#), Hardcopy

Exploration Class missions to Mars will require precautions against potential contamination by any native microorganisms that may be incidentally pathogenic to humans. While the results of NASA's Viking biology experiments of 1976 have been generally interpreted as inconclusive for surface organisms, the possibility of native surface life has never been ruled out and more recent studies suggest that the case for biological interpretation of the Viking Labeled Release data may now be stronger than it was when the experiments were originally conducted. It is possible that, prior to the first human landing on Mars, robotic craft and sample return missions will provide enough data to know with certainty whether or not future human landing sites harbor extant life forms. However, if native life is confirmed, it will be problematic to determine whether any of its species may present a medical risk to astronauts. Therefore, it will become necessary to assess empirically the risk that the planet contains pathogens based on terrestrial examples of pathogenicity and to take a reasonably cautious approach to bio-hazard protection. A survey of terrestrial pathogens was conducted with special emphasis on those pathogens whose evolution has not depended on the presence of animal hosts. The history of the development and implementation of Apollo anticontamination protocol and recent recommendations of the NRC Space Studies Board regarding Mars were reviewed. Organisms can emerge in nature in the absence of indigenous animal hosts and both infectious and non-infectious human pathogens are theoretically possible on Mars. The prospect of Martian surface life, together with the existence of a diversity of routes by which pathogenicity has emerged on Earth, suggests that the possibility of human pathogens on Mars, while low, is not zero. Since the discovery and study of Martian life can have long-term benefits for humanity, the risk that Martian life might include pathogens should not be an obstacle to human exploration. As a precaution, however, it is recommended that EVA suits be decontaminated when astronauts enter surface habitats when returning from field activity and that biosafety protocol approximating laboratory BSL 2 be developed for astronauts working in laboratories on the Martian surface. Quarantine of astronauts and Martian materials arriving on Earth should also be part of a human Mars mission and this and the surface biosafety program should be integral to human expeditions from the earliest stages of the mission planning.

Author

*Biological Hazards; Microorganisms; Organisms; Manned Mars Missions; Extraterrestrial Life*

93  
**SPACE RADIATION**

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics*.

**20070028913** NASA Johnson Space Center, Houston, TX, USA

**Operational Aspects of Space Radiation Analysis**

Weyland, M. D.; Johnson, A. S.; Semones, E. J.; Shelfer, T.; Dardano, C.; Lin, T.; Zapp, N. E.; Rutledge, R.; George, T.; October 17, 2005; 1 pp.; In English; *Solar and Space Physics and the Vision for Space Exploration*, 17-21 Oct. 2005, Charlottesville, VA, USA

Contract(s)/Grant(s): 337-42-04-01; Copyright; Avail.: Other Sources; Abstract Only

Minimizing astronaut's short and long-term medical risks arising from exposure to ionizing radiation during space missions is a major concern for NASA's manned spaceflight program, particularly exploration missions. For ethical and legal reasons, NASA follows the 'as low as reasonably achievable' (ALARA) principal in managing astronaut's radiation exposures. One implementation of ALARA is the response to space weather events. Of particular concern are energetic solar particle events, and in low Earth orbit (LEO), electron belt enhancements. To properly respond to these events, NASA's Space Radiation Analysis Group (SRAG), in partnership with the NOAA Space Environment Center (SEC), provides continuous flight support during U.S. manned missions. In this partnership, SEC compiles space weather data from numerous ground and space based assets and makes it available in near real-time to SRAG (along with alerts and forecasts), who in turn uses these data as input to models to calculate estimates of the resulting exposure to astronauts. These calculations and vehicle instrument data form the basis for real-time recommendations to flight management. It is also important to implement ALARA during the design phase. In order to appropriately weigh the risks associated with various shielding and vehicle configuration concepts, the expected environment must be adequately characterized for nominal and worst case scenarios for that portion of the solar cycle and point in space. Even with the best shielding concepts and materials in place (unlikely), there will be numerous occasions where the crew is at greater risk due to being in a lower shielded environment (short term transit or lower shielded vehicles, EVAs), so that accurate space weather forecasts and nowcasts, of particles at the relevant energies, will be crucial to protecting crew health and safety.

Author

*Aerospace Medicine; Astronauts; Extraterrestrial Radiation; Manned Space Flight*

**20070029991** NASA Johnson Space Center, Houston, TX, USA

**Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions**

Kim, Myung-Hee Y.; Hayat, Mathew; Nounu, Hatem N.; Feiveson, Alan H.; Cucinotta, Francis A.; September 09, 2007; 26 pp.; In English; 12th WRMISS Meeting, 9-13 Sep. 2007, Stillwater, OK, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation reviews the risk factors from space radiation for astronauts on future lunar missions. Two types of radiation are discussed, Galactic Cosmic Radiation (GCR) and Solar Particle events (SPE). Distributions of Dose from 1972 SPE at 4 DLOCs inside Spacecraft are shown. A chart with the organ dose quantities is also given. Designs of the exploration class spacecraft and the planned lunar rover are shown to exhibit radiation protections features of those vehicles. CASI

*Extraterrestrial Radiation; Solar Corpuscular Radiation; Radiation Effects; Radiation Shielding; Radiation Protection; Radiation Hazards; Radiation Dosage*

# Subject Term Index

## ABERRATION

Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool – 600

Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 597

## ABILITIES

Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters – 136

## ABLATION

A Phase II Immunotherapeutic Trial: Combination Androgen Ablative Therapy and CTLA-4 Blockade as a Treatment for Advanced Prostate Cancer – 298

Effect of Thermal Conductivity on the Knudsen Layer at Ablative Surfaces – 607

## ABLATIVE MATERIALS

Effect of Thermal Conductivity on the Knudsen Layer at Ablative Surfaces – 607

## ABNORMALITIES

Evaluation of Genomic Instability in the Abnormal Prostate – 405

Pharmacological and Nonpharmacological Methods of Treatment for Fragile – 410

Prostate Cancer Gene Discovery Using ROMA – 371

## ABSORPTION SPECTRA

Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – 102

## ABSORPTIVITY

Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 225

Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – 102

## ACCELERATED LIFE TESTS

Systems Engineering for Rapid Prototyping: Friendly Marking Device – 227

## ACCELERATION (PHYSICS)

A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37

Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI – 481

## ACCELERATORS

Coreless Approaches for On/Off Marx Type Modulators – 579

Employment of Second Order Ruled Surfaces in Design of Sheet Beam Guns – 579

## ACCEPTABILITY

Lethality and Autonomous Robots: An Ethical Stance – 504

Usability and Acceptability of Biometric Security Systems – 473

## ACCESS CONTROL

A Security Risk Measurement for the RAdAC Model – 490

An Enterprise Solution for Biometric Authentication and Identification – 473

Communication Security Establishment Briefing on Government of Canada Biometrics Reports – 477

Independent Testing of Iris Recognition Technology (ITIRT) – 475

Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478

Secure Enterprise Access Control (SEAC) Role Based Access Control (RBAC) – 483

Technical and Non-Technical Problems in Biometric Physical Access Control Systems – 473

Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers – 476

Transforming Intra- and Interagency Processes through Advanced Models and Simulations: An Information Assurance Model – 487

Usability and Acceptability of Biometric Security Systems – 473

## ACCIDENT INVESTIGATION

Shuttle Entry Imaging Using Infrared Thermography – 57

## ACCIDENT PREVENTION

Learning from Past Experiences – 56

## ACCRETION DISKS

FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere' – 672

## ACCUMULATORS

8 GeV Beam Line Optics Optimization for the Rapid Antiproton Transfers at Fermilab – 557

Development of a Charged-particle Accumulator Using an RF Confinement Method II – 591

Development of a Charged-Particle Accumulator Using an RF Confinement Method – 593

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

## ACCURACY

An Inverse of the Circular Coverage Function – 525

An Inverse of the Elliptic Coverage Function – 525

An Inverse of the Generalized Circular Error Function – 525

Systematic Procedure for Assigning Uncertainties to Data Evaluations – 567

The Accuracy of a Fingerprint/Voice Multimodal Verification System – 473

## ACETYL COMPOUNDS

Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – 372

Atropine and Other Anticholinergic Drugs – 372

Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333

## ACETYLATION

Maintenance of Glucose Homeostasis through Acetylation of the Metabolic Transcriptional Coactivator PGC-1alpha – 343

## ACETYLCHOLINE

Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333

## ACHIEVEMENT

Baylor College of Medicine Saturday Morning Science Workshop – 608

## ACOUSTIC EMISSION

A Device for the In-Situ Measurement of Acoustically Stimulated Bioluminescence – 310

## ACOUSTIC IMAGING

Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314

## ACOUSTIC MEASUREMENT

Fault Tolerance in Autonomous Acoustic Arrays – 185

## ACOUSTIC PROPAGATION

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 589

## ACOUSTIC PROPERTIES

Acoustic Identification of Filler Materials in Unexploded Ordnance – 82

Signal Event Detection System – 590

## ACOUSTIC SCATTERING

A Geometric Investigation of Acoustical Wavefront Scattering and Healing Induced by Ocean Internal Waves – 588

## ACOUSTIC VELOCITY

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 589

## ACOUSTICS

A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT) – 218

Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 224

Dark Core Analysis of Coaxial Injectors at Sub-, Near-, and Supercritical Conditions in a Transverse Acoustic Field – 589

Design and Validation of an Aeroacoustic Anechoic Test Facility – 587

Early Detection of Prostate Cancer – 323

NOAA National Passive Acoustics Workshop, 2006 – 590

Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509

## ACQUISITION

Defense Acquisitions. Improved Management and Oversight Needed to Better Control DOD's Acquisition of Services – 492

## ACTINOMYCETES

Degradation of Polycyclic Aromatic Hydrocarbons by Actinomycetes – 104

## ACTIVATED CARBON

Adsorption and Desorption of Dinitrotoluene on Activated Carbon – 91

## ACTIVATION

Activation and Protection of Dendritic Cells in the Prostate Cancer Environment – 313

Method, System and Device for Microscopic Examination Employing Fibre-Prepared Sample Grasping Element – 206

Platelet Activating Factor: A Growth Factor for Breast Cancer – 341

Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3 – 358

## ACTIVE CONTROL

Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4

Distributed Command and Control Research: Networking Multiple Simulation Platforms – 495

Distributed Computing and Collaboration Framework (DCCF) – 466

Dynamic-Active Flow Control - Phase I – 2

Performance Measurement for Diagnosing and Debriefing Distributed Command and Control Teams – 150

## ACTUATORS

Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18

High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor – 119

Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215

Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551

Optimization of Synthetic Jet Actuators – 235

Performance Measurement of the Upgraded D0 Central Track Trigger – 558

Pneumatically Actuated Flexible Coupling and Effectors for Lapping/Polishing – 34

SparkJet Actuators for Flow Control – 235

Tip Clearance Control Using Plasma Actuators – 16

## ADA (PROGRAMMING LANGUAGE)

Ada County Sheriff's Office Internet Site – 429

## ADAPTATION

Adaptive Sampling for Network Management – 485

Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 537

Climate Change Impacts and Adaptation in California. Staff Paper – 279

Conditions for Achieving Network-Centric Operations in Systems of Systems – 465

Inhibiting Adaptation – 169

Military Information Networks as Complex Adaptive Systems – 512

Principles of Adaptive Array Processing – 176

System-of-Systems Governance: New Patterns of Thought – 465

Training Coordination Proxy Agents – 616

User-Level QoS-Adaptive Resource Management in Server End-Systems – 485

## ADAPTIVE CONTROL

Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – 21

Organizational Fragility Curves: Sense-making under Stress – 544

## ADAPTIVE FILTERS

Adaptive Identification of Fluid-Dynamic Systems – 215

## ADAPTIVE OPTICS

Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors – 600

Adaptive Optics Views of the Hubble Deep Fields Final Report on LLNL LDRD Project 03-ERD-002 – 672

Exploiting Adaptive Optics with Deformable Secondary Mirrors – 231

High Contrast Imaging Using Adaptive Optics for Extrasolar Planet Detection – 666

How Important is Oblique Vision in Aviation? – 596

Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – 675

## ADDITIVES

Development and Testing of Flame Retardant Additives and Polymers – 67

Fuel Property Effects on T700 Exhaust Particulates – 132

Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 604

Nanoengineered Additives for Active Coatings – 61

## ADDUCTS

Feasibility of Biomonitoring of Exposure to Permethrin Through Analysis of Long-Lived (Metabolite) Adducts to Proteins – 320

## ADENOVIRUSES

Midkine Promoter-Driven Adenovirus as Potential Therapy for NF1 – 341

Vasculature-Specific Adenovirus Vectors for Gene Therapy of Prostate Cancer – 352

## ADHESION TESTS

System and Method for Field Testing a Tack Coat Layer – 75

## ADHESION

A Study of the Attraction Forces of Lunar Dust Simulant – 664

FGFR4 Downregulation of Cell Adhesion in Prostate Cancer – 376

The Role of TSC Proteins in Regulating Cell Adhesion and Motility – 281

## ADHESIVE BONDING

Best Practice in Adhesive-Bonded Structures and Repairs – 67

## ADHESIVES

Integration of Soluble and Adhesive Gradient Signals in Directed Cell Migration – 310

Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81

## **ADIPOSE TISSUES**

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357

## **ADSORPTION**

Adsorption and Desorption of Dinitrotoluene on Activated Carbon – 91

## **ADVECTION**

A Detailed Study of Advection Sea Fog Formation to Reduce the Operational Impacts Along the Northern Gulf of Mexico – 268

## **AERIAL EXPLOSIONS**

Detection of Atmospheric Explosions at IMS Monitoring Stations using Infrared Sound Techniques – 265

## **AERIAL RECONNAISSANCE**

A Bold 21st Century Strategy for U.S. Airborne ISR – 24

A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620

Background Modeling and Algorithm Fusion for Airborne Landmine Detection – 517

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

Pilot Study: Parasitic and Passive Radar – 179

The Coalition Aerial Surveillance and Reconnaissance (CAESAR) Approach to Enhancing the Interoperability of Coalition Ground Surveillance Systems – 224

## **AEROACOUSTICS**

Design and Validation of an Aeroacoustic Anechoic Test Facility – 588

## **AEROBES**

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 114

Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons – 101

## **AEROBRAKING**

Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59

## **AERODYNAMIC CONFIGURATIONS**

Structural Design and Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile Configurations – 217

## **AERODYNAMIC DRAG**

Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 4

## **AERODYNAMIC FORCES**

Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems – 2

Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48

## **AERODYNAMIC HEATING**

Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58

## **AERODYNAMIC NOISE**

Design and Validation of an Aeroacoustic Anechoic Test Facility – 588

## **AERODYNAMIC STABILITY**

Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 44

Unattended Ground Sensor Assembly – 436

## **AERODYNAMIC STALLING**

Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – 519

## **AERODYNAMICS**

Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems – 2

Characteristics of Runback Ice Accretions and Their Aerodynamic Effects – 1

High-Speed/-Hypersonic-Weapon-Development-Tool Integration – 22

Relaxed Fidelity CFD Methods Applied to Store Separation Problems – 5

Simulation and Analysis of Dart Dispense Events with Collisions – 235

## **AERONAUTICS**

A Review of Australian and New Zealand Investigations on Aeronautical Fatigue During the Period April 2005 to March 2007 – 3

## **AEROSERVOELASTICITY**

Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 4

F-15B QuietSpike(TradeMark) Aeroservoelastic Flight Test Data Analysis – 35

## **AEROSOLS**

Automating the Shadow Method for Aerosol Optical Depth Retrieval – 462

Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335

Effect of Atmospheric Background Aerosols on Biological Agent Detectors – 222

Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System – 271

## **AEROSPACE ENGINEERING**

Fully Reusable Access to Space Technology (FAST) Methane Rocket – 46

## **AEROSPACE ENVIRONMENTS**

Critical Review of the U.S. Marine Corps' Space Cadre Strategy – 674

Exploration Medical Capability (ExMC) Program – 417

MURI Center for Materials Chemistry in the Space Environment – 112

Naval Research Laboratory Space Science Division Newsletter: 01/2007 – 669

## **AEROSPACE MEDICINE**

A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414

An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415

An Introduction to the History of Aerospace Medicine – 419

Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411

Behavioral Health Program Element – 417

Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416

Exploration Medical Capability (ExMC) Program – 417

Flight Attendant Fatigue – 412

Fundamentals of Aerospace Medicine: Cosmic Radiation – 412

IMMR Phase 1 Prototyping Plan Inputs – 663

Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415

Integrated Crew Health Care System for Space Flight – 412

Johnson Space Center Flight Medicine Clinic Experience – 413

Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 418

Operational Aspects of Space Radiation Analysis – 676

Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425

Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – 419

Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – 415

- The Need for an Aerospace Pharmacy Residency – 419
- Translational Research in Space Exploration – 413
- AEROSPACE SAFETY**  
Learning from Past Experiences – 56
- AEROSPACE SYSTEMS**  
Alternatives for Military Space Radar – 223  
An Evaluation of High Velocity Wear – 142  
F-15B QuietSpike(TradeMark) Aeroservoelastic Flight Test Data Analysis – 35  
Sustaining Air Force Space Systems: A Model for the Global Positioning System – 26  
Synthesis and Characterization of Space-Survivable POSS-Kapton (TradeMark) Polyimides (Preprint) – 52  
The Combined Aerospace Operations Center (CAOC) of the Future – 160
- AEROSPACE VEHICLES**  
Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 17  
Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48  
Novel Continuous Carbon Nanofibers for the Next Generation Lightweight Structural Nanocomposites – 112
- AEROSTATICS**  
Potential Military Use of Airships and Aerostats – 28
- AEROTHERMODYNAMICS**  
Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237  
Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58  
Technologies for Propelled Hypersonic Flight, Volume 1 - Subgroup 1: Plug Nozzles – 40
- AFGHANISTAN**  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396  
Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of Travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan – 375  
Long-Range Operational Military Forecasts for Afghanistan – 271
- AFRICA**  
A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296  
Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – 47  
Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261  
Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340  
PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – 302  
Short-Term Exercise and Prostate Cancer Prevention in African American Men – 359  
The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402
- AGGREGATES**  
Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – 74
- AGING (BIOLOGY)**  
Biological Impact of Senescence Induction in Prostate Cancer Therapy – 293
- AGREEMENTS**  
Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – 398  
Iran's Nuclear Program: Recent Developments – 594
- AGRICULTURE**  
Agriculture: The Potential Consequences of Climate Variability and Change for the USA – 278
- AIR BREATHING ENGINES**  
Experimental and Detailed Numerical Studies of Fundamental Flame Properties of Gaseous and Liquid Fuels – 38
- AIR DEFENSE**  
The Effects of Wind Turbine Farms on Air Defence Radars – 23
- AIR FLOW**  
Analysis of the Thermal Shielding Properties of Camouflage Materials Brief – 192  
Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250
- AIR POLLUTION**  
Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities – 64  
Feasibility Study of H(sub2)S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California – 259  
Guidance for Estimating VOC and NOx Emission Changes from MACT Rules – 257
- LLNL 10(a)(1)(A) Annual Report (TE-053672-2)-2006 – 253
- Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274
- Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254
- Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – 256
- Public Health Assessment for Galena Airport (A.K.A. USAF Galena Air Force Station), Galena, Yukon-Koyukuk County, Alaska, May 21, 2007. EPA Facility ID: AK9570028655 – 257
- Removal of Elemental Mercury from a Gas Stream Facilitated by a Non-Thermal Plasma Device. Final Report – 258
- Review of the Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper – 256
- Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – 251
- Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – 252
- AIR QUALITY**  
Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 256  
Guidance for Estimating VOC and NOx Emission Changes from MACT Rules – 257  
Guidelines for Oxygenated Gasoline Credit Programs under Section 211(m) of the Clean Air Act as Amended – 252  
IAQ Tools for Schools. Managing Asthma in the School Environment – 259  
Review of the Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper – 256  
Southern Nevada Air Quality Study – 236
- AIR TO AIR REFUELING**  
Automated Aerial Refueling Presentation to 2007 ARSAG Conference (Preprint) – 15

- Autonomous Unmanned Aerial Vehicle Rendezvous for Automated Aerial Refueling – 11
- AIR TRAFFIC CONTROLLERS (PERSONNEL)**
- Enhanced Aircraft Conspicuity to Reduce Runway Incursions – 13
- Prediction and Classification of Operational Errors and Routine Operations Using Sector Characteristics Variables – 12
- AIR TRAFFIC CONTROL**
- Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR) – 277
- Developing the Federal Aviation Administration's Requirements for Color Use in Air Traffic Control Displays – 16
- Operator Influence of Unexploded Ordnance Sensor Technologies – 227
- Pilot Study: Parasitic and Passive Radar – 179
- Prediction and Classification of Operational Errors and Routine Operations Using Sector Characteristics Variables – 12
- Relationship of Complexity Factor Ratings With Operational Errors – 513
- The Effects of Wind Turbine Farms on ATC Radar – 134
- AIR TRANSPORTATION**
- An Introduction to the History of Aerospace Medicine – 419
- Aviation Security: Efforts to Strengthen International Passenger Prescreening are Under Way, but Planning and Implementation Issues Remain – 3
- Aviation Security: Foreign Airport Assessments and Air Carrier Inspections Help Enhance Security, but Oversight of These Efforts Can Be Strengthened – 12
- CANPASS Air/NEXUS Air - Border Clearance in the Blink of an Eye – 476
- Civil Reserve Air Fleet (CRAF) – 25
- AIR WATER INTERACTIONS**
- Meteorological Factors That Lead to Separation of the California Coastal Jet from the Central Coast – 271
- Microphysics of Air-Sea Exchanges – 274
- AIRBORNE EQUIPMENT**
- Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 461
- AIRBORNE LASERS**
- An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234
- AIRBORNE RADAR**
- Space-Time Adaptive Processing: Algorithms – 177
- AIRCRAFT ACCIDENTS**
- Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps – 7
- First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005 – 9
- AIRCRAFT CARRIERS**
- Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 628
- AIRCRAFT CONFIGURATIONS**
- V-22 Osprey Tilt-Rotor Aircraft – 17
- AIRCRAFT CONSTRUCTION MATERIALS**
- Shot-Peening Sensitivity of Aerospace Materials – 5
- AIRCRAFT DESIGN**
- Human Engineering Design Data Digest – 22
- AIRCRAFT DETECTION**
- Platform Camera Aircraft Detection for Approach Evaluation and Training – 29
- AIRCRAFT ENGINES**
- A Value-Focused Thinking Model for the Selection of the Best Rigid Pavement, Partial-Depth Spall Repair Material – 20
- Experimental Characterization of Turbulent Flow Around Cylinder Arrays – 219
- Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 23
- Reduced Exhaust Emissions Gas Turbine Engine Combustor – 39
- Thermal Applications for Advanced Metallic Materials (Preprint) – 18
- AIRCRAFT EQUIPMENT**
- Aircraft Battery Design Concept for Improved Ultra Low Temperature Performance (Postprint) – 17
- Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44
- AIRCRAFT PILOTS**
- Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – 419
- AIRCRAFT SPIN**
- Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – 519
- AIRCRAFT STRUCTURES**
- Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers – 35
- AIRCRAFT**
- Aircraft Downwind Hazard Distance After a Chemical Attack – 34
- Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft – 583
- Experimental Methods to Characterize Nonlinear Vibration of Flapping Wing Micro Air Vehicles – 32
- Flexible UAV Mission Management Using Emerging Technologies – 23
- Guidance Material for Mode S-Specific Protocol Application Avionics – 37
- Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – 38
- The Effects of Wind Turbine Farms on Air Defence Radars – 22
- UAV Scheduling via the Vehicle Routing Problem with Time Windows (Preprint) – 20
- AIRDROPS**
- Low Cost Parachute – 2
- AIRFOILS**
- Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4
- Cooled Turbine Airfoil – 42
- Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18
- AIRFRAMES**
- A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division – 20
- Control of Spinning Symmetric Airframes – 552
- Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31
- Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8
- AIRLINE OPERATIONS**
- Civil Reserve Air Fleet (CRAF) – 26
- Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10
- Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27
- AIRPORT SECURITY**
- Aviation Security: Efforts to Strengthen International Passenger Prescreening are Under Way, but Planning and Implementation Issues Remain – 3
- AIRPORTS**
- Aviation Security: Foreign Airport Assessments and Air Carrier Inspections Help Enhance Security, but Oversight of These Efforts Can Be Strengthened – 13
- CANPASS Air/NEXUS Air - Border Clearance in the Blink of an Eye – 476
- Decks for Rapid Runway Mat Application (Postprint) – 45
- Development and Implementation of Noise Analysis Standards for ACSA Airports – 255



Environmental Impacts of Airport Operations: Maintenance, and Expansion – 44

Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – 45

Homeland Security: Protecting Airspace in the National Capital Region – 25

Public Health Assessment for Galena Airport (A.K.A. USAF Galena Air Force Station), Galena, Yukon-Koyukuk County, Alaska, May 21, 2007. EPA Facility ID: AK9570028655 – 257

Subgrade CBR Values for Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility – 13

TARDEC National Automotive Center - Selfridge Air National Guard Base – 132

Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers – 476

## AIRSHIPS

Potential Military Use of Airships and Aerostats – 28

## AIRSPACE

Homeland Security: Protecting Airspace in the National Capital Region – 25

## ALASKA

Public Health Assessment for Galena Airport (A.K.A. USAF Galena Air Force Station), Galena, Yukon-Koyukuk County, Alaska, May 21, 2007. EPA Facility ID: AK9570028655 – 257

## ALBEDO

Correcting the Response of an Albedo Neutron Dosimeter for Energy – 220

## ALBUMINS

Feasibility of Biomonitoring of Exposure to Permethrin Through Analysis of Long-Lived (Metabolite) Adducts to Proteins – 320

## ALCOHOLS

Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption – 337

Immobilized Iminophosphatranes Useful for Transesterification – 70

Large Scale Green Synthesis of 1,2,4-Butanetriol – 66

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 113

NMR Analysis of Thiodiglycol Oxidation by Mammalian Alcohol Dehydrogenases – 371

Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – 384

## ALGEBRA

High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations – 527

Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer – 513

Learning Robustly From Instructions – 519

Parallel Auxiliary Space AMG for Definite Maxwell Problems – 436

Parallel Eigensolver for H (curl) Problems using H1 Auxiliary Space AMG Preconditioning – 434

Some Experience with a H1 Based Auxiliary Space AMG for H (curl) Problems – 437

## ALGORITHMS

A Comparison of Trajectory Determination Approaches for Small UAVs – 11

A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – 550

A Heuristic Design Information Sharing Framework for Hard Discrete Optimization Problems – 542

A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration – 510

A Parallel Particle Swarm Optimizer – 533

A Review of Recent Algorithms and a New and Improved Cooperative Control Design for Generating a Phantom Track (Preprint) – 26

Advanced Radar Signal and Data Processing – 174

Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 537

An Inverse of the Circular Coverage Function – 525

An Inverse of the Elliptic Coverage Function – 525

An Inverse of the Generalized Circular Error Function – 525

An Inverse of the Incomplete Beta Function (F-(Variance Ratio) Distribution Function) – 467

Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy – 286

Automatic Target Recognition User Interface Tool – 510

Background Modeling and Algorithm Fusion for Airborne Landmine Detection – 517

Code Verification Results of an LLNL ASC Code on Some Tri-Lab Verification Test Suite Problems – 562

Comparing the Performance of Collection Selection Algorithms – 613

Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash – 580

Development and Assessment of a Complete ATR Algorithm Based on ISAR Euler Imagery – 468

Development of an Experimental Platform for Testing Autonomous UAV Guidance and Control Algorithms – 38

Digital Watermarking Using Syndrome Codes – 516

Discrete Data Transfer Technique for Fluid-Structure Interaction – 478

Empirical Effective Dimension and Optimal Rates for Regularized Least Squares Algorithm – 524

Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – 511

Fault-Tolerant Parallel Algorithms for Adaptive Matched-Field Processing on Distributed Array Systems – 509

Hyperspectral Imagery Target Detection Using Principal Component Analysis – 522

Integrated Sensing and Processing (ISP) Phase 2: Demonstration and Evaluation for Distributed Sensor Networks and Missile Seeker Systems – 514

New Tools for Hybrid Systems – 517

Parallel Global Optimization with the Particle Swarm Algorithm (Preprint) – 533

Proceedings of the Quantum Computation for Physical Modeling Workshop Held in North Falmouth, Massachusetts on October 18-19, 2000 – 519

Prognostic Fusion for Uncertainty Reduction – 35

Quantum Algorithms and Initialization – 547

Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58

RIDE vs. CLASP Comparison and Evaluation: Models and Parameters – 662

Risk Bounds for Regularized Least-Squares Algorithm with Operator-Value Kernels – 524

Scale-Independent Biomechanical Optimization – 521

Self-Stabilizing Mobile Node Location Management and Message – 511

Space-Time Adaptive Processing: Algorithms – 177

The Matrix Pencil and its Applications to Speech Processing – 589

Theory and Applications of Computational Time-Reversal Imaging – 516

UAV Scheduling via the Vehicle Routing Problem with Time Windows (Preprint) – 20

Using a Shortest Path Algorithm for Identifying Areas of Interest in An Area of Operations – 543

Virtual Stationary Automata for Mobile Networks – 536

**ALIGNMENT**

Data Alignment between Army C4I Databases and Army Simulations – 653

Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans – 640

Survey and Alignment of the Fermilab Electron Cooling System – 585

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

**ALIPHATIC HYDROCARBONS**

Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons – 102

**ALKALIES**

Heat of Dilution Calculation for 19 Molar Sodium Hydroxide with Water for Use in 241-S-112 – 103

**ALKENES**

Alkene- and Alkyne- Substituted Methylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – 100

**ALKYLATION**

Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor kB Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling – 388

**ALKYNES**

Alkene- and Alkyne- Substituted Methylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – 100

**ALLOCATIONS**

A Method for Including Control Effector Interactions in the Control Allocation Problem (Preprint) – 461

Optimizing the Allocation of Sensor Assets for the Unit of Action – 531

Using Cyclic Memory Allocation to Eliminate Memory Leaks – 442

**ALLOYS**

Meso-Scale Self-Assembly Pilot Study – 199

Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99

**ALTERNATING CURRENT**

AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605

**ALTERNATIVES**

Alternatives for Military Space Radar – 223

Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR) – 276

**ALUMINATES**

Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures – 96

**ALUMINIDES**

Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558

**ALUMINUM ALLOYS**

Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44

Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion – 116

The Effect of Inhomogeneous Plastic Deformation on the Ductility and Fracture Behavior of Age Hardenable Aluminum Alloys – 115

**ALUMINUM GALLIUM ARSENIDES**

Pyroelectric AlGaIn/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 97

**ALUMINUM OXIDES**

Effects of Temperature and Environment on Creep Behavior of an Oxide-Oxide Ceramic Matrix Composite – 103

High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – 125

Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127

Supported Metal Catalyst with Improved Thermal Stability – 64

**ALUMINUM**

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99

Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – 91

Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127

**AMBIENCE**

Review of the Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper – 256

**AMERICAN INDIANS**

Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360

**AMINES**

PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – 303

**AMINO ACIDS**

Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110

Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394

**AMMUNITION**

Acoustic Identification of Filler Materials in Unexploded Ordnance – 82

Adaptive and Iterative Processing Techniques for Overlapping Signatures – 555

Evaluation of airborne Electromagnetic Systems for Detection and Characterization of unexploded ordnance (uXo) – 12

Handheld Broadband Electromagnetic UXO Sensor – 198

Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – 637

Non-Thermal, On-Site Decontamination and Destruction of Practice Bombs – 141

Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – 251

Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140

Unexploded Ordnance Site Investigation of US Military Ranges in Panama: Empire, Balboa West and Pina Ranges – 135

**AMORPHOUS MATERIALS**

Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 131

Collaborations in Nuclear Reactors – 559

Corrosion Resistance of Structural Amorphous Metal – 104

Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69

Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107

- High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe<sub>49.7</sub>Cr<sub>17.7</sub>Mn<sub>1.9</sub>Mo<sub>7.4</sub>W<sub>1.6</sub>B<sub>15.2</sub>C<sub>3.8</sub>Si<sub>2.4</sub> – 107
- Infrared and Electrical Properties of Amorphous Sputtered (La<sub>x</sub>Al<sub>1-x</sub>)<sub>2</sub>O<sub>3</sub> films – 63
- Molecular Volume and Electronic and Vibrational Polarizabilities for Amorphous LaAlO<sub>3</sub> – 86
- Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures – 96
- X ray Diffraction Techniques for Structural Determination of Amorphous Materials – 69
- AMORPHOUS SILICON**  
Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 605
- AMOUNT**  
Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570
- AMPLIFICATION**  
Prostate Cancer Gene Discovery Using ROMA – 371
- ANALOG TO DIGITAL CONVERTERS**  
Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441  
The Synergic Integrated Concepts of C2S – 174
- ANALOGIES**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415  
Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666  
Content Based Retrieval Database Management System with Support for Similarity Searching and Query Refinement – 622
- ANALOGS**  
Atomtronics: Ultracold Atom Analogs of Electronic Devices – 194
- ANALYSIS (MATHEMATICS)**  
Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens – 405
- ANALYSIS OF VARIANCE**  
Feasibility Study of Variance Reduction in the Logistics Composite Model – 523
- ANATOMY**  
Bone Conduction: Anatomy, Physiology, and Communication – 163
- High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350
- Integration of Anatomic and Pathogenetic Bases for Early Lung Cancer Diagnosis – 506
- ANECHOIC CHAMBERS**  
Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 225  
Design and Validation of an Aeroacoustic Anechoic Test Facility – 587
- ANESTHETICS**  
Evaluation of Daphnia Magna Neonate Viability under Low Temperature Exposure Conditions – 310
- ANGIOGENESIS**  
Anti-Angiogenic Action of Neutral Endopeptidase – 285  
Chemokine Blockade in Combination with Cyto-reductive Conditioning in Metastatic Breast Cancer – 290
- ANGULAR DISTRIBUTION**  
New Results on X(3872) from CDF – 585  
Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere – 261
- ANHYDRIDES**  
Characterization of the Structure-Processing-Performance Relations of Phenylethynyl Phthalic Anhydride Crosslinked Fluorinated Polyimides (AFR-PEPA-N) and Their Carbon Fiber Composites – 85
- ANIMALS**  
Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587  
Health Effects Support Document for Terbacil – 73  
NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252  
Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems – 354
- ANIONS**  
Cloning and Characterization of SLC26A7 and SLC26A9 Anion Exchangers – 68  
Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103
- ANISOTROPY**  
Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115
- Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Test – 117
- Impact Location for a Multilayer Transversely Isotropic Plate – 604
- ANNIHILATION REACTIONS**  
Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – 454
- ANOMALIES**  
Cfetool. A General Purpose Tool for Anomaly Detection in Periodic Data – 439  
Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391  
Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391  
Hyperspectral Imagery Target Detection Using Improved Anomaly Detection and Signature Matching Methods – 592  
Long-Range Operational Military Forecasts for Afghanistan – 271
- ANTARCTIC REGIONS**  
Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica – 241
- ANTENNA ARRAYS**  
Non-Multiple Delay Element Values for Phase Shifting – 199  
Principles of Adaptive Array Processing – 176  
T/R Module for Satellite TT&C Ground Link – 200
- ANTENNA DESIGN**  
10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 191  
A Pareto Approach to Lossy Matching – 203  
Very High Resolution SAR and Multichannel SAR/MTI – 175
- ANTHROPOMETRY**  
Anthropometric Accommodation in Space Suit Design – 424  
Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10
- ANTIAIRCRAFT MISSILES**  
Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 22
- ANTIBIOTICS**  
Antimicrobial Polymeric Surfaces – 79  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335  
Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385

Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340

## ANTIBODIES

Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles – 381

Human Spotted Fever Rickettsial Infections – 386

Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377

Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344

Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351

Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379

Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – 394

Process Research and Development of Antibodies as Countermeasures for C. Botulinum – 308

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

## ANTICHOLINERGICS

Atropine and Other Anticholinergic Drugs – 372

## ANTICONVULSANTS

Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – 110

## ANTIFERROMAGNETISM

Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438

## ANTIGENS

A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389

Cloning and Sequence Analysis of the 22-kDa Antigen Genes of Orientia tsutsugamushi Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – 399

Cross-Serotype Neutralization of Dengue Virus in Aotus nancymae Monkeys – 387

Developing Models to Facilitate the Appropriate Selection and Effective Targeting of Candidate Antigens for Specific Cellular Immunotherapy of Prostate Cancer – 349

Development of Antigen Presenting Cells for Adoptive Immunotherapy in Prostate Cancer – 286

Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium falciparum Malaria in Peru – 380

HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400

Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285

Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388

Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353

Intra-Prostate Cancer Vaccine Inducer – 316

Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344

Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351

Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379

Origin and Properties of Prostatic Stem Cells – 299

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394

The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401

White Blood Cell Counts and Malaria – 400

## ANTIHISTAMINICS

First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005 – 10

## ANTIINFECTIVES AND ANTIBACTERIALS

Antimicrobial Polymeric Surfaces – 79

Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385

## ANTIMISSILE DEFENSE

A System of Systems Interface Hazard Analysis Technique – 541

## ANTIOXIDANTS

Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 337

Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor  $\kappa$ B Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling – 388

Monitoring and Counteracting Functional Deterioration in Parkinson's Disease: A Multilevel Integrative Approach in a Primate Model System – 319

Post-Coupling Synthetic Approach for Polymeric Antioxidants – 65

## ANTIPIROTONS

8 GeV Beam Line Optics Optimization for the Rapid Antiproton Transfers at Fermilab – 557

Development of a Charged-Particle Accumulator Using an RF Confinement Method – 593

## ANTISUBMARINE WARFARE

Analysis of Network-Enabled ASW Concepts of Operation – 529

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

## ANTITANK MISSILES

Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 22

## APERTURES

Multiple Aperture Radiation Therapy (MART) for Breast Cancer – 292

Vertical Cavity Surface Emitting Laser Having a Gain Guide Aperture Interior to an Oxide Confinement Layer – 599

## APOGEE BOOST MOTORS

Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 538

## APOPTOSIS

A Biophysico-computational Perspective of Breast Cancer Pathogenesis and Treatment Response – 325

Apoptosis and Tumor Progression in Prostate Cancer – 338

Apoptosis-Dependent and Apoptosis-Independent Functions of Bim in Prostate Cancer Cells – 307

Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells – 303

Development of Novel Bifunctional Compounds that Induce Apoptosis in Prostate Cancer Cells – 365

Intracellular Survival of Campylobacter jejuni in Human Monocytic Cells and Induction of Apoptotic Death by Cytolethal Distending Toxin – 394

Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287

Mechanisms of p53-Mediated Apoptosis – 350

Methylselenium and Prostate Cancer Apoptosis – 339

Molecular Analysis of Neurotoxin-Induced Apoptosis – 323

Radio-sensitizing Effects of Novel Histone De-Acetylase Inhibitors in Prostate Cancer – 283

Regulation of Apoptosis by AFG3L2, a Potential Oncogene – 293

#### **APPLICATIONS PROGRAMS (COMPUTERS)**

An Adaptive Quality of Service Aware Middleware for Replicated Services – 521

#### **APPROXIMATION**

An Approximation Technique for Belief Revision in Timed Influence Nets – 521

Approximate Analysis of an Unreliable M/M/2 Retrial Queue – 494

Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer – 513

Workforce Configuration of a Canadian Forces Gematics Division – 539

#### **AQUATIC PLANTS**

Experimental Effects of Lime Application on Aquatic Macrophytes: 4. Growth Response of Three Species – 89

#### **AQUIFERS**

CLMT2 User's Guide: A Coupled Model for Simulation of Hydraulic Processes from Canopy to Aquifer – 276

#### **ARCHITECTURE (COMPUTERS)**

A Modular, Scalable, Architecture for Unmanned Vehicles – 547

An Open Architecture Approach to Network Enabled Capability – 656

Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144

Open Architecture in Naval Combat System Computing of the 21st Century: Network-Centric Applications – 442

Quality-Attribute-Based Economic Valuation of Architectural Patterns – 479

Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457

Reconfigurable Matrix Multiplier Architecture and Extended Borrow Parallel Counter and Small-Multiplier Circuits – 208

Service Oriented Architecture for Coast Guard Command and Control – 633

Software Communications Architecture (SCA) Compliant Software Defined Radio Design for Interim Standard 95B (IS-95B) Transceiver – 463

Standard-Cell, Open-Architecture Power Conversion Systems – 247

System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory – 50

The DoD Architecture Framework Views as Requirements Vehicles in a Model Driven Architecture Systems Development Process – 496

Using Formal Methods to Reason about Architectural Standards – 472

USNORTHCOM Integrated Architecture: A Means to an End – 494

#### **ARCTIC REGIONS**

On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263

#### **ARMATURES**

Incident, Action, Recovery, and Recommissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – 202

#### **ARMED FORCES (UNITED STATES)**

Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27

Hurricane Katrina: Lessons for Army Planning and Operations – 163

Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement – 181

TARDEC National Automotive Center - Selfridge Air National Guard Base – 132

The Effect of Graduate Education on the Performance of Air Force Officers – 526

#### **ARMOR**

Defense Logistics: Army and Marine Corps' Body Armor Requirements, Controls, and Other Issues – 426

FCS Technology Insertion and Transition – 508

#### **ARRAYS**

Electro-Optic Array Interface – 213

Fault Tolerance in Autonomous Acoustic Arrays – 185

#### **ARSENIC**

Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – 65

#### **ARTHROPODS**

Evaluation of Daphnia Magna Neonate Viability under Low Temperature Exposure Conditions – 310

#### **ARTIFICIAL GRAVITY**

Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411

Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 418

#### **ARTIFICIAL INTELLIGENCE**

A Qualitative Approach to Rigid Body Mechanics – 501

An Agent-Based Dynamic Information Security Model in Information Warfare – 643

Automated Run-Time Mission and Dialog Generation – 632

Automatic Author Profiling of Online Chat Logs – 503

Boot Camp for Cognitive Systems: A Model for Preparing Systems with Machine Learning for Deployment – 463

Dynamic Cross-Time Measurement Interpretation: Maintaining Qualitative Understandings of Physical System Behavior – 500

Flexible UAV Mission Management Using Emerging Technologies – 23

Information Fusion for Hypothesis Generation under Uncertain and Partial Information Access Situation – 499

Introducing Actions into Qualitative Simulation – 499

Modeling Command and Control in Multi-Agent Systems – 452

Qualitative Reasoning about Fluids and Mechanics – 446

The Logic of Occurrence – 500

#### **ARTIFICIAL SATELLITES**

Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – 48

Mission Support for the Communications/Navigation Outage Forecast Satellite – 49

Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites – 123

Prioritizing Satellite Payload Selection via Optimization – 46

Quick-Turn Finite Element Analysis for Plug-and-Play Satellite Structures – 520

Real Options as a Strategic Management Framework: A Case Study of the Operationally Responsive Space Initiative – 51

System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory – 50

Video Enabling the Combatant Commander's Headquarters – 48

## ARTILLERY

Human Factors Evaluation of the High Mobility Artillery Rocket System (HIMARS) in the Combined HIMARS-Guided Multiple Launch Rocket System (GMLRS) Initial Operational Test – [424](#)

Human Factors Evaluation of the XM30 Guided Multiple Launch Rocket System (GMLRS) in the Combined High Mobility Artillery Rocket System (HIMARS)-GMLRS Initial Operational Test – [423](#)

## ASBESTOS

Asbestos Survey for Fort Point US Coast Guard Station. Presidio of San Francisco. Volume 2 – [241](#)

Jefferson Proving Ground, South of the Firing Line, Final Asbestos Survey Summary Report. Volume 3. Buildings 230 through 475 – [241](#)

## ASIA

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – [262](#)

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – [265](#)

Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – [262](#)

## ASPHALT

Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – [74](#)

System for the Evaluation of Moisture Damage Using Fundamental Material Properties – [74](#)

## ASSAYING

Development of In Vitro Correlate Assays of Immunity to Infection with Yersinia Pestis – [327](#)

Liquid Mixing Reactor for Biochemical Assays – [71](#)

## ASSOCIATIVE MEMORY

Feasibility Study on Magnetic Content Addressable Memory – [196](#)

## ASTHMA

IAQ Tools for Schools. Managing Asthma in the School Environment – [260](#)

Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – [333](#)

Scavenger Receptors and Resistance to Inhaled Allergens – [328](#)

## ASTRONAUTS

A Study of the Attraction Forces of Lunar Dust Simulant – [664](#)

Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – [417](#)

Johnson Space Center Flight Medicine Clinic Experience – [413](#)

Operational Aspects of Space Radiation Analysis – [676](#)

## ASTRONOMICAL OBSERVATORIES

Exploring the High Energy Universe: GLAST Mission and Science – [667](#)

## ASTROPHYSICS

Hypothesis of the Magnetostatic Turbulence and its Implications for Astrophysics – [672](#)

Naval Research Laboratory Space Science Division Newsletter: 01/2007 – [669](#)

Relativistic Jets in the Radio Reference Frame Image Database. 1. Apparent Speeds From the First 5 Years of Data – [670](#)

## ASYMMETRY

Characterization Of Commonly Encountered Explosives Using Highfield Asymmetric Waveform Ion Mobility Spectrometry Coupled With Mass Spectrometry – [594](#)

e-/e+ Accelerating Structure with Cyclic Variation of Azimuth Asymmetry – [578](#)

Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – [437](#)

Measurements of CP-Violating Asymmetries in B0 to a1+(1260) pi+ Decays – [578](#)

Method and Apparatus for Providing an Asymmetric Watermark Carrier – [430](#)

## ATMOSPHERIC BOUNDARY LAYER

Implementation of the Immersed Boundary Method in the Weather Research and Forecasting Model – [275](#)

Meteorological Factors That Lead to Separation of the California Coastal Jet from the Central Coast – [270](#)

## ATMOSPHERIC COMPOSITION

Achievements in Stratospheric Ozone Protection – [278](#)

## ATMOSPHERIC EFFECTS

Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – [675](#)

## ATMOSPHERIC ENTRY

Shuttle Entry Imaging Using Infrared Thermography – [57](#)

## ATMOSPHERIC MODELS

Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – [335](#)

Implementation of the Immersed Boundary Method in the Weather Research and Forecasting Model – [275](#)

Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere – [260](#)

Stratospheric Relaxation in IMPACTs Radiation Code – [275](#)

Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – [253](#)

## ATMOSPHERIC SOUNDING

On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – [263](#)

## ATMOSPHERIC STRATIFICATION

Implementation of the Immersed Boundary Method in the Weather Research and Forecasting Model – [275](#)

## ATMOSPHERIC TEMPERATURE

Microphysics of Air-Sea Exchanges – [274](#)

Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared – [271](#)

## ATMOSPHERIC TIDES

Observation of Tidal Effects on LWIR Radiance Above the Mesopause – [262](#)

## ATOMIC FORCE MICROSCOPY

Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – [591](#)

## ATOMIC PHYSICS

Proving Atomicity: An Assertional Approach – [487](#)

## ATOMIC STRUCTURE

On the Importance of Atomic Packing in Determining Dielectric Permittivities – [553](#)

## ATOMIZING

A Method to Predict Atomization Performance in Gas-Centered Swirl-Coaxial Injectors – [218](#)

A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT) – [218](#)

Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors – [216](#)

## ATOMS

Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – [105](#)

Atomtronics: Ultracold Atom Analogs of Electronic Devices – [194](#)

On the Importance of Atomic Packing in Determining Dielectric Permittivities – [553](#)

Scalability, Complexity and Reliability in Quantum Information Processing – [591](#)

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – [88](#)

## ATROPINE

Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – [110](#)

- Atropine and Other Anticholinergic Drugs – 372
- ATTACK AIRCRAFT**  
Enhancing Army S&T Lessons from ‘Project Hindsight Revisited’ – 22
- ATTENUATION**  
Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265  
Self Attenuation Correction for Holdup Measurements. An Historical Perspective – 581
- ATTITUDE CONTROL**  
Fine Pointing of Military Spacecraft – 51  
Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667
- ATTITUDE (INCLINATION)**  
Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps – 7
- AUDIO EQUIPMENT**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – 588  
Video Enabling the Combatant Commander’s Headquarters – 48
- AUDITORY DEFECTS**  
NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252
- AUDITORY PERCEPTION**  
Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 154
- AUDITORY SIGNALS**  
Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 154
- AUGMENTATION**  
Automated Information Extraction System (AIES) Capability Enhancement and Support – 614  
Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314  
Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps – 6  
Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers – 272  
Enhancement of the Computational Efficiency of Membrane Computing Models – 550  
Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor – 281
- Mediators in Infrastructure Survivability Enhancement – 449
- AUSTRALIA**  
A Review of Australian and New Zealand Investigations on Aeronautical Fatigue During the Period April 2005 to March 2007 – 3  
Developing and Evolving a Joint Australian Task List – 155  
Interoperability -- An Australian View – 639  
Joint Essential Tasks and a Framework for Evaluation – 136
- AUTOMATA THEORY**  
System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory – 50  
Virtual Stationary Automata for Mobile Networks – 536
- AUTOMATIC CONTROL**  
Automated STR Analysis for DNA Databases – 429  
Development of an Experimental Platform for Testing Autonomous UAV Guidance and Control Algorithms – 38  
Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States – 439  
QoS Negotiation in Real-Time Systems and its Application to Automated Flight Control – 43
- AUTOMATION**  
ISO/IEC JTC1 SC37 Overview – 474
- AUTOMOBILES**  
How the Car Affects the Activity patterns of Children and Youth – 170  
Tank Automotive Research, Development, and Engineering Center – 129  
TARDEC National Automotive Center - Selfridge Air National Guard Base – 132  
The Supreme Court’s Climate Change Decision: Massachusetts v. EPA – 263
- AUTONOMIC NERVOUS SYSTEM**  
Atropine and Other Anticholinergic Drugs – 372  
Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – 373  
PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498
- AUTONOMOUS NAVIGATION**  
A Modular, Scalable, Architecture for Unmanned Vehicles – 547  
A Study of Autonomous Micro-Robots and Their Application to Complex Environments, Volume 1 – 543  
Compliant Formation Control of an Autonomous Multiple Vehicle System – 507
- Path Planning Software and Graphics Interface for an Autonomous Vehicle, Accounting for Terrain Features – 480  
Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26  
Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – 523  
Vector Pursuit Path Tracking for Autonomous Ground Vehicles – 507  
Wide Area Search and Engagement Simulation Validation – 32
- AUTONOMY**  
A Distributed Parallel Embedded System for Autonomous Sonar Arrays – 450  
A Study of Autonomous Micro-Robots and Their Application to Complex Environments, Volume 1 – 543  
An Expose of Autonomous Agents in Command and Control Planning – 498  
Autonomous Unmanned Aerial Vehicle Rendezvous for Automated Aerial Refueling – 11  
Autonomous Virtual Mobile Nodes – 535  
Compliant Formation Control of an Autonomous Multiple Vehicle System – 507  
Development of an Experimental Platform for Testing Autonomous UAV Guidance and Control Algorithms – 38  
Fault Tolerance in Autonomous Acoustic Arrays – 185  
Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – 505  
Information Fusion for Hypothesis Generation under Uncertain and Partial Information Access Situation – 499  
Lethality and Autonomous Robots: An Ethical Stance – 504  
Optimal UAV Task Assignment and Scheduling (Preprint) – 24  
Path Planning Software and Graphics Interface for an Autonomous Vehicle, Accounting for Terrain Features – 480  
Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – 38  
Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26  
Research Institute for Autonomous Precision Guided Systems – 31  
Simultaneous Planning and Control for Autonomous Ground Vehicles – 507  
Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – 523

- Vector Pursuit Path Tracking for Autonomous Ground Vehicles – 507
- AUXILIARY POWER SOURCES**  
A Review of the History of Fire Suppression on U.S. DoD Aircraft – 34
- AVIONICS**  
A Multiservice Switch for Advanced Avionics Data Networks – 43  
Guidance Material for Mode S-Specific Protocol Application Avionics – 37
- AWACS AIRCRAFT**  
IEIST Technologies Enabling TCT Prosecution – 538  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- AXIAL FLOW**  
Novel Collective Protection Filters for Emerging TIC Requirements: Axial and Radial-Flow Filter Designs – 55
- AZIDES (INORGANIC)**  
Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- AZIDES (ORGANIC)**  
Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- AZIMUTH**  
e-/e+ Accelerating Structure with Cyclic Variation of Azimuth Asymmetry – 578
- BACILLUS**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377  
Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335  
Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – 386  
Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – 394  
Role of Superoxide in the Germination of Bacillus Anthracis Endospores – 380
- BACKSCATTERING**  
Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere – 261
- BACTERIA**  
A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414  
Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204  
Cell-surface Alpha-glucan in Campylobacter jejuni 81-176 – 401
- Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375  
Microbial Dynamics during Barley Tempeh Fermentation – 104  
Process Research and Development of Antibodies as Countermeasures for C. Botulinum – 308  
Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398  
Proteomic Analysis of Rickettsia prowazekii – 395  
Role of Superoxide in the Germination of Bacillus Anthracis Endospores – 380  
Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420  
Structural Studies on Intact Clostridium Botulinum Neurotoxins Complexed with Inhibitors Leading to Drug Design – 304
- BAGGAGE**  
Tag Device, Luggage Tag, and Method of Manufacturing a Tag Device – 200
- BALANCE**  
WABED Model in the SMS: Part 2. Graphical Interface – 470
- BALL BEARINGS**  
Development of ASTM Precision Bearing Grease Guide – 64
- BALLISTIC RANGES**  
Boundary Layer Transition Experiments in Support of the Hypersonics Program – 1
- BALLISTICS**  
Ballistic Evaluation of Magnesium Alloy AZ31B – 117
- BANDWIDTH**  
A CBO Study. The Army's Bandwidth Bottleneck – 154  
Infiniband Performance Comparisons of SDR, DDR and Infinipath – 204  
Very High Resolution SAR and Multichannel SAR/MTI – 175
- BARIUM**  
Searching for Double Beta Decay with the Enriched Xenon Observatory – 566
- BARLEY**  
Microbial Dynamics during Barley Tempeh Fermentation – 104
- BARYONS**  
AdS/CFT and QCD – 572  
First Observation of Bottom Baryon Sigma(b) States at CDF – 586  
SELEX: Recent Progress in the Analysis of Charm-Strange and Double-Charm Baryons – 557
- BATHS**  
Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – 109
- BATS**  
Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250
- BATTERY CHARGERS**  
Servicing Hawker Vehicle Batteries with Standard Battery Charging and Test Equipment – 248
- BAYES THEOREM**  
Survey of Bayesian Models for Modelling of Stochastic Temporal Processes – 434
- BEACONS**  
Exploiting Adaptive Optics with Deformable Secondary Mirrors – 232
- BEAM INTERACTIONS**  
Closed Orbit Distortion and the Beam-Beam Interaction – 556
- BEAMFORMING**  
Fundamentals of Signal Processing for Phased Array Radar – 176  
Principles of Adaptive Array Processing – 176  
Real-Time Sonar Beamforming on High-Performance Distributed Computers – 596
- BEAMS (SUPPORTS)**  
Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53
- BED REST**  
Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 419
- BETA PARTICLES**  
Searching for Double Beta Decay with the Enriched Xenon Observatory – 566
- BIBLIOGRAPHIES**  
Detonation Nanodiamonds and Related Materials. Bibliography Index, Issue 1 – 103
- BIDIRECTIONAL REFLECTANCE**  
Coherence Solution for Bidirectional Reflectance of Surfaces with Wavelength-Scale Statistics (Postprint) – 529  
Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54
- BINARY STARS**  
Eta Carinae: Viewed from Multiple Vantage Points – 674
- BINDERS (MATERIALS)**  
Composite Materials Containing a Nanostructured Carbon Binder Phase and High Pressure Process for Making the Same – 83



## BIOASTRONAUTICS

A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414

An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415

Integrated Crew Health Care System for Space Flight – 412

Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – 415

## BIOAVAILABILITY

Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 417

## BIOCHEMISTRY

Liquid Mixing Reactor for Biochemical Assays – 71

Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems – 354

Transformational Medical Technologies Initiative (TMTI) – 310

Ultra Fast Coherent Diffraction Imaging of Single Particles, Clusters and Biomolecules – 572

## BIODEGRADATION

Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305

Literature Review of Biodegradation in Soil of Selected Rocky Mountain Arsenal Contaminants: Isodrin, Dieldrin, Diisopropylmethyl-Phosphonate, 1,2-Dibromo-3-Chloropropane, and p-Chloro-Phenylmethylsulfoxide – 61

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 113

Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture – 93

## BIODYNAMICS

Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – 512

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

Scale-Independent Biomechanical Optimization – 521

## BIOLOGICAL HAZARDS

Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – 675

## BIOLOGICAL WEAPONS

Effect of Atmospheric Background Aerosols on Biological Agent Detectors – 222

Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274

## BIOLUMINESCENCE

A Device for the In-Situ Measurement of Acoustically Stimulated Bioluminescence – 310

IDO Inhibitors for Combination Therapy of Prostate Cancer – 317

Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems – 354

## BIOMARKERS

A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 340

Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308

Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – 338

HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate – 290

Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model – 375

## BIOMEDICAL DATA

An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415

Testing the Effectiveness of the North Shore - LIJ Health System's Bioterrorism Response Program to Identified Surveillance Data – 345

Translational Research in Space Exploration – 413

## BIOMETRICS

An Enterprise Solution for Biometric Authentication and Identification – 473

Biometric Security Issues – 474

CANPASS Air/NEXUS Air - Border Clearance in the Blink of an Eye – 476

Challenges and Potential Research Areas in Biometrics – 476

Challenges for Biometrics Systems: Performance and Fake Resistance – 475

Communication Security Establishment Briefing on Government of Canada Biometrics Reports – 477

DigitalPersona - Case Study: Department of Defense – 475

Enhancing Information Systems Security through Biometrics – 472

Future Applications in Using Biometrics to Enhance Security Level of Coalition Information Sharing Networks – 477

Human Factors and Privacy – 476

Immunology, Systems Biology, and Immunotherapy of Breast Cancer – 360

ISO/IEC JTC1 SC37 Overview – 474

Multimodal Biometric Systems – 472

Privacy and Biometrics: The Human Factors – 477

Security Strategy for a Biometrics Deployment – 474

Technical and Non-Technical Problems in Biometric Physical Access Control Systems – 473

Testing and Evaluation of Dynasig Biometric Pen in Support of Tactical Military and Law Enforcement Missions – 422

The Accuracy of a Fingerprint/Voice Multimodal Verification System – 473

Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers – 476

Usability and Acceptability of Biometric Security Systems – 473

Vulnerabilities in Biometric Encryption Systems – 473

White Blood Cell Counts and Malaria – 400

## BIOMIMETICS

Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204

## BIOPROCESSING

Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 417

## BIOREACTORS

Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 412

## BIOTECHNOLOGY

2006 In Vitro Biology Meeting. Volume 42 – 291

Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305

Transformational Medical Technologies Initiative (TMTI) – 310

## BIPOLAR TRANSISTORS

Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186

## BIPOLARITY

Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186

## BIRDS

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 322

## BITUMENS

System and Method for Field Testing a Tack Coat Layer – 75

## **BLACK HOLES (ASTRONOMY)**

FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere' – 672

## **BLACK SEA**

European Security in the Wider Black Sea Area – 242

## **BLOOD CELLS**

Cord Blood Stem Cell Procurement in Minority Donors – 302

HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400

Mechanisms of Disease Persistence in Chronic Myelogenous Leukemia (CML) – 318

## **BLOOD CIRCULATION**

A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395

A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 374

## **BLOOD COAGULATION**

Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385

## **BLOOD PRESSURE**

Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385

## **BLOOD VESSELS**

Anti-Angiogenic Action of Neutral Endopeptidase – 285

## **BLOOD**

Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 309

Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – 338

Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374

Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

Human Spotted Fever Rickettsial Infections – 386

Immunology, Systems Biology, and Immunotherapy of Breast Cancer – 360

Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404

Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389

Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379

White Blood Cell Counts and Malaria – 400

## **BODY FLUIDS**

Far Forward Treatment of Hemorrhagic Shock – 378

## **BODY SIZE (BIOLOGY)**

Anthropometric Accommodation in Space Suit Design – 424

## **BODY WEIGHT**

The Effect of Increasing Mass on Locomotion – 414

## **BODY-WING AND TAIL CONFIGURATIONS**

Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing – 36

## **BOLOMETERS**

GISMO – 231

## **BONDED JOINTS**

Best Practice in Adhesive-Bonded Structures and Repairs – 67

Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81

## **BONDING**

Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapotic Self-complementary Tecton Tailored to Halogen Bonding – 98

## **BONE DEMINERALIZATION**

Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411

Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411

## **BONE MARROW**

Autologous Marrow-Derived Stem Cell-Seeded Gene-Supplemented Collagen Scaffolds for Spinal Cord Regeneration as a Treatment for Paralysis – 299

Origin and Properties of Prostatic Stem Cells – 299

Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305

## **BONES**

Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411

Bone Conduction: Anatomy, Physiology, and Communication – 163

Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287

Effect of COX-2 (PGE2) and IL-6 on Prostate Cancer Bone Mets – 294

Efficacy of Calcium and Vitamin D Supplementation for the Prevention of Stress Fractures in Female Naval Recruits – 288

Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis – 344

Imaging Primary Prostate Cancer and Bone Metastasis – 325

Leg Muscle Usage Effects on Tibial Elasticity during Running – 295

Molecular Mechanisms of Soft Tissue Regeneration and Bone Formation in Mice: Implications in Fracture Repair and Wound Healing in Humans – 298

Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411

Skeletal Complications in Neurofibromatosis Type 1: The Role of Neurofibromin Haploinsufficiency in Defective Skeletal Remodeling and Bone Healing in NF1 – 377

Targeted Therapies for Myeloma and Metastatic Bone Cancers – 328

Vulnerable Factors to Improve Bone Healing – 347

## **BOOSTER ROCKET ENGINES**

The Independent Readiness Team (IRRT) of SMC – 49

## **BOSNIA AND HERZEGOVINA**

Coalition Information Sharing: Lessons from Kosovo – 183

## **BOSONS**

Search for Chargino and Neutralino at Run II of the Tevatron Collider – 576

W + Jet Production at CDF – 585

## **BOUNDARIES**

Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270

## **BOUNDARY CONDITIONS**

Concepts Associated with Transferring Temporal and Spatial Boundary Conditions Between Modules in the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) – 431

High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations – 526

Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – 430

## **BOUNDARY LAYER FLOW**

Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 44

Direct Numerical Simulation and Experimental Validation of Hypersonic Boundary-Layer Receptivity and Instability – 512

Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4

Implementation of the Immersed Boundary Method in the Weather Research and Forecasting Model – 275

## **BOUNDARY LAYER SEPARATION**

Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4

## **BOUNDARY LAYER TRANSITION**

Boundary Layer Transition Experiments in Support of the Hypersonics Program – 1

Shuttle Entry Imaging Using Infrared Thermography – 57

## **BOUNDARY LAYERS**

Direct Numerical Simulation and Experimental Validation of Hypersonic Boundary-Layer Receptivity and Instability – 512

Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270

Meteorological Factors That Lead to Separation of the California Coastal Jet from the Central Coast – 270

## **BRAGG GRATINGS**

Thermally Compensated Fiber Bragg Grating Mount – 236

## **BRAIN DAMAGE**

Preventing Epilepsy after Traumatic Brain Injury – 366

## **BRAIN**

Brain's DNA Repair Response to Neurotoxicants – 317

Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps – 6

High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain – 409

Systems and Methods for Altering Vestibular Biology – 506

The Role of TSC Proteins in Regulating Cell Adhesion and Motility – 281

## **BRANCHING (PHYSICS)**

First NNLL Prediction of  $B(\text{bar}B \text{ right arrow } Xs \text{ gamma})$  – 567

## **BRAZIL**

Automatic Generation of Best Emergency Routes and Procedures on a Brazilian Frigate – 467

## **BRAZING**

Titanium Brazing for Structures and Survivability – 120

## **BREAST**

A Biophysico-computational Perspective of Breast Cancer Pathogenesis and Treatment Response – 325

A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – 406

A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358

A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296

A Rat Model for Human Ductal Carcinoma In Situ – 392

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357

Antagonism of Taxol Cytotoxicity by Prolactin: Implications for Patient Resistance to Chemotherapy – 364

Are Anti-Inflammatory Lymphocytes Able to Induce Remission of Breast Cancer. Addendum – 364

Association between Microtubule Associated Protein -2 and the EGFR Signaling in Breast Cancer – 296

BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – 406

Cellular Senescence and Breast Cancer – 292

Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391

Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391

Characterization of the Role of Breast Tumor Kinase (BRK) in Breast Cancer Cells Non-responsive to EGFR-targeted Agents – 329

Chemokine Blockade in Combination with Cytoreductive Conditioning in Metastatic Breast Cancer – 290

Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376

Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314

cSrc and Her2 Signaling Pathways Cooperate with Estrogen to Promote ER Phosphorylation, Ubiquitination and Proteolysis in ER Negative Breast Cancers – 356

Deciphering the Molecular Mechanisms of Breast Cancer – 324

Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation – 365

Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer – 364

Development of an Automated Modality-Independent Elastographic Image Analysis System for Tumor Screening – 357

Disruption of the Circadian Rhythms of Gene Expression and the Development of Breast Cancer – 313

Domain Specific Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on erbB Positive Breast Cancer – 348

Effects of Extracellular Matrix on DNA Repair in Vivo – 363

Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on Hormonal Responsiveness of Breast Cancer – 362

Endothelial Progenitors as Vectors for Systemic Gene Therapy of Breast Cancer – 332

Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast – 319

Exploring Early Detection Methods: Using the Intraductal Approach to Predict Breast Cancer – 326

Expression and Genomic Profiling of Minute Breast Cancer Samples – 281

Functional Genomic Analysis of Breast Cancer Cell Tumorigenicity Using a Noval Gene Silencing Resource – 325

Genomic Approaches for Detection and Treatment of Breast Cancer – 346

Hot Flashes and Quality of Life Among Breast Cancer Patients – 288

Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285

Immunology, Systems Biology, and Immunotherapy of Breast Cancer – 360

Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – 301

Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens – 405

Measuring 'Impossible' Intermolecular Cross-Peaks to Improve Selectivity and Sensitivity in Breast MRI – 396

Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287

Mechanisms of p53-Mediated Apoptosis – 350

Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – 324

Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289

Molecular Mechanisms in Compromised Endothelial Barrier during Breast Cancer Metastasis – 377

Multiple Aperture Radiation Therapy (MART) for Breast Cancer – 292

Physiological Stress Reactivity and Breast Cancer – 391

Platelet Activating Factor: A Growth Factor for Breast Cancer – 341

Prognostic Significance of Telomere Attrition in Ductal Carcinoma in Situ of the Breast – 390

Protein Transduction Based Therapies for Breast Cancer – 315

Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers – 322

Regulation of Apoptosis by AFG3L2, a Potential Oncogene – 293

Screening Doses for Induction of Cancers Calculated with the Interactive RadioEpidemiological Program (IREP) – 348

Selenium and Breast Cancer Chemoprevention – 339

Semi-Synthesis and In-vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism – 401

Structure-Based Approach for Discovery of Small Molecule Inhibitors Targeted at AKT – 296

Structure-Based Design of Cdk4/6-Specific Inhibitors – 290

Structural Determination of Certain Novel ER Complexes – 304

Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3 – 358

The Distribution, Levels, and Relevance of the Interleukin-1 Family of Cytokines and Receptors in Human Breast Carcinoma-Induced Osteolysis – 300

The Effect of COX-2 Inhibitors on the Aromatase Gene (CYP19) Expression in Human Breast Cancer – 347

The Impact of Tyrosine Kinase Signaling on Breast Cancer Development – 289

The Opposing Roles of Nucleophosmin and the ARF Tumor Suppressor in Breast Cancer – 283

The Role of CRELD1 Isoform 9B in the Pathogenesis of Breast Cancer – 280

The Role of RB in the Therapeutic Response of Breast Cancer – 301

The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy – 361

Three-Dimensional near Infrared Imaging of Pathophysiological Changes within the Breast – 363

#### **BRIDGES (STRUCTURES)**

Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – 240

#### **BRIGHTNESS TEMPERATURE**

Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared – 272

#### **BRIGHTNESS**

Final Scientific/Technical Phase I Report on Sliding Mode Pulsed Current Averaging IC Drivers for High-Brightness Light Emitting Diodes – 603

New Strategic Plan Takes the ALS into the Future – 576

#### **BRILLOUIN ZONES**

3D Photonic Crystals Build Up By Self-Organization Of Nanospheres – 450

#### **BRINES**

Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69

Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107

#### **BROADBAND**

Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – 196

Analysis of USA' Broadband Policy – 491

GaN Wide Band Power Integrated Circuits (Preprint) – 95

Handheld Broadband Electromagnetic UXO Sensor – 198

Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95

On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263

Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184

#### **BROADCASTING**

Global Broadcast Service Security Classification/Declassification Guide (SCG) – 160

Partnerships: The Path to Improving Crisis Communication – 156

#### **BROKEN SYMMETRY**

Broken Symmetries and Magnetic Dynamics – 220

#### **BROMIDES**

Alkene- and Alkyne- Substituted Methylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – 100

Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350

#### **BUBBLES**

Application of Morse Theory to Analysis of Rayleigh Taylor Topology – 569

Feasibility of Measuring 3He Bubble Diameter Populations in Deuterium-Tritium Ice Layers Using Mie Scattering – 573

#### **BUCKLING**

Nanomaniipulation: Buckling, Transport and Rolling at the Nanoscale – 188

#### **BUDGETING**

Navy-Marine Corps Tactical Air Integration Plan: Background and Issues for Congress – 9

#### **BUILDINGS**

Jefferson Proving Ground, South of the Firing Line, Final Asbestos Survey Summary Report. Volume 3. Buildings 230 through 475 – 241

No Further Action Decision Under CERCLA, Fort Devens Study Area 58, Buildings 2648 and 2650 Fuel Oil Spills – 128

Radon Screening of Buildings at the Umatilla Depot Activity, Hermiston, Oregon – 94

Seismic Response of a Half-Scale Masonry Building with Flexible Diaphragms – 239

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

#### **BULK MODULUS**

Estimating Runflat Stiffness – 552

#### **BUNCHING**

Emittance Correction in the 2006 ILC Bunch Compressor – 580

#### **BUOYANCY**

Filtered Rayleigh Scattering Measurements in a Buoyant Flowfield – 544

#### **BUOYS**

Ocean Wave Energy Harvesting Devices – 480

#### **BURNS (INJURIES)**

State of the Science Meeting: Burn Care: Goals for Treatment and Research – 370

#### **BUTENES**

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 114

## BY-PRODUCTS

Storage, Generation, and Use of Hydrogen – 69

## C BAND

Non-Electronic Radio Front-End (NERF) – 211

## C-135 AIRCRAFT

Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8

Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability – 33

Simulation of the Dynamically Coupled KC-135 Tanker and Refueling Boom – 11

## C-141 AIRCRAFT

Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 32

## CADMIUM TELLURIDES

Studies of Basic Electronic Properties of CdTe-Based Solar Cells and Their Evolution During Processing and Stress. Final Technical Report October 16, 2001-August 31, 2005 – 246

## CADMIUM

Cadmium, Zinc, and Selenium Levels in Carcinoma of the Human Prostate – 356

Nano-Dots Enhanced White Organic Light-Emitting Diodes – 90

## CALCIFEROL

Efficacy of Calcium and Vitamin D Supplementation for the Prevention of Stress Fractures in Female Naval Recruits – 289

## CALCIUM CHLORIDES

Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69

Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107

## CALCIUM OXIDES

Experimental Effects of Lime Application on Aquatic Macrophytes: 4. Growth Response of Three Species – 89

## CALCIUM

Efficacy of Calcium and Vitamin D Supplementation for the Prevention of Stress Fractures in Female Naval Recruits – 289

## CALIBRATING

A Novel Approach to Calibrating Wave-makers and Generating Wavemaker Transfer Functions – 516

BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261

Preflight and Vicarious Calibration of Hyperspectral Imagers – 598

Shakedown & Determination of Tunnel Control Settings for Refurbished Trisonic Gasdynamic Facility (TGF) – 134

Simultaneous Localization, Calibration, and Tracking in an ad Hoc Sensor Network – 536

## CALIFORNIA

A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California – 222

Climate Change Impacts and Adaptation in California. Staff Paper – 279

## CALORIMETERS

Design and Application of the Reconstruction Software for the BaBar Calorimeter – 584

Progress on the Europium Neutron-Capture Study Using DANCE – 673

Superconducting High Resolution Fast-Neutron Spectrometers – 564

## CAMERAS

An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234

An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

Center for Coastline Security Technology, Year-2 – 228

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

GISMO – 231

Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – 118

Platform Camera Aircraft Detection for Approach Evaluation and Training – 29

Source Camera Identification and Blind Tamper Detections for Images – 504

## CAMOUFLAGE

Analysis of the Thermal Shielding Properties of Camouflage Materials Brief – 192

Analysis of the Thermal Shielding Properties of Camouflage Materials – 191

## CANADA

A Conceptual Operational Model for Command and Control of International Missions in the Canadian Forces – 180

Canadian Network Enabled Operations Initiatives – 144

CANPASS Air/NEXUS Air - Border Clearance in the Blink of an Eye – 476

Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective – 621

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective – 623

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective – 623

Workforce Configuration of a Canadian Forces Gematics Division – 539

## CANCER

A Biophysico-computational Perspective of Breast Cancer Pathogenesis and Treatment Response – 325

A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339

A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – 406

A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358

A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296

A Phase II Immunotherapeutic Trial: Combination Androgen Ablative Therapy and CTLA-4 Blockade as a Treatment for Advanced Prostate Cancer – 297

A Rat Model for Human Ductal Carcinoma In Situ – 392

Activation and Protection of Dendritic Cells in the Prostate Cancer Environment – 312

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357

Adjuvant Immunotherapy for Patients at High Risk of Recurrence Following Radiation Therapy for Prostate Cancer – 298

Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308

Antagonism of Taxol Cytotoxicity by Prolactin: Implications for Patient Resistance to Chemotherapy – 364

- Anti-Angiogenic Action of Neutral Endopeptidase – 285
- Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 336
- Apoptosis and Tumor Progression in Prostate Cancer – 338
- Apoptosis-Dependent and Apoptosis-Independent Functions of Bim in Prostate Cancer Cells – 307
- Are Anti-Inflammatory Lymphocytes Able to Induce Remission of Breast Cancer. Addendum – 364
- Association between Microtubule Associated Protein -2 and the EGFR Signaling in Breast Cancer – 296
- ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer – 344
- Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy – 286
- Biological Basis for Chemoprevention of Ovarian Cancer – 359
- Biological Impact of Senescence Induction in Prostate Cancer Therapy – 293
- BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – 406
- Cadmium, Zinc, and Selenium Levels in Carcinoma of the Human Prostate – 356
- Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer – 320
- Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells – 303
- Cellular Senescence and Breast Cancer – 292
- Centrosome-Based Mechanisms, Prognostics and Therapeutics in Prostate Cancer – 345
- Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391
- Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391
- Characterization of the Role of Breast Tumor Kinase (BRK) in Breast Cancer Cells Non-responsive to EGFR-targeted Agents – 329
- Chemokine Blockade in Combination with Cytoreductive Conditioning in Metastatic Breast Cancer – 290
- Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376
- Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314
- cSrc and Her2 Signaling Pathways Cooperate with Estrogen to Promote ER Phosphorylation, Ubiquitination and Proteolysis in ER Negative Breast Cancers – 356
- Decipher the Transcriptional Program in Prostate Cancer Cells – 305
- Deciphering the Molecular Mechanisms of Breast Cancer – 324
- Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362
- Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation – 365
- Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer – 364
- Developing Models to Facilitate the Appropriate Selection and Effective Targeting of Candidate Antigens for Specific Cellular Immunotherapy of Prostate Cancer – 349
- Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321
- Development of a Novel, Non-Invasive Diagnostic Test for Prostate Cancer – 284
- Development of an Automated Modality-Independent Elastographic Image Analysis System for Tumor Screening – 357
- Development of Antigen Presenting Cells for Adoptive Immunotherapy in Prostate Cancer – 286
- Development of Methodology to Maintain Primary Cultures of Normal and Malignant Human Prostatic Epithelial Cells in Vivo – 342
- Development of Novel Bifunctional Compounds that Induce Apoptosis in Prostate Cancer Cells – 365
- Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340
- Differential Mechanisms of Androgen Resistance – 313
- Disruption of the Circadian Rhythms of Gene Expression and the Development of Breast Cancer – 313
- DNA Damage and Genomic Instability Induced by Inappropriate DNA Replication – 336
- Domain Specific Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on erbB Positive Breast Cancer – 348
- DRF3 as a Cholesterol-Dependent Regulator of Src in Prostate Cancer – 315
- Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381
- Early Detection of Prostate Cancer – 323
- Effect of COX-2 (PGE2) and IL-6 on Prostate Cancer Bone Mets – 294
- Effects of Extracellular Matix on DNA Repair in Vivo – 363
- Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on Hormonal Responsiveness of Breast Cancer – 362
- Effects of Modifications in the Laminin-10 Basal Laminina on Prostate Cancer Invasion – 376
- Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum – 357
- Endothelial Progenitors as Vectors for Systemic Gene Therapy of Breast Cancer – 332
- Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor – 281
- Evaluating an Interactive, Multimedia Education and Decision Program for Early-Stage Prostate Cancer Patients in a Randomized Controlled Trial – 342
- Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast – 319
- Evaluation of Genomic Instability in the Abnormal Prostate – 405
- Exploring Early Detection Methods: Using the Intraductal Approach to Predict Breast Cancer – 326
- Expression and Genomic Profiling of Minute Breast Cancer Samples – 281
- FGFR4 Downregulation of Cell Adhesion in Prostate Cancer – 376
- Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes – 341
- Functional Genomic Analysis of Breast Cancer Cell Tumorigenicity Using a Novel Gene Silencing Resource – 325
- Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – 329
- Genomic Approaches for Detection and Treatment of Breast Cancer – 346
- GKLF as a Novel Target in Selenium Chemoprevention of Prostate Cancer – 361
- Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis – 344
- High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350
- Hot Flashes and Quality of Life Among Breast Cancer Patients – 288

- Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285
- Humanin: A Novel Therapeutic Target in Prostate Cancer – 319
- Identification of a Protein for Prostate-Specific Infection – 301
- Identification of Sonic Hedgehog-Induced Stromal Factors That Stimulate Prostate Tumor Growth – 295
- Identifying Molecular Factors in Androgen Receptor Nuclear Export – 282
- IDO Inhibitors for Combination Therapy of Prostate Cancer – 317
- Imaging Primary Prostate Cancer and Bone Metastasis – 325
- Immunology, Systems Biology, and Immunotherapy of Breast Cancer – 360
- Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – 301
- IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345
- Integration of Anatomic and Pathogenetic Bases for Early Lung Cancer Diagnosis – 506
- Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging – 355
- Interactions between Dietary Factors and Inflammation in Prostate Carcinogenesis – 349
- Intra-Prostate Cancer Vaccine Inducer – 316
- Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344
- Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens – 405
- Involvement and Regulation of Heparanase in Prostate Cancer Progression – 318
- Knockout AR in Prostate – 280
- Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 352
- Long-Term Outcomes of Alternative Brachytherapy Techniques for Early Prostate Cancer – 294
- Measuring ‘Impossible’ Intermolecular Cross-Peaks to Improve Selectivity and Sensitivity in Breast MRI – 396
- Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351
- Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287
- Mechanism of Tumor Metastasis Suppression by the KA11 Gene – 318
- Mechanisms and Chemoprevention of Ovarian Carcinogenesis – 358
- Mechanisms of p53-Mediated Apoptosis – 350
- Methylselenium and Prostate Cancer Apoptosis – 339
- Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – 324
- Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289
- Molecular Effects of 13C/DIM in Prostate Cancer – 406
- Molecular Mechanisms in Compromised Endothelial Barrier during Breast Cancer Metastasis – 377
- MR Imaging Based Treatment Planning for Radiotherapy of Prostate Cancer – 349
- Multiple Aperture Radiation Therapy (MART) for Breast Cancer – 292
- Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy – 363
- p63 in Development and Maintenance of the Prostate Epithelium – 355
- PARK2, a Large Common Fragile Site Gene, is Part of a Stress Response Network in Normal Cells That is Disrupted During the Development of Ovarian Cancer – 359
- Physiological Stress Reactivity and Breast Cancer – 391
- Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313
- Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemo-Resistance - Potential Mechanism of PIM Action – 282
- Platelet Activating Factor: A Growth Factor for Breast Cancer – 341
- Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer – 302
- Prevention of Prostate Cancer by Inositol Hexaphosphate – 361
- Prognostic Significance of Telomere Attrition in Ductal Carcinoma in Situ of the Breast – 390
- Proof of Concept for Systematic Collection of Optimal Molecular Quality Anatomically Oriented Normal Prostate from Diverse Age and Race Transplant Donors – 326
- Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – 352
- Prostate Cancer Gene Discovery Using ROMA – 371
- Protein Transduction Based Therapies for Breast Cancer – 315
- Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers – 322
- PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – 302
- Radiation-Induced Immune Modulation in Prostate Cancer – 325
- Radio-sensitizing Effects of Novel Histone De-Acetylase Inhibitors in Prostate Cancer – 283
- Regulation of Apoptosis by AFG3L2, a Potential Oncogene – 293
- Restoration of Wild-Type Activity to Mutant p53 in Prostate Cancer: A Novel Therapeutic Approach – 365
- Role of Caveolin-1 in Prostate Cancer Angiogenesis – 286
- Role of Growth Hormone in Prostate Cancer – 342
- Role of Obesity in Prostate Cancer Development – 336
- Role of Reactive Stroma in Prostate Cancer Progression – 317
- Screening Doses for Induction of Cancers Calculated With the Interactive Radio Epidemiological Program (IREP) – 306
- Screening Doses for Induction of Cancers Calculated with the Interactive RadioEpidemiological Program (IREP) – 348
- Selective Androgen Receptor Downregulators (SARDs): A New Prostate Cancer Therapy – 303
- Selenium and Breast Cancer Chemoprevention – 339
- Semi-Synthesis and In-vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism – 401
- Short-Term Exercise and Prostate Cancer Prevention in African American Men – 359
- Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy – 316

Structure-Based Approach for Discovery of Small Molecule Inhibitors Targeted at AKT – 296

Structure-Based Design of Cdk4/6-Specific Inhibitors – 290

Structural Determination of Certain Novel ER Complexes – 304

Studies of Prostate Tumor Development Via CRE/LOXP Technology – 309

Targeted Therapies for Myeloma and Metastatic Bone Cancers – 328

Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3 – 358

The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway through High-Throughput Cell-Based Screens – 329

The Distribution, Levels, and Relevance of the Interleukin-1 Family of Cytokines and Receptors in Human Breast Carcinoma-Induced Osteolysis – 300

The Effect of COX-2 Inhibitors on the Aromatase Gene (CYP19) Expression in Human Breast Cancer – 347

The Impact of Tyrosine Kinase Signaling on Breast Cancer Development – 289

The Opposing Roles of Nucleophosmin and the ARF Tumor Suppressor in Breast Cancer – 283

The Role of CRELD1 Isoform 9B in the Pathogenesis of Breast Cancer – 280

The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis – 322

The Role of RB in the Therapeutic Response of Breast Cancer – 301

The Significance of Focal Basal Cell Layer Disruption-Induced Immuno-Cell Infiltration in Prostate Cancer Invasion – 364

The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy – 361

Unique Approaches to Androgen Effects on Prostate Cancer – 334

Validation of Quantitative Multimodality Analysis of Telomerase Activity in Urine Cells as a Noninvasive Diagnostic and Prognostic Tool for Prostate Cancer – 366

Vasculature-Specific Adenovirus Vectors for Gene Therapy of Prostate Cancer – 352

## CANYONS

Computational Experimentation with the Virtual Design Team: Bridging the Chasm between Laboratory and Field Research in C2 – 445

## CAPACITORS

Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – 91

Solid State Capacitor Discharge Pulsed Power Supply Design for Railguns – 193

## CAPILLARY TUBES

Kapillaarelektrofores i Tva Dimensioner. Slutrapport Fran Innovationsprojekt 14215 (Two-Dimensional Capillary Electrophoresis Final Report of the Innovative Project 14215) – 68

## CAPTURE EFFECT

Progress on the Europium Neutron-Capture Study Using DANCE – 673

## CARBON COMPOUNDS

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

## CARBON CYCLE

Environmental Consequences of Large-Scale Deployment of New Energy Systems – 253

## CARBON DIOXIDE

Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel – 15

## CARBON FIBER REINFORCED PLASTICS

Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers – 35

## CARBON FIBERS

Characterization of the Structure-Processing-Performance Relations of Phenylethynyl Phthalic Anhydride Crosslinked Fluorinated Polyimides (AFR-PEPA-N) and Their Carbon Fiber Composites – 85

Tension-Compression Fatigue Behavior of a Carbon Fiber/Epoxy (IM7/EPON 862) Composite Fabricated Using Vacuum Assisted Resin Transfer Molding Process – 85

## CARBON MONOXIDE

Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92

## CARBON NANOTUBES

Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92

Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113

Multi-Wall Carbon Nanotubes for Flow-Induced Voltage Generation (Preprint) – 95

Novel Continuous Carbon Nanofibers for the Next Generation Lightweight Structural Nanocomposites – 112

Novel Synthesis of Branched Carbon Nanotubes – 207

Synthesis, Structure, and Properties of PBO/SWNT Composites – 104

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

Tubular Carbon Nano/micro Structures and Method of Making Same – 74

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

## CARBON STEELS

Heat of Dilution Calculation for 19 Molar Sodium Hydroxide with Water for Use in 241-S-112 – 103

## CARBONIZATION

Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – 100

## CARBON

Composite Materials Containing a Nanostructured Carbon Binder Phase and High Pressure Process for Making the Same – 83

Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 83

Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorenocarbonyl Methano[60]Fullerene Pentaads – 87

Novel Continuous Carbon Nanofibers for the Next Generation Lightweight Structural Nanocomposites – 112

Oxygen Plasma Treatment and Deposition of CN<sub>x</sub> on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121

Tubular Carbon Nano/micro Structures and Method of Making Same – 74

## CARBONYL COMPOUNDS

Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorenocarbonyl Methano[60]Fullerene Pentaads – 88

## CARBOXYLIC ACIDS

Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110

## CARCINOGENS

A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 340

A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358

Are Anti-Inflammatory Lymphocytes Able to Induce Remission of Breast Cancer. Addendum – 364

Interactions between Dietary Factors and Inflammation in Prostate Carcinogenesis – 349



- Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens – 405
- Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351
- Mechanisms and Chemoprevention of Ovarian Carcinogenesis – 358
- CARDIOVASCULAR SYSTEM**
- Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391
- Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391
- Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 418
- Skin Temperature Feedback Optimizes Microclimate Cooling – 272
- CARGO**
- Appraising Policies to Reduce Freight Transport Time and Its Variability-A New Method – 430
- Low Cost Parachute – 2
- CARTESIAN COORDINATES**
- Application of the Unscented Transformation to Obtain Target Range, Bearing, Elevation, Range Rate, Speed and Course Estimates and Errors From Tracks Given in Cartesian Coordinates – 517
- CASTING**
- Advanced Polymer Composite Molding Through Intelligent Process Analysis and Control – 85
- Permeability Prediction of Three-Dimensional Woven Fabrics – 89
- CASUALTIES**
- Mapping of WDMET in AIS 2005 and AIS 2005 Military – 645
- CATALOGS (PUBLICATIONS)**
- Catalog of Air Force Weather Technical Documents, 1941-2006 – 266
- MDS MIC Catalog Inputs – 416
- CATALYSTS**
- Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – 105
- Conversion of Hydrogen Sulfide in Coal Gases to Liquid Elemental Sulfur with Monolithic Catalysts. (Annual Report, October 1, 2005-September 30, 2006) – 107
- Immobilized Iminophosphatranes Useful for Transesterification – 70
- Supported Metal Catalyst with Improved Thermal Stability – 64
- CATALYTIC ACTIVITY**
- Immobilized Iminophosphatranes Useful for Transesterification – 70
- CATHETERIZATION**
- The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402
- CATIONS**
- Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103
- CATTLE**
- Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385
- Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597
- CAVITIES**
- Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565
- Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250
- Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab – 564
- Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79
- Studies of a Gas-Filled Helical Muon Beam Cooling Channel – 565
- CELL CULTURING**
- Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development – 371
- CELL DIVISION**
- Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287
- CELLS (BIOLOGY)**
- Characterization of Neurofibromas of the Skin and Spinal Roots in a Mouse Model – 408
- Ethanol and Mesolimbic Serotonin/Dopamine Interactions via 5HT-1B Receptors – 346
- Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – 373
- Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations – 370
- Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287
- Midkine Promoter-Driven Adenovirus as Potential Therapy for NF1 – 341
- Molecular Analysis of Neurotoxin-Induced Apoptosis – 323
- Program Project on the Pathogenesis and Treatment of Parkinson's Disease – 334
- Role of Merlin in the Growth and Transformation of Arachnoidal Cells – 370
- Single Cell Chromatography, LDRD, Feasibility Study – 105
- Single-Cell Level Investigation of Cytoskeletal/Cellular Response to External Stimuli – 107
- Utility of DF-1 for Radioprotection in Lymphocytes – 420
- CEMENTS**
- Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – 45
- CENTRAL AMERICA**
- Building Alternative-Energy Partnerships with Latin America – 249
- CENTRAL NERVOUS SYSTEM**
- Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350
- CERAMIC MATRIX COMPOSITES**
- Effects of Temperature and Environment on Creep Behavior of an Oxide-Oxide Ceramic Matrix Composite – 103
- Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear – 80
- Off-Axis Creep Behavior of Oxide/Oxide Nextel(Trademark)720/AS-0 (Preprint) – 122
- Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – 211
- Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122
- Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91
- CERAMICS**
- Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65
- Oxygen Transport Ceramic Membranes. Quarterly Report from October 2006 through December 2006 – 126
- CEREBRAL CORTEX**
- Ultra-fast Object Recognition from Few Spikes – 502
- CERTIFICATION**
- Real Time Identification – 475
- CHAIN REACTIONS (CHEMISTRY)**
- Short Report: Detection of Orienta Tsutsumamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385

## CHALCOGENIDES

A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 54

## CHANGE DETECTION

Change-Point Methods for Overdispersed Count Data – 522

## CHAOS

The Chaos of Katrina – 267

## CHARACTERIZATION

Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237

Cloning and Characterization of SLC26A7 and SLC26A9 Anion Exchangers – 68

Experimental Characterization of Turbulent Flow Around Cylinder Arrays – 219

Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274

New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210

Novel Two- and Three-Photon Pumped Lasing Dyes: Design, Synthesis, and Characterization – 232

Three-Dimensional near Infrared Imaging of Pathophysiological Changes within the Breast – 363

## CHARGE TRANSFER

Charge Transfer Nanocomposites: The Effects of Scale-Hierarchy – 111

Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100

## CHARGED PARTICLES

Development of a Charged-particle Accumulator Using an RF Confinement Method II – 591

Development of a Charged-Particle Accumulator Using an RF Confinement Method – 593

Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates – 513

Improved Charged Particle Model in CALEICF – 569

## CHARM (PARTICLE PHYSICS)

SELEX: Recent Progress in the Analysis of Charm-Strange and Double-Charm Baryons – 557

## CHARTS

A Multivariate Magnitude Robust Control Chart for Mean Shift Detection and Change Point Estimation – 510

A Unifying Strategy for Data Integration for Global Force Management (Briefing Charts) – 147

Army Fuels: Policies, Regulations, and Executive Orders – 129

Charting a Course for the 21st Century: NLM's (National Library of Medicine's) Long Range Plan, 2006-2016 – 658

Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts) – 411

Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts) – 537

## CHEMICAL ANALYSIS

Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations – 61

Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10

Health Effects Support Document for Terbacil – 73

Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan ASSF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI – 87

## CHEMICAL ATTACK

Aircraft Downwind Hazard Distance After a Chemical Attack – 34

## CHEMICAL BONDS

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

## CHEMICAL COMPOSITION

Methods for Effective Virtual Screening and Scaffold-Hopping in Chemical Compounds – 653

Screening Level Ecological Risk Assessments of Some Military Munitions and Obscure-related Compounds for Selected Threatened and Endangered Species – 251

## CHEMICAL ENERGY

Critical Infrastructure: Control Systems and the Terrorist Threat – 496

## CHEMICAL OXYGEN-IODINE LASERS

Improving COIL Efficiency By Iodine Pre-Dissociation Via Corona Discharge In The Transonic Section Of The Secondary Flow – 234

## CHEMICAL REACTIONS

Controls of Fluid Chemistry on Fracture Growth – 106

MURI Center for Materials Chemistry in the Space Environment – 112

Stab Sensitivity of Energetic Nanolaminates – 84

## CHEMICAL WARFARE

Aircraft Downwind Hazard Distance After a Chemical Attack – 34

Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations – 284

Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374

Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379

Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – 230

Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – 256

## CHEMICALS

Chemical Management Resource Guide for School Administrators – 75

## CHEMILUMINESCENCE

Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems – 355

## CHEMOTHERAPY

A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – 406

Antagonism of Taxol Cytotoxicity by Prolactin: Implications for Patient Resistance to Chemotherapy – 364

Are Anti-Inflammatory Lymphocytes Able to Induce Remission of Breast Cancer. Addendum – 364

Biological Impact of Senescence Induction in Prostate Cancer Therapy – 293

Discovery of Therapeutics for Ricin Toxicosis – 299

Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – 329

Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – 301

Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemoresistance - Potential Mechanism of PIM Action – 282

Regulation of Apoptosis by AFG3L2, a Potential Oncogene – 293

Selenium and Breast Cancer Chemoprevention – 339

The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy – 361

## CHILDREN

Children's Hospice – 293

HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400

How the Car Affects the Activity patterns of Children and Youth – 170

- Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – [387](#)
- Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – [379](#)
- Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – [360](#)
- CHINA**
- China: Possible Missile Technology Transfers from U.S. Satellite Export Policy - Actions and Chronology – [637](#)
- China's Anti-Satellite Weapon Test – [53](#)
- China's Energy Security and Its Military Modernization Efforts: How China Plans to Dominate the World – [248](#)
- Russian and Chinese Information Warfare: Theory and Practice – [628](#)
- CHIPS**
- Parallel Simulation of Chip-Multiprocessor Architectures – [447](#)
- Spread Spectrum Signal Characteristic Estimation Using Exponential Averaging and an AD-HOC Chip rate Estimator – [195](#)
- Victim Migration: Dynamically Adapting Between Private and Shared CMP Caches – [442](#)
- CHIRALITY**
- Chiral Multichromic Single Crystals for Optical Devices – [580](#)
- CHLOROCARBONS**
- Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons – [102](#)
- CHOLESTEROL**
- DRF3 as a Cholesterol-Dependent Regulator of Src in Prostate Cancer – [316](#)
- CHOLINERGICS**
- Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – [373](#)
- CHOLINESTERASE**
- Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – [372](#)
- Atropine and Other Anticholinergic Drugs – [372](#)
- In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents – [77](#)
- Pulmonary Toxicity of Cholinesterase Inhibitors – [382](#)
- CHOLINE**
- Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – [373](#)
- Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – [333](#)
- CHROMATOGRAPHY**
- High Throughput Screening of Potential Displacer Molecules – [73](#)
- Single Cell Chromatography, LDRD, Feasibility Study – [105](#)
- CHROMOPHORES**
- New Materials, Techniques and Device Concepts for Organic NLO Chromophore-based Electrooptic Devices. Part 1 – [291](#)
- CHROMOSOME ABERRATIONS**
- Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations – [371](#)
- Utility of DF-1 for Radioprotection in Lymphocytes – [420](#)
- CHROMOSOMES**
- Centrosome-Based Mechanisms, Prognostics and Therapeutics in Prostate Cancer – [346](#)
- Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – [352](#)
- Prostate Cancer Gene Discovery Using ROMA – [371](#)
- CHRONOLOGY**
- China: Possible Missile Technology Transfers from U.S. Satellite Export Policy - Actions and Chronology – [637](#)
- Evolution of Time Scales – [666](#)
- CIRCADIAN RHYTHMS**
- Disruption of the Circadian Rhythms of Gene Expression and the Development of Breast Cancer – [314](#)
- High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain – [409](#)
- CIRCUIT BOARDS**
- Assured Reference Technology Research (ARTHUR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – [596](#)
- CIRCUIT PROTECTION**
- Pager Phones: Circuit Protection – [168](#)
- CIRCUITS**
- Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – [196](#)
- Configuration Management Support for Long Haul C2 Circuit Switched Services – [154](#)
- Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel – [15](#)
- Fermi Timing and Synchronization System – [605](#)
- Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode – [212](#)
- Reconfigurable Matrix Multiplier Architecture and Extended Borrow Parallel Counter and Small-Multiplier Circuits – [208](#)
- Self Limiting Gate Leakage Driver – [200](#)
- Sharp-Looking Geometric Partitioning – [199](#)
- Solid State Capacitor Discharge Pulsed Power Supply Design for Railguns – [193](#)
- CIRCULATION**
- Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – [330](#)
- Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers – [322](#)
- CITIES**
- Different Approaches for the Creation and Exploitation of 3D Urban Models – [159](#)
- HUMINT Communication Information Systems for Complex Warfare – [642](#)
- Simulation of Radiowave Propagation in a Dense Urban Environment – [554](#)
- The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – [164](#)
- CIVIL AVIATION**
- Aviation Security: Efforts to Strengthen International Passenger Prescreening are Under Way, but Planning and Implementation Issues Remain – [3](#)
- Civil Reserve Air Fleet (CRAF) – [25](#)
- First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005 – [9](#)
- Fundamentals of Aerospace Medicine: Cosmic Radiation – [412](#)
- Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – [419](#)
- CIVIL DEFENSE**
- Terrorist 'Dirty Bombs': A Brief Primer – [251](#)
- CLASSIFICATIONS**
- Analysis and Classification of Traffic in Wireless Sensor Network – [160](#)
- Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – [308](#)
- Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – [224](#)
- Classifying Failing States – [528](#)

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 223

Global Broadcast Service Security Classification/Declassification Guide (SCG) – 160

Security Classification Policy and Procedure: E.O. 12958, as Amended – 650

Security Classified and Controlled Information: History, Status, and Emerging Management Issues – 658

Towards Next Generation WWW: Push, Reuse and Classification – 614

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

## CLEANING

Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel – 15

Fort Holabird Defense Investigative Service (DIS), Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II – 422

## CLEARANCES

DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – 644

Real Time Identification – 475

Simulation and Analysis of Dart Dispense Events with Collisions – 235

Tip Clearance Control Using Plasma Actuators – 16

## CLIENT SERVER SYSTEMS

A Distributed Parallel Processing System for Command and Control Imagery – 466

A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492

Agile Coalition Environment (ACE) – 613

An Agent-Based Dynamic Information Security Model in Information Warfare – 643

Approximate Analysis of an Unreliable M/M/2 Retrial Queue – 494

Distributed Computing and Collaboration Framework (DCCF) – 466

User-Level QoS-Adaptive Resource Management in Server End-Systems – 485

## CLIMATE CHANGE

Agriculture: The Potential Consequences of Climate Variability and Change for the USA – 278

Bringing Climate Change Into Natural Resource Management. Proceedings of a Workshop – 273

Climate Change Impact on Forest Resources. White Paper – 277

Climate Change Impacts and Adaptation in California. Staff Paper – 279

Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277

Ecosystems and Climate Change: Research Priorities for the U.S. Climate Change Science Program. Recommendations from the Scientific Community – 278

Environmental Consequences of Large-Scale Deployment of New Energy Systems – 253

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 – 259

National Security and the Threat of Climate Change – 279

The Supreme Court's Climate Change Decision: Massachusetts v. EPA – 263

U.S. Climate Change Technology Program: Vision and Framework for Strategy and Planning – 258

## CLIMATE MODELS

Environmental Consequences of Large-Scale Deployment of New Energy Systems – 253

## CLIMATE

Global Climate Change: National Security Implications – 267

Long-Range Operational Military Forecasts for Afghanistan – 271

National Security and the Threat of Climate Change – 279

## CLIMATOLOGY

1958-2006 Precipitation Climatology for Lawrence Livermore National Laboratory, Livermore Site and Site 300 – 275

Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277

Global Climate Change: National Security Implications – 266

Severe Weather Forecasting for Laughlin AFB, TX – 267

Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System – 271

## CLINICAL MEDICINE

ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer – 344

Automating Behavioral Health Screening - Addressing Risk Communication Electronically – 306

Development of Antigen Presenting Cells for Adoptive Immunotherapy in Prostate Cancer – 286

Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394

Johnson Space Center Flight Medicine Clinic Experience – 413

Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351

Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289

Multiple Aperture Radiation Therapy (MART) for Breast Cancer – 292

National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397

Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387

Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385

Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development – 371

Translational Research from an Informatics Perspective – 416

UH-USA Agreement - A Telemedicine Research Proposal – 624

## CLINOROTATION

Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 412

## CLINOSTATS

Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 412

## CLONING (BIOLOGY)

Cloning and Characterization of SLC26A7 and SLC26A9 Anion Exchangers – 68

Cloning and Sequence Analysis of the 22-kDa Antigen Genes of Orientia tsutsugamushi Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – 399

Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388

Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389

## **CLOSTRIDIUM BOTULINUM**

Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403

Process Research and Development of Antibodies as Countermeasures for C. Botulinum – 308

Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – 369

Structural Studies on Intact Clostridium Botulinum Neurotoxins Complexed with Inhibitors Leading to Drug Design – 304

## **CLOSURES**

Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing – 568

## **CLUTTER**

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 227

## **CMOS**

Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope – 140

## **COAGULATION**

Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385

The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314

## **COAL DERIVED GASES**

Conversion of Hydrogen Sulfide in Coal Gases to Liquid Elemental Sulfur with Monolithic Catalysts. (Annual Report, October 1, 2005-September 30, 2006) – 107

## **COAL GASIFICATION**

Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.) – 126

## **COAL**

Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor. Semi-Annual Technical Progress Report for April 1, 2006 to September 30, 2006 – 68

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

## **COASTAL WATER**

Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407

## **COASTS**

Analyzing the Interdiction of Sea-Borne Threats Using Simulation Optimization – 451

Asbestos Survey for Fort Point US Coast Guard Station. Presidio of San Francisco. Volume 2 – 241

Center for Coastline Security Technology, Year-2 – 228

Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277

Meteorological Factors That Lead to Separation of the California Coastal Jet from the Central Coast – 270

Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227

Service Oriented Architecture for Coast Guard Command and Control – 633

The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193

## **COATINGS**

Report on the Wisconsin-Stanford-Kansas-Davis-Florida State MURI on Scientific Challenges of Coated Conductors – 555

## **COATING**

An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coating Systems – 60

Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities – 64

## **COBALT**

Structural Investigations of Surface and Orientation-Specific Phenomena in Nanocrystals and Their Assemblies – 203

## **COCKPITS**

Signals Intelligence Support to the Cockpit – 504

## **CODE DIVISION MULTIPLE ACCESS**

Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) – 178

## **CODING**

Digital Watermarking Using Syndrome Codes – 516

Multi-Description Coding for Video Delivery Over Networks – 440

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

Simulation of Coherent Signals with Forward Error Correction Coding – 540

The Matrix Pencil and its Applications to Speech Processing – 589

Ultra-fast Object Recognition from Few Spikes – 501

## **COEFFICIENTS**

Test Suite for Nuclear Data I. Deterministic Calculations for Critical Assemblies and Replacement Coefficients – 575

## **COGNITION**

A New Perspective on Use of the Critical Decision Method with Intelligence Analysts – 610

A Process Model of Situated Cognition in Military Command and Control – 421

Boot Camp for Cognitive Systems: A Model for Preparing Systems with Machine Learning for Deployment – 463

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

The Right Information...and Intelligent Nodes – 456

The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy – 361

## **COHERENT LIGHT**

Gas Detector LCLS Engineering Specifications Document – 574

## **COHERENT RADIATION**

Ultra Fast Coherent Diffraction Imaging of Single Particles, Clusters and Biomolecules – 572

## **COLD TOLERANCE**

Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water – 410

## **COLD WATER**

Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water – 410

## **COLLAGENS**

A Biophysico-computational Perspective of Breast Cancer Pathogenesis and Treatment Response – 325

Autologous Marrow-Derived Stem Cell-Seeded Gene-Supplemented Collagen Scaffolds for Spinal Cord Regeneration as a Treatment for Paralysis – 299

## **COLLISIONS**

Simulation and Analysis of Dart Dispense Events with Collisions – 236

SOME Aspects of Hadron Hadron Collisions in High Energy Interactions (B(O)(s) Mixing Oscillations in Semileptonic Decay at D0 Experiment) – 557

## **COLLOIDS**

Structural Investigations of Surface and Orientation-Specific Phenomena in Nanocrystals and Their Assemblies – 203

## COLONIES

Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110

## COLOR INFRARED PHOTOGRAPHY

Integrated Stereo Infrared and Color Human Detection on the ART platform – 226

## COLOR

Developing the Federal Aviation Administration's Requirements for Color Use in Air Traffic Control Displays – 16

## COMBAT

A Model of Command and Control Processes for JWARS: Test Results from Controlled Experiments and Simulation Runs – 152

A Model of Tactical Battle Rhythm – 170

A Review of Recent Algorithms and a New and Improved Cooperative Control Design for Generating a Phantom Track (Preprint) – 26

Application of NCO Conceptual Framework to US/UK Coalition Combat Operations during Operation Iraqi Freedom – 494

C3X: Correlation, Causation and Controlled Experimentation for C2 – 146

Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630

Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460

FCS Technology Insertion and Transition – 508

Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144

High-Energy Laser Weapon Integration with Ground Vehicles – 234

Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396

Incorporating New Technology to Create a Comprehensive Realistic Training Environment for the 91W – 343

Lightweight and Advanced Materials for Defense: Materials for Military Ground Vehicles – 85

M1114 -- Golden HMMWV Power: Electrical Systems Used in Theater – 192

Mapping of WDMET in AIS 2005 and AIS 2005 Military – 644

Modeling Command and Control in Multi-Agent Systems – 452

Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion – 622

NDIA FORCENet Study - Overview of the Human Element Group's Findings: Implications for C2 and other Aspects of NCW – 172

Open Architecture in Naval Combat System Computing of the 21st Century: Network-Centric Applications – 442

Particle Filter Based Tracking in a Detection Sparse Discrete Event Simulation Environment – 541

Preparing Junior Officers for Roles in FORCENet & Network Centric Operations – 152

Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26

Selection Process of a Non-Primary Power Source for a Combat Vehicle – 242

Suitability of Agent Technology for Military Command and Control in the Future Combat System Environment – 457

Techniques for the Statistical Analysis of Observer Data – 524

The Quest for Effective Interoperability - Issues in Achieving a Naval Coalition Force Virtual Combat System – 645

Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System – 271

Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments – 384

US/UK Sensor-To-Shooter Multinational C4 Interoperability Study Force-On-Force Effectiveness Methodology – 179

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

Value Added Analysis - VAAFY03 – 532

Voice Recognition Interface in the Rehabilitation of Combat Amputees – 307

## COMBINATORIAL ANALYSIS

An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems – 60

## COMBUSTION CHAMBERS

Design, Construction, and Validation of the AFIT Small Scale Combustion Facility and Sectional Model of the Ultra-Compact Combustor – 139

Development of Subscale Fast Cookoff Test – 134

Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – 99

Numerical Analysis of Chamber Wall Heat Transfer in a GH2/GO2 Sub-Scale Combustor – 98

Reduced Exhaust Emissions Gas Turbine Engine Combustor – 39

## COMBUSTION PRODUCTS

AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – 255

Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – 99

Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 237

Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335

Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237

Southern Nevada Air Quality Study – 236

## COMBUSTION STABILITY

Lessons Learned in Solid Rocket Combustion Instability – 93

## COMBUSTION

Code Validation of CFD Heat Transfer Models for Liquid Rocket Engine Combustion Devices – 217

Design, Construction, and Validation of the AFIT Small Scale Combustion Facility and Sectional Model of the Ultra-Compact Combustor – 139

Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – 130

High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77

Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120

Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions – 217

## COMMAND AND CONTROL

A CBO Study. The Army's Bandwidth Bottleneck – 154

A Computer Tool for Modeling C4I Applications – 167

A Conceptual Operational Model for Command and Control of International Missions in the Canadian Forces – 180

A Correlation Between Quality Management Metrics and Technical Performance Measurement – 636

A Cultural Framework for the Interoperability of C2 Systems – 150

- A Distributed Parallel Processing System for Command and Control Imagery – 466
- A Model of Command and Control Processes for JWARS: Test Results from Controlled Experiments and Simulation Runs – 151
- A Model of Tactical Battle Rhythm – 170
- A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration – 510
- A Pragmatic C4ISR Approach From the US Army CECOM Security Assistance Perspective – 614
- A Process Model of Situated Cognition in Military Command and Control – 421
- A Reference Architecture for Network-Centric Information Systems – 619
- A Roadmap for Developing Architectures in a Net-Centric World – 609
- A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620
- A System Design Archetype for C4ISR Systems of the 21st Century – 159
- Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 537
- Air Force Information Workflow Automation through Synchronized Air Power Management (SAPM) – 610
- An Experimental 3-D Framework to Support C2 – 458
- An Expose of Autonomous Agents in Command and Control Planning – 498
- An Intelligent Interface-Agent Framework for Supervisory Command and Control – 498
- Analysis of Metrics Utilized in U.S. Joint Experimentation of Future C2 Concepts – 171
- Applying Executable Architectures to Support Dynamic Analysis of C2 Systems – 482
- Army Digitization Operational Impacts – 661
- Army Fire Support Investment Framework – 472
- Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – 422
- Battle Command on the Move – 145
- Bilateral Interoperability through Enterprise Architecture – 493
- Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Building Information Systems for Network-Centric Warfare – 615
- C2 Interoperability: Simulation, Architecture and Information Security – 642
- C2 Product-Centric Approach to Transforming Current C4ISR Information Architectures – 612
- C3X: Correlation, Causation and Controlled Experimentation for C2 – 146
- C4I Tactical Applications Utilizing Embedded Simulations – 150
- C4ISR Architectural Frameworks in Coalition Environments – 153
- Canadian Network Enabled Operations Initiatives – 144
- Case Study of a Prototype Set of Behaviorally Anchored Rating Scales (BARS) for C2 Assessment – 135
- Challenges for Vertical Collaboration Among Warfighters for Missile Defense C2 – 443
- Client Location in 802.11 Networks – 639
- Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – 471
- Collaborative Critical Thinking – 148
- Combined Enterprise Regional Information Exchange System (CENTRIXS): Supporting Coalition Warfare World-Wide – 486
- Command and Control Automation - MIP and MSC2 FOSC – 161
- Command and Control in Peace Support Operations Model PAX - Approaching New Challenges in the Modeling of C2 – 148
- Command Control and Information Systems in the Age of Knowledge-Centricity – 143
- Command, Control, Coordination, and Cooperation during Defense Support to Civil Authority Operations – 182
- Computational Experimentation in C2 – 140
- Computational Experimentation with the Virtual Design Team: Bridging the Chasm between Laboratory and Field Research in C2 – 445
- Concept of C4I Data Fusion Command Center for Urban Operations – 155
- Configuration Management Support for Long Haul C2 Circuit Switched Services – 154
- Constructible Assessment for Situation Awareness in a Distributed C2 Environment – 148
- Counter-Trafficking Integrated Display System (CIDS): A GIS-Based Command & Control Environment for Coalition Nations – 470
- Critiquing: A Methodology to Extract C2 Expertise – 166
- Data Alignment between Army C4I Databases and Army Simulations – 653
- Data Mining Techniques Applied to Urban Terrain Command and Control Experimentation – 615
- Developing an Information Superiority-Command and Control Joint Experimentation Strategy – 648
- Developing and Evolving a Joint Australian Task List – 155
- Development of a Battlefield Management System: How to Use the User – 172
- Different Approaches for the Creation and Exploitation of 3D Urban Models – 159
- Digital C4I Interoperability: The EM Protection Issue – 163
- Distributed Command and Control Research: Networking Multiple Simulation Platforms – 495
- Distributed Computing and Collaboration Framework (DCCF) – 466
- Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460
- Evolution of C4I Systems – 174
- Experimentation with Evolving C2 Operation Centers - Implications for the Human Element – 137
- Experimenting with C2 Applications and Federated Infrastructures for Integrated Full-Spectrum Operational Environments in Support of Collaborative Planning and Interoperable Execution – 143
- Finishing Together: Coalition End-State Development Since 1990 – 161
- Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144
- From Simple Prescriptive to Complex Descriptive Models: An Example from a Recent Command Decision Experiment – 147
- From Stove-pipe to Network Centric Leveraging Technology to Present a Unified View – 616
- Generic Organisation Data Integration Solution: The Fast and Convenient Way to Integrate Data – 644
- Human Systems Integration Assessment of Network Centric Command and Control – 421
- Hurricane Katrina: Lessons for Army Planning and Operations – 163
- Identifying Battlefield Metrics Through Experimentation – 158
- Information Engineering in Support of Multilateral Joint Operational Interoperability – 611
- Information Superiority through Data Warehousing – 655

Information Technology and Knowledge Distribution in C3I teams – 627

Inhibiting Adaptation – 169

Interoperability -- An Australian View – 639

Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – 166

Joint and Allied Logistics Opportunities and Tools Supporting 21st Century War Fighter Rapid Decisive Operations – 149

Joint Space Forces in Theater: Coordination is No Longer Sufficient – 47

Levels of Interoperability in Coalition Systems – 646

Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273

Making the Mix Work: Coalition C2 Interoperability during Recent Operations – 161

Methodology for Rapid Development of C2 Planning Systems – 173

Modeling and Simulation Links with Command & Control (C2) Systems: Considerations in Architecture Designs – 162

Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461

Modeling Command and Control in Multi-Agent Systems – 452

Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts) – 411

Modelling a Network of Decision Makers – 610

Models of Jointness: Infrastructure Issues for Inter-Organisational Working – 642

Monitoring the Command and Control Weapon System. A Master Caution Panel for C2 System Monitoring – 154

Multinational C2 Experiments Supported by C2 Systems and Modeling and Simulations Addressing Army Transformation of Collaborative Planning and Interoperable Execution in a Coalition Environment – 615

Multinational Interoperability Requirements -- A Core Competency – 645

Multipurpose Activity Definitions and Interfaces to Support Operational Needs (MADISON) – 542

Network Centric Operations: Background and Oversight Issues for Congress – 486

Network Centric Warfare in the U.S. Navy's Fifth Fleet. Network-Supported Operational Level Command and Control in Operation Enduring Freedom – 143

New Approaches C4I Data Warehousing for Crisis Action - Synchronization, Replication, Sustainment Design Implications – 645

Operational Trust: A New Look at the Human Requirement in Network Centric Warfare – 146

Optimising the Design of Land Force C2 Architectures – 152

Performance Measurement for Diagnosing and Debriefing Distributed Command and Control Teams – 150

Performance Measurement in C2 Systems – 496

Preparing Junior Officers for Roles in FORCEnet & Network Centric Operations – 152

Quality of Service Behavioral Model From Event Trace Analysis – 166

Report Out of the C4I Study Group – 162

Re-Use of Integrated Dictionary Components for C4ISR Architectures – 148

Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations – 640

Sensor Management in Command & Control – 632

Service Oriented Architecture for Coast Guard Command and Control – 633

Software Agents as Facilitators of Coherent Coalition Operations – 459

Suitability of Agent Technology for Military Command and Control in the Future Combat System Environment – 457

Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452

The Benefit of Ontologies for Interoperability of CCIS. (Easy, Quick and Cheap Solutions are Impossible, if Semantics of CCIS are Affected.) – 620

The Combined Aerospace Operations Center (CAOC) of the Future – 160

The Contribution of Command and Control to Unity of Effort – 157

The Critical Role of Intelligent Software Agents in Enabling Net-Centric Command and Control – 444

The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164

The Synergic Integrated Concepts of C2S – 174

Toward an Interoperability Architecture – 646

Transforming Coalition Warfare with Network Centric Capabilities – 149

Understanding and Improving Knowledge Transactions in Command and Control – 624

USAF Command Doctrine of Centralized Control with Decentralized Execution: Never Divide the Fleet – 170

Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – 469

Use of Modeling and Simulation (M&S) in Support of the Quantitative Assessment of FORCEnet Systems and Concepts – 456

Using a Combination of UML, C2RM, XML, and Metadata Registries to Support Long-Term Development/Engineering – 452

Using Gaming and Agent Technology to Explore C2 – 537

Using the Command and Control Framework to Analyse Command Challenges – 151

Using Wargames for Command and Control Experimentation – 145

Using Work-Centered Support System Technology to Enhance Command and Control – 488

US/UK Sensor-To-Shooter Multinational C4 Interoperability Study Force-On-Force Effectiveness Methodology – 179

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

Workforce Configuration of a Canadian Forces Gematics Division – 539

## COMMERCE

A Possible Solution for the U.S. Navy's Addiction to Petroleum: A Business Case Analysis for Transitioning the U.S. Navy From Petroleum to Synthetic Fuel Resources – 63

An Enterprise Solution for Biometric Authentication and Identification – 473

Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478

Operational Agility: Composing and Orchestrating Mission Capability Packages Through Business Process Execution Language (BPEL) – 444

## COMMERCIAL AIRCRAFT

Civil Reserve Air Fleet (CRAF) – 26

Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10

Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27



## COMMERCIAL OFF-THE-SHELF PRODUCTS

Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – 6

## COMMUNICATING

A Study of Communicating Science and Engineering – 142

Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178

## COMMUNICATION NETWORKS

A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492

A Strong Zero-One Law for Connectivity in One-Dimensional Geometric Random Graphs With Non-Vanishing Densities – 527

A Unifying Strategy for Data Integration for Global Force Management (Briefing Charts) – 147

A Woven Web of Guesses – 538

An Efficient Metaheuristic for Dynamic Network Design and Message Routing – 617

Analysis and Classification of Traffic in Wireless Sensor Network – 159

C2 Interoperability: Simulation, Architecture and Information Security – 642

Communications Architecture Recommendations to Enable Joint Vision 2020 – 488

Cooperative Multi-Agent Systems in Mobile Ad Hoc Networks – 495

Defense Science Board 2006 Summer Study of Information Management for Net-Centric Operations. Volume 2. Operations Panel Report – 158

Defense Science Board 2006 Summer Study on Information Management for Net-Centric Operations. Volume 1: Main Report – 158

Distributed Fault-Tolerant Quality Of Service Routing in Hybrid Directional Wireless Networks – 182

Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145

Metrics for Command in an NEC Era: Operational Analysis of Way of Command in the Era of Network Enabled Capability – 170

Mobile Sensor Networks: A Discrete Event Simulation of WMD Threat Detection in Urban Traffic Schemes – 156

Modeling and Simulation in Support of Network Centric Warfare Analysis – 143

Modular Structures in a Multinational Force Headquarters – 147

Multicast Performance Analysis for High-Speed Torus Networks – 484

Network Aware Tactical Collaborative Environments – 165

Network Centric Warfare for Coalition Integrated Defense Against Terrorism – 165

Network-Centric Applications and Tactical Networks – 173

Observation Uncertainty in Gaussian Sensor Networks – 162

Potential System Vulnerabilities of a Network Enabled Force – 487

Preparing Junior Officers for Roles in FORCENet & Network Centric Operations – 152

Quick-Turn Finite Element Analysis for Plug-and-Play Satellite Structures – 520

Real-Time Communication and Coordination in Embedded Sensor Networks – 533

Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement – 181

Static Reachability Analysis and Validation Regarding Security Policies Implemented via Packet Filters – 489

Time Synchronization in Wireless Sensor Networks – 164

## COMMUNICATION

Decentralized Control Using Global Optimization (DCGO) (Preprint) – 495

## COMPARISON

Rayleigh Taylor Instability induced Mixing. Initial Conditions Modeling, Three Dimensional Simulations and Comparisons with Experiment – 570

## COMPARTMENTS

A Review of the History of Fire Suppression on U.S. DoD Aircraft – 34

## COMPILERS

Next Generation Systems Languages – 455

## COMPLEX COMPOUNDS

Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115

## COMPLEX SYSTEMS

Complex Processes in Electrochemical Systems – 114

Executive Overview of SEI MOSAIC: Managing for Success Using a Risk-Based Approach – 545

Military Information Networks as Complex Adaptive Systems – 512

Organizational Fragility Curves: Sense-making under Stress – 544

## COMPOSITE MATERIALS

Advanced Polymer Composite Molding Through Intelligent Process Analysis and Control – 85

Characterization of the Structure-Processing-Performance Relations of Phenylethynyl Phthalic Anhydride Crosslinked Fluorinated Polyimides (AFR-PEPA-N) and Their Carbon Fiber Composites – 84

Composite Materials Containing a Nanostructured Carbon Binder Phase and High Pressure Process for Making the Same – 83

Decks for Rapid Runway Mat Application (Postprint) – 45

Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 81

Development and Manufacture of Cost Effective Composite Drill Pipe. 2006 Annual Technical Progress Report – 84

Development of Nanocomposite Reinforced Polymeric Materials to be Used for Racks for Retorting Polymeric Trays – 123

Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 83

Image Reconstruction Based Modeling of 3D Textile Composite (Postprint) – 127

Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81

Numerical Investigation for the Microstructural Effects on the Crack Growth Behavior of Particulate Composite Materials – 79

Permeability Prediction of Three-Dimensional Woven Fabrics – 89

Research Institute for Autonomous Precision Guided Systems – 31

Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers – 34

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

## COMPOSITE STRUCTURES

Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 17

Chamber Core Structures for Fairing Acoustic Mitigation – 50

Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers – 34

Titanium Brazing for Structures and Survivability – 120

## COMPOSITION (PROPERTY)

High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe49.7Cr17.7Mn1.9Mo7.4W1.6B15.2C3.8Si2.4 – 107

## COMPRESSION LOADS

Investigation of the Effect of Fuselage Dents on Compressive Failure Load – 23

## COMPRESSOR EFFICIENCY

Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – 39

## COMPRESSORS

Emission Correction in the 2006 ILC Bunch Compressor – 580

## COMPUTATIONAL CHEMISTRY

Applications of Molecular and Materials Modeling – 94

Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – 105

## COMPUTATIONAL FLUID DYNAMICS

Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors – 216

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 226

Code Validation of CFD Heat Transfer Models for Liquid Rocket Engine Combustion Devices – 217

Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel – 15

Discrete Data Transfer Technique for Fluid-Structure Interaction – 478

IHRPRT Improvements to the Solid Performance Program (SPP) – 542

Probabilistic Modeling of Space Shuttle Debris Impact – 58

Quantifying Non-Equilibrium in Hypersonic Flows Using Entropy Generation – 219

Relaxed Fidelity CFD Methods Applied to Store Separation Problems – 5

Technologies for Propelled Hypersonic Flight, Volume 1 - Subgroup 1: Plug Nozzles – 40

Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight – 41

Technologies for Propelled Hypersonic Flight – 40

## COMPUTATIONAL GRIDS

Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – 437

Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere – 260

Summary of LLNL Russian Projects – 573

## COMPUTATION

A Parallel Particle Swarm Optimizer – 533

Computational Experimentation in C2 – 140

Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597

## COMPUTER AIDED DESIGN

Introducing Actions into Qualitative Simulation – 499

Sharp-Looking Geometric Partitioning – 199

## COMPUTER AIDED TOMOGRAPHY

Advanced Technologies in Safe and Efficient Operating Rooms – 309

Enhancement of the Computational Efficiency of Membrane Computing Models – 550

## COMPUTER ASSISTED INSTRUCTION

Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS) – 625

## COMPUTER GRAPHICS

Towards a Computational Model of Sketching – 451

## COMPUTER INFORMATION SECURITY

Advancing Software Security - The Software Protection Initiative – 626

An Agent-Based Dynamic Information Security Model in Information Warfare – 643

Applying the Concept of Minimal Essential to Maintain Operational Continuity and Attain Mission Assurance During Internal and External Attacks on the Information Environment – 495

Assessing Technology, Methods, and Information for Committing and Combating Cyber Crime – 428

Communication Security Establishment Briefing on Government of Canada Biometrics Reports – 477

Digital Convergence Authenticated Video, Voice, & Text – 476

DigitalPersona - Case Study: Department of Defense – 475

Enhancing Information Systems Security through Biometrics – 472

Incident Management Capability Metrics Version 0.1 – 482

Information Security: Federal Deposit Insurance Corporation Needs to Sustain Progress Improving Its Program – 167

Intrusion and Misuse Deterrence System Employing a Virtual Network – 432

Issues and Requirements for Cybersecurity in Network Centric Warfare – 446

Key Establishment in Heterogeneous Self-Organized Networks – 484

Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497

Mediators in Infrastructure Survivability Enhancement – 449

Modelling Information Age Warfare: Work In Progress – 654

Multimodal Biometric Systems – 472

Route Optimization for Mobile IPV6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis – 489

The President's Identity Theft Task Force: Combating Identity Theft a Strategic Plan – 652

Willow System Demonstration – 449

## COMPUTER NETWORKS

An Open Architecture Approach to Network Enabled Capability – 656

Bridging the Gap in Port Security; Network Centric Theory Applied to Public/Private Collaboration – 492

Client Location in 802.11 Networks – 639

Emergency Preparedness and the Year 2000 Challenge – 443

Hacking Social Networks: Examining the Viability of Using Computer Network Attack Against Social Networks – 491

Incident Management Capability Metrics Version 0.1 – 482

Intrusion and Misuse Deterrence System Employing a Virtual Network – 432

Intrusion Deception in Defense of Computer Systems – 462

Investigations Involving the Internet and Computer Networks – 438

Issues and Requirements for Cybersecurity in Network Centric Warfare – 446

Making Network Intrusion Detection Work With IPsec – 505

Method and System for Interactive Modeling of High-Level Network Performance with Low-Level Link Design – 436

Multi-Description Coding for Video Delivery Over Networks – 440

Net-Centric Test & Evaluation – 133

Network Centric Operations Conceptual Framework Air-to-Ground Case Study – 483

Operational Agility: Composing and Orchestrating Mission Capability Packages Through Business Process Execution Language (BPEL) – 444

Pattern Analysis of Directed Graphs Using DEDICOM: An Application to Enroll Email – 439

Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – 38

Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457

Secure Peer-to-Peer Object Storage System – 439

Willow System Demonstration – 449

## COMPUTER PROGRAMMING

A Practical Example of Applying Application-Driven Design (ADD), Version 2.0 – 545

A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – 478

An Empirical Assessment of the Impact of Requirements Uncertainty on Development Quality Performance – 446

Automating the Shadow Method for Aerosol Optical Depth Retrieval – 462

Boot Camp for Cognitive Systems: A Model for Preparing Systems with Machine Learning for Deployment – 463

C2 Interoperability: Simulation, Architecture and Information Security – 642

CASE Planning and the Software Process – 481

Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI – 481

CCG-LCONE CT Reconstruction Code User and Programmers Guide – 570

Conditions for Achieving Network-Centric Operations in Systems of Systems – 465

Design and Implementation of a Modular Manipulator Architecture – 546

Distributed Computing and Collaboration Framework (DCCF) – 466

Evolution of C4I Systems – 174

Experiments with the Sun Java Real-Time System -- Part 2 – 466

Firefighting Agent Research, Phase I – 10

Mediators in Infrastructure Survivability Enhancement – 449

Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478

Optimizing the Prioritization of Natural Disaster Recovery Projects – 274

Quality-Attribute-Based Economic Valuation of Architectural Patterns – 479

Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452

System-of-Systems Governance: New Patterns of Thought – 465

Task Adaptable Display of Information for Training, Maintenance, and Emergency Response – 654

The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities – 480

Topics in Interoperability: Structural Programmatics in a System of Systems – 465

Willow System Demonstration – 449

## COMPUTER PROGRAMS

3D Photonic Crystals Build Up By Self-Organization Of Nanospheres – 450

A Methodology for End-to-End Evaluation of Arabic Document Image Processing Software – 468

CASE Planning and the Software Process – 481

Cooperative Multi-Agent Systems in Mobile Ad Hoc Networks – 495

ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual – 469

Formal Methods for Developing High Assurance Computer Systems: Working Group Report – 471

Issues and Requirements for Cybersecurity in Network Centric Warfare – 446

Modeling the Joint Battlespace Infosphere – 644

Multi-Description Coding for Video Delivery Over Networks – 440

Next Generation Systems Languages – 455

Protection of Software-based Survivability Mechanisms – 447

Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions – 265

Software to Generate 3-Dimensional Displays of Inverse Synthetic aperture Radar Data – 455

Stratospheric Relaxation in IMPACTs Radiation Code – 275

The Joy of Computing with Volume-Integrals – 19

Visual Spreadsheets in VisIt – 432

Voice Recognition Interface in the Rehabilitation of Combat Amputees – 307

## COMPUTER STORAGE DEVICES

A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 54

Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438

Feasibility Study on Magnetic Content Addressable Memory – 196

High Performance Polymer Memory and Its Formation – 210

Molecular Random Access Memory Cell – 441

Two Bit/Four Bit SONOS Flash Memory Cell – 200

Using Cyclic Memory Allocation to Eliminate Memory Leaks – 442

Victim Migration: Dynamically Adapting Between Private and Shared CMP Caches – 442

## COMPUTER SYSTEMS DESIGN

Formal Methods for Developing High Assurance Computer Systems: Working Group Report – 471

Methodology for Rapid Development of C2 Planning Systems – 173

## COMPUTER SYSTEMS PROGRAMS

Report to the Institutional Computing Executive Group (ICEG) August 14, 2006 – 433

## COMPUTER TECHNIQUES

Building a Deterrence Policy Against Strategic Information Warfare – 654

CASE Planning and the Software Process – 481

Development of an Assistive Technology and Environmental Assessment Instrument for National Surveys: Final Report. Part One: Recommended Modules and Instrument Development Process – 440

Integration of Anatomic and Pathogenic Bases for Early Lung Cancer Diagnosis – 506

## COMPUTER VISION

Velocity Estimation Using Forward Looking Sonar – 463

## COMPUTERIZED SIMULATION

A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 375

Advanced Technologies in Safe and Efficient Operating Rooms – 309

Analyzing the Interdiction of Sea-Borne Threats Using Simulation Optimization – 451

Assessing Error in PMI (Post-Mortem Interval) Prediction Using a Forensic Entomological Computer Model – 437

Assessment of Two Desk-Top Computer Simulations Used to Train Tactical Decision Making (TDM) of Small Unit Infantry Leaders – 481

Boundary Layer Transition Experiments in Support of the Hypersonics Program – 1

Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454

Computational Experimentation with the Virtual Design Team: Bridging the Chasm between Laboratory and Field Research in C2 – 445

Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – 453

Distributed Simulation Run Automation Capability for the Navy PRA Test-bed – 453

Firefighting Agent Research, Phase I – 10

Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52

Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461

Modeling the Structure and Effectiveness of Intelligence Organizations: Dynamic Information Flow Simulation – 626

Modeling the U.S. Military Intelligence Process – 448

Modelling Operational Command Structures Using ORGAHEAD – 451

New Navy Solutions: Developing Simulation Based C4I Applications – 445

Ocean Wave Energy Harvesting Devices – 479

Particle Splitting for Monte-Carlo Simulation of the National Ignition Facility – 561

Qualitative Reasoning about Fluids and Mechanics – 446

Research Institute for Autonomous Precision Guided Systems – 31

Risk Advised Course of Action (COA) Analysis – 532

Self-Organized Air Tasking: Examining a Non-Hierarchical Model for Joint Air Operations – 499

Simulating Candidate Missions for a Novel Glider Unmanned Underwater Vehicle – 464

Simulation-Based Learning: Workshops for Researchers and Educators in the Western USA, and the Pacific Rim – 619

System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory – 50

Use of Modeling and Simulation (M&S) in Support of the Quantitative Assessment of FORCenet Systems and Concepts – 456

WABED Model in the SMS: Part 2. Graphical Interface – 470

Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7

Wide Area Search and Engagement Simulation Validation – 32

## COMPUTERS

A Computer Tool for Modeling C4I Applications – 167

A High-Performance Communication Service for Parallel Computing on Distributed DSP Systems – 449

Data Alignment between Army C4I Databases and Army Simulations – 653

Digital C4I Interoperability: The EM Protection Issue – 163

Emergency Preparedness and the Year 2000 Challenge – 443

Field Level Computer Exploitation Package – 464

Intrusion Deception in Defense of Computer Systems – 462

Methods and Computer-Readable Medium for Navigating between a Plurality of Discrete Images – 432

Real-Time Sonar Beamforming on High-Performance Distributed Computers – 596

Systems and Methods for Altering Vestibular Biology – 506

US/UK Sensor-To-Shooter Multinational C4 Interoperability Study Force-On-Force Effectiveness Methodology – 179

## CONCENTRATORS

Preliminary Low Frequency Electromagnetic Analysis of a Flux Concentrator – 569

## CONCRETES

A Value-Focused Thinking Model for the Selection of the Best Rigid Pavement, Partial-Depth Spall Repair Material – 20

Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – 74

Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – 255

Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306

Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – 240

Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – 45

Modeling Damage and Fragmentation in Concrete – 122

## CONDUCTING POLYMERS

Dynamically Modifiable Polymer Coatings and Devices – 126

Reversible Electrodeposition Optical Modulation Device with Conducting Polymer Counter Electrode – 213

## CONDUCTORS

Report on the Wisconsin-Stanford-Kansas-Davis-Florida State MURI on Scientific Challenges of Coated Conductors – 555

## CONFERENCES

Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249

Automated Aerial Refueling Presentation to 2007 ARSAG Conference (Preprint) – 15

Bringing Climate Change Into Natural Resource Management. Proceedings of a Workshop – 273

Proceedings of the 1st Army Installation Energy Security and Independence Conference – 245

Proceedings of the Quantum Computation for Physical Modeling Workshop 2004. Held in North Falmouth, MA on 12-15 September 2004 – 592

Proceedings of the Quantum Computation for Physical Modeling Workshop Held in North Falmouth, Massachusetts on October 18-19, 2000 – 519

Proceedings of the Symposium on Ferroelectricity and Piezoelectricity (IMRC 2005) – 76

Symposium on Nano- and Micro-Scale Mechanics of Engineering Materials – 660

Symposium Q: Magnetic Thin Films, Heterostructures, and Device Materials – 197

Truck Driver Occupational Safety and Health. 2003 Conference Report and Selective Literature Review – 238

What's in a Name. Examination of Light and Intermittent Smokers. Helping to Set the Tobacco Control Research Agenda. – 257

## CONFIGURATION INTERACTION

A Multireference Density Functional Approach to the Calculation of the Excited States of Uranium Ions – 87

## CONFIGURATION MANAGEMENT

Configuration Management Support for Long Haul C2 Circuit Switched Services – 155

## CONFINEMENT

Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454

Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint) – 55

Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint) – 55

Development of a Charged-particle Accumulator Using an RF Confinement Method II – 591

Development of a Charged-Particle Accumulator Using an RF Confinement Method – 593

Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma – 574

Vertical Cavity Surface Emitting Laser Having a Gain Guide Aperture Interior to an Oxide Confinement Layer – 599

## CONGRESSIONAL REPORTS

Report to Congress on Assessment of Potential Impact of Concentrating Solar Power for Electricity Generation (EPACT 2005 - Section 934 (c)) – [247](#)

Report to Congress on the Activities of the DoD Office of Technology Transition – [651](#)

## CONGRUENCES

Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts) – [537](#)

## CONJUGATION

A New Synthesis of Porphyrins with Extended Conjugation and their Photophysics – [62](#)

HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – [397](#)

Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – [121](#)

## CONNECTORS

Microconnectors and Non-Powered Microassembly Therewith – [202](#)

## CONSERVATION LAWS

Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – [515](#)

## CONSERVATION

Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – [515](#)

## CONSISTENCY

An Adaptive Quality of Service Aware Middleware for Replicated Services – [521](#)

## CONSOLIDATION

Bilateral Interoperability through Enterprise Architecture – [494](#)

## CONSTRUCTION

Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – [240](#)

Design, Construction, and Validation of the AFIT Small Scale Combustion Facility and Sectional Model of the Ultra-Compact Combustor – [139](#)

Final Environmental Assessment for Construction of an Addition to Support the Joint Strike Fighter Reprogramming Facility, Building 614, on Eglin Air Force Base, Florida – [251](#)

Modular Structures in a Multinational Force Headquarters – [147](#)

Searching for Double Beta Decay with the Enriched Xenon Observatory – [566](#)

## CONSUMERS

Consumer Control of Electronic Personal Health Information: What Does It Mean. Why Is it Important. A Report on Three Consumer Focus Group Meetings Convened October 2005 by the Office of the Assistant Secretary for Planning and Evaluation – [663](#)

## CONTAMINANTS

Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD – [139](#)

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – [138](#)

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – [138](#)

Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – [78](#)

Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – [123](#)

Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – [252](#)

## CONTAMINATION

Aircraft Downwind Hazard Distance After a Chemical Attack – [34](#)

Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – [321](#)

Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – [398](#)

Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – [637](#)

Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – [54](#)

No Further Action Decision Under CERCLA Study Area 43F Historic Gas Station Sites Fort Devens, Massachusetts – [94](#)

No Further Action Decision Under CERCLA, Study Area 43P Historic Gas Station Sites, Fort Devens, Massachusetts – [62](#)

Nuclear Safety: DOE's Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened – [131](#)

Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – [123](#)

Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons – [101](#)

Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface – [102](#)

Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan ASSF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI – [87](#)

## CONTINGENCY

Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – [305](#)

## CONTINUOUS RADIATION

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – [224](#)

## CONTINUOUS WAVE RADAR

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – [224](#)

## CONTINUUM MECHANICS

Atomistic Calculation of Elastic Moduli in Strained Silicon – [187](#)

## CONTRACTORS

Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – [426](#)

DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – [643](#)

## CONTROL EQUIPMENT

A Method for Including Control Effector Interactions in the Control Allocation Problem (Preprint) – [461](#)

Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities – [64](#)

Toward Neural Control of Prosthetic Devices – [209](#)

## CONTROL SIMULATION

Distributed Command and Control Research: Networking Multiple Simulation Platforms – [495](#)

## CONTROL SURFACES

Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities – [64](#)

Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – [3](#)

## CONTROL SYSTEMS DESIGN

Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – [21](#)

## CONTROL THEORY

F-15B QuietSpike(TradeMark) Aeroservoelastic Flight Test Data Analysis – 36

Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 23

Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – 21

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

## CONTROLLERS

New Tools for Hybrid Systems – 518

Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184

## CONTROL

A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – 551

Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems – 2

Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631

Research Institute for Autonomous Precision Guided Systems – 31

## CONVECTIVE HEAT TRANSFER

Nonequilibrium Stagnation-Line Radiative Heating for Fire II – 221

## CONVERGENCE

Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – 515

## COOLING SYSTEMS

Survey and Alignment of the Fermilab Electron Cooling System – 585

## COOLING

Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water – 410

Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint) – 55

Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint) – 55

Motor Frame Cooling with Hot Liquid Refrigerant and Internal Liquid – 76

Skin Temperature Feedback Optimizes Microclimate Cooling – 272

Studies of a Gas-Filled Helical Muon Beam Cooling Channel – 565

Survey and Alignment of the Fermilab Electron Cooling System – 585

## COORDINATES

Command, Control, Coordination, and Cooperation during Defense Support to Civil Authority Operations – 182

Massive Metrology: Development and Implementation of a 3D Reference Frame for the Realignment of Fermilab's Tevatron – 606

Relativistic Jets in the Radio Reference Frame Image Database. 1. Apparent Speeds From the First 5 Years of Data – 670

The Status and Future of the ICRF – 665

## COORDINATION

BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – 407

Command, Control, Coordination, and Cooperation during Defense Support to Civil Authority Operations – 182

Joint Space Forces in Theater: Coordination is No Longer Sufficient – 47

Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92

Motion Coordination Using Virtual Nodes – 454

Real-Time Communication and Coordination in Embedded Sensor Networks – 533

Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds – 90

Training Coordination Proxy Agents – 616

## COPOLYMERS

Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81

## COPPER

Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106

## CORDAGE

Cord Blood Stem Cell Procurement in Minority Donors – 302

## CORES

Photonic Crystal Fibers – 232

## CORONAGRAPHS

Interplanetary CMEs Without Observed Coronagraph CMEs – 670

Observational Properties of Coronal Mass Ejections – 671

## CORONAL MASS EJECTION

Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events – 668

Imaging Interplanetary Disturbances Causing Forbush Decreases – 670

Interplanetary CMEs Without Observed Coronagraph CMEs – 669

Observational Properties of Coronal Mass Ejections – 671

Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – 669

Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – 668

## CORONAS

Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events – 668

Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – 668

## CORRECTION

Correcting the Response of an Albedo Neutron Dosimeter for Energy – 220

First NNLL Prediction of B(barB right arrow Xs gamma) – 567

Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 597

## CORROSION PREVENTION

Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120

Releaseable Corrosion Inhibitor Compositions – 108

## CORROSION RESISTANCE

Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 131

Corrosion Resistance of Structural Amorphous Metal – 104

Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69

Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107

Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.) – 126

High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe49.7Cr17.7Mn1.9Mo7.4W1.6B15.2C3.8Si2.4 – 107

Oxygen Plasma Treatment and Deposition of CNx on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121

## CORROSION

Crevice Repassivation Potentials for Alloy 22 in Simulated Concentrated Ground Waters – 119

Modeling the Effects of Crevice Former, Particulates, and the Evolving Surface Profile In Crevice Corrosion – 119

Releaseable Corrosion Inhibitor Compositions – 108

## COSMIC RAYS

Fundamentals of Aerospace Medicine: Cosmic Radiation – 413

Proposal to Upgrade the MIPP Experiment – 563

## COSMOLOGY

Predicting the Cosmological Constant from the Causal Entropic Principle – 671

## COST ANALYSIS

Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8

Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel – 424

Information Age Architectures Must Be Enterprise Architecture – 171

Price vs. Performance: The Value of Next Generation Fighter Aircraft – 25

Value Added Analysis - VAAFY03 – 532

## COST EFFECTIVENESS

Can GWOT Primary Prevention Strategy More Effectively Impede Religious Extremism? – 390

Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178

Development and Manufacture of Cost Effective Composite Drill Pipe. 2006 Annual Technical Progress Report – 84

Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183

Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters – 135

Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 237

Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237

The Costs of Not Using Green Design in the USAF: Would Using Green Building Design Have Resulted in Life Cycle Cost – 212

Value Added Analysis - VAAFY03 – 532

## COST REDUCTION

DigitalPersona - Case Study: Department of Defense – 475

Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27

## COSTS

Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27

Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8

Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel – 424

Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters – 135

The Costs of Not Using Green Design in the USAF: Would Using Green Building Design Have Resulted in Life Cycle Cost – 212

Unmanned Aerial Vehicles: Background and Issues for Congress – 30

## COTTON

Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103

## COUNTERMEASURES

Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411

Bio-Defense Now: 56 Suggestions for Immediate Improvements – 427

Flight Attendant Fatigue – 412

Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353

Process Research and Development of Antibodies as Countermeasures for C. Botulinum – 308

## COUNTING

White Blood Cell Counts and Malaria – 401

## COUPLERS

Variable Directional Coupler for an Alternate ILC High-Power RF Distribution Scheme – 605

## COUPLINGS

Photonic Device and Method for Making Same – 209

## COUPLING

Post-Coupling Synthetic Approach for Polymeric Antioxidants – 65

## CP VIOLATION

Charmless B Decays – 577

Measurements of CP-Violating Asymmetries in B0 to a1+- (1260) pi+ Decays – 578

## CRACK PROPAGATION

3-Dimensional Crack Growth Behavior of Turbine Engine Materials (Preprint) – 555

Controls of Fluid Chemistry on Fracture Growth – 105

Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31

Numerical Investigation for the Microstructural Effects on the Crack Growth Behavior of Particulate Composite Materials – 79

## CRACKS

Crevice Repassivation Potentials for Alloy 22 in Simulated Concentrated Ground Waters – 119

Modeling the Effects of Crevice Former, Particulates, and the Evolving Surface Profile In Crevice Corrosion – 119

Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193

## CRASHWORTHINESS

Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10

## CREEP PROPERTIES

Effects of Temperature and Environment on Creep Behavior of an Oxide-Oxide Ceramic Matrix Composite – 103

Off-Axis Creep Behavior of Oxide/Oxide Nextel(Trademark)720/AS-0 (Preprint) – 122

Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122

## CREW EXPLORATION VEHICLE

Sonic Boom Assessment for the Crew Exploration Vehicle – 56

## CRIME

Incident Management Capability Metrics Version 0.1 – 482

Investigations Involving the Internet and Computer Networks – 438

The President's Identity Theft Task Force: Combating Identity Theft a Strategic Plan – 652

## CROSS FLOW

Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 44

## CROSS SECTIONS

POINT 2007: A Temperature Dependent ENDF/B-VII.0 Data Cross Section Library – 562

t-tbar Production at the Tevatron. Event Selection and Cross Section Measurement – 586

## CROSSLINKING

Characterization of the Structure-Processing-Performance Relations of Phenylethynyl Phthalic Anhydride Crosslinked Fluorinated Polyimides (AFR-PEPA-N) and Their Carbon Fiber Composites – 85

Crosslinked Compounds and Methods of Making and Using Thereof – 72

Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103

Telechelic Alkadiene Polymers with Crosslinkable End Groups and Methods for Making the Same – 73

## CRUDE OIL

A Possible Solution for the U.S. Navy's Addiction to Petroleum: A Business Case Analysis for Transitioning the U.S. Navy From Petroleum to Synthetic Fuel Resources – 63

European Security in the Wider Black Sea Area – 242

Oil Vulnerabilities and USA Strategy – 241

## CRUSTS

Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – 262

## CRYPTOGRAPHY

An Agent-Based Dynamic Information Security Model in Information Warfare – 643

An Evaluation Methodology for Protocol Analysis Systems – 490

Method and Apparatus for Providing an Asymmetric Watermark Carrier – 430

Signals Intelligence Support to the Cockpit – 504

Vulnerabilities in Biometric Encryption Systems – 473

## CRYSTAL GROWTH

Dynamics of Epitaxy on the Nano-sized Semiconductor Surfaces – 188

## CRYSTAL STRUCTURE

Alkene- and Alkyne- Substituted Methyylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – 100

## CRYSTALLINITY

Topological Close Packing in Structurally Complex Intermetallics (Crystalline, Quasicrystalline and Noncrystalline) – 116

## CRYSTALLIZATION

Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – 109

High Throughput Screening of Crystallization of Materials – 71

Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 604

## CRYSTALLOGRAPHY

Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 84

## CRYSTALS

3D Photonic Crystals Build Up By Self-Organization Of Nanospheres – 450

Chiral Multichromic Single Crystals for Optical Devices – 580

High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 556

Photonic Crystal Fibers – 232

## CULTURE TECHNIQUES

Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381

## CURRENT DENSITY

Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns – 96

Synthesis of One-dimensional Nano-sized Defects in High Tc Superconductor – 552

## CYANATES

A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125

## CYANIDES

Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92

Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110

## CYCLES

AFCI Storage and Disposal FY-06 Progress Report – 106

## CYCLONES

A Weighted Consensus Approach to Tropical Cyclone 96-H and 120-H Track Forecasting – 269

Downstream Impacts Due to the Extratropical Transition of Tropical Cyclones Over the Western North Pacific – 267

## CYCLOTRON RESONANCE

High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – 72

Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere – 261

## CYLINDRICAL BODIES

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 227

Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet – 221

## CYLINDRICAL COORDINATES

Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates – 513

## CYTOLOGY

Exploring Early Detection Methods: Using the Intraductal Approach to Predict Breast Cancer – 326

Integration of Anatomic and Pathogenetic Bases for Early Lung Cancer Diagnosis – 506

Role of Merlin in the Growth and Transformation of Arachnoidal Cells – 370

## DAMAGE ASSESSMENT

Shuttle Entry Imaging Using Infrared Thermography – 57

Towards the Development of a Defensive Cyber Damage and Mission Impact Methodology – 641

## DAMAGE

Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – 74

Automatic Generation of Best Emergency Routes and Procedures on a Brazilian Frigate – 467

BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – 406

Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31

Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint) – 80

Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 81

DNA Damage and Genomic Instability Induced by Inappropriate DNA Replication – 336

Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145

Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – 118

Modeling Damage and Fragmentation in Concrete – 122

Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193

Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – 211

Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58



System for the Evaluation of Moisture Damage Using Fundamental Material Properties – 74

Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86

## DAMPING

Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft – 583

## DATA ACQUISITION

A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620

Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354

Electronic Vehicle Identification: Industry Standards, Performance, and Privacy Issues – 178

High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77

Hospital Quality Data: HHS Should Specify Steps and Time Frame for Using Information Technology to Collect and Submit Data – 428

Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node – 641

POINT 2007: A Temperature Dependent ENDF/B-VII.0 Data Cross Section Library – 562

Proposal to Upgrade the MIPP Experiment – 563

Signals Intelligence Support to the Cockpit – 504

Subgrade CBR Values for Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility – 13

Test Suite for Nuclear Data I. Deterministic Calculations for Critical Assemblies and Replacement Coefficients – 574

The Department of Defense Net-Centric Data Strategy: Implementation Requires a Joint Community of Interest (COI) Working Group and Joint COI Oversight Council – 659

## DATA BASE MANAGEMENT SYSTEMS

Content Based Retrieval Database Management System with Support for Similarity Searching and Query Refinement – 622

## DATA BASES

A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296

Automated STR Analysis for DNA Databases – 429

Content Based Retrieval Database Management System with Support for Similarity Searching and Query Refinement – 622

Data Alignment between Army C4I Databases and Army Simulations – 653

Data Mining and Homeland Security: An Overview – 648

Database Dictionary for Ethiopian National Ground-Water Database (ENGDA) Data Fields – 631

Database Manipulations Using Group Theory – 435

Hao Spectral Diagnostic Package for Emitted Radiation (Haos-Diper) Reference Guide. Version 1.0 – 558

HEND: A Database for High Energy Nuclear Data – 559

Industrial Base Model Data Requirements (IBMDR) – 650

Information Technology and Knowledge Distribution in C3I teams – 627

Locally Dimensionality Reduction: A New Approach to Indexing High Dimensional Spaces (Preprint) – 612

Mapping of WDMET in AIS 2005 and AIS 2005 Military – 644

MDS MIC Catalog Inputs – 416

Methods for Effective Virtual Screening and Scaffold-Hopping in Chemical Compounds – 653

National Solar Radiation Data Base 1991-2005 Update: User's Manual – 245

Preliminary Findings: Design of Experiments University XXI (FY05) Research and Support for the US Army – 621

Relativistic Jets in the Radio Reference Frame Image Database. 1. Apparent Speeds From the First 5 Years of Data – 670

Using Dynamic Adjustment of Serialization Order for Real-Time Database Systems – 613

## DATA INTEGRATION

A Unifying Strategy for Data Integration for Global Force Management (Briefing Charts) – 147

Generic Organisation Data Integration Solution: The Fast and Convenient Way to Integrate Data – 644

## DATA LINKS

A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – 190

Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 460

T/R Module for Satellite TT&C Ground Link – 200

## DATA MANAGEMENT

A Unifying Strategy for Data Integration for Global Force Management (Briefing Charts) – 147

An Enterprise Identifier Strategy for Global Naming Across Arbitrary C4I Systems – 459

Client Location in 802.11 Networks – 639

ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual – 469

Focused Knowledge to the Warfighter – 617

Integration of SATURN System and VGIS – 530

Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan ASSF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI – 87

The Department of Defense Net-Centric Data Strategy: Implementation Requires a Joint Community of Interest (COI) Working Group and Joint COI Oversight Council – 659

The Hybrid Tree: An Index Structure for High Dimensional Feature Spaces (Preprint) – 529

## DATA MINING

Assessing C3I in Support of Dismounted Operations in Complex Terrain – 540

Data Mining and Homeland Security: An Overview – 647

Data Mining Techniques Applied to Urban Terrain Command and Control Experimentation – 615

Towards Next Generation WWW: Push, Reuse and Classification – 614

## DATA PROCESSING

Advanced Radar Signal and Data Processing – 175

Automated Run-Time Mission and Dialog Generation – 632

Building the Readiness Data Warehouse – 479

Cfetooth. A General Purpose Tool for Anomaly Detection in Periodic Data – 439

Data Mining and Homeland Security: An Overview – 648

Dataflow Integration and Simulation Techniques for DSP System Design Tools – 467

Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8

Grid Computing for High Performance Computing (HPC) Data Centers – 451

Health Information Exchange in Post-Acute and Long-Term Care – 663

Human Factors and Privacy – 476

IEIST Technologies Enabling TCT Prosecution – 538

- Improving Analysis with Information Extraction Technology – [630](#)
- Integrated Information Management (IIM) – [484](#)
- Intelligent Nodes in Coalition Warfare – [630](#)
- Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – [450](#)
- Proceedings of the Quantum Computation for Physical Modeling Workshop 2004. Held in North Falmouth, MA on 12-15 September 2004 – [592](#)
- Scalability, Complexity and Reliability in Quantum Information Processing – [591](#)
- The Control of Multi-Agent Systems (MAS) – [609](#)
- Very High Resolution SAR and Multi-channel SAR/MTI – [175](#)
- DATA PRODUCTS**
- National Solar Radiation Data Base 1991-2005 Update: User's Manual – [245](#)
- DATA STORAGE**
- Feasibility Study on Magnetic Content Addressable Memory – [196](#)
- Large Synoptic Survey Telescope and Foundations for Data Exploitation of Petabyte Data Sets – [673](#)
- Secure Peer-to-Peer Object Storage System – [439](#)
- Using Cyclic Memory Allocation to Eliminate Memory Leaks – [442](#)
- Victim Migration: Dynamically Adapting Between Private and Shared CMP Caches – [442](#)
- DATA SYSTEMS**
- Challenges for Vertical Collaboration Among Warfighters for Missile Defense C2 – [444](#)
- Development of a Geospatial Data-Sharing Method for Unmanned Vehicles Based on the Joint Architecture for Unmanned Systems (JAUS) – [662](#)
- IEIST Technologies Enabling TCT Prosecution – [538](#)
- DATA TRANSFER (COMPUTERS)**
- Discrete Data Transfer Technique for Fluid-Structure Interaction – [478](#)
- DATA TRANSMISSION**
- Can a Self-Diagnostic Digitally Controlled Pacemaker/Defibrillator Device be Used for Alerting Military Personnel When a Soldier Health Condition Becomes Compromised Out in the Field – [426](#)
- DDT**
- Behavioral Responses to DDT and Pyrethroids Between Anopheles Minimimus Species A and C Malaria Vectors in Thailand – [393](#)
- DEATH**
- Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor kB Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling – [388](#)
- Intracellular Survival of Campylobacter jejuni in Human Monocytic Cells and Induction of Apoptotic Death by Cytholethal Distending Toxin – [394](#)
- Program Project on the Pathogenesis and Treatment of Parkinson's Disease – [334](#)
- DEBRIS**
- A Value-Focused Thinking Model for the Selection of the Best Rigid Pavement, Partial-Depth Spall Repair Material – [20](#)
- Probabilistic Modeling of Space Shuttle Debris Impact – [58](#)
- Sonic Boom Assessment for the Crew Exploration Vehicle – [56](#)
- DECAY**
- First NNLL Prediction of  $B(\text{bar}B \text{ right arrow } Xs \text{ gamma})$  – [567](#)
- DECEPTION**
- Demonstratore Foer Stoerskydd av GNSS-Mottagare (Demonstrator for Anti-Jamming of GNSS Receivers) – [204](#)
- Extended Research on Detection of Deception Using Volatile Organic Compound (VOC) Emissions. Final Report – [425](#)
- Intrusion Deception in Defense of Computer Systems – [462](#)
- DECISION MAKING**
- A Decision Model for Selecting Energy Efficient Technologies for Low-Sloping Roof Tops Using Value-Focused Thinking – [243](#)
- A New Perspective on Use of the Critical Decision Method with Intelligence Analysts – [609](#)
- A Quantum Approach to Multi-Agent Systems (MAS), Organizations, and Control – [534](#)
- Army Fire Support Investment Framework – [472](#)
- Army Intelligence Analysis and Interpretation: Assessing the Utility and Limitations of Computational Diagnostic Reasoning – [652](#)
- Assessment of Two Desk-Top Computer Simulations Used to Train Tactical Decision Making (TDM) of Small Unit Infantry Leaders – [481](#)
- Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – [459](#)
- Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – [471](#)
- Collaborative Critical Thinking – [148](#)
- Communication and Decision Making in C4ISR Sustained Operations: An Experimental Approach – [409](#)
- Cooperative Solutions in Multi-Person Quadratic Decision Problems: Finite-Horizon and State-Feedback Cost-Cumulant Control Paradigm – [516](#)
- Critiquing: A Methodology to Extract C2 Expertise – [166](#)
- Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – [426](#)
- Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – [460](#)
- Evaluating an Interactive, Multimedia Education and Decision Program for Early-Stage Prostate Cancer Patients in a Randomized Controlled Trial – [342](#)
- From Simple Prescriptive to Complex Descriptive Models: An Example from a Recent Command Decision Experiment – [147](#)
- From the Battlefield to the Homeland: Building the Case for Network-Centric Response – [636](#)
- Generic Organisation Data Integration Solution: The Fast and Convenient Way to Integrate Data – [644](#)
- 'How Much is a Pound of C4ISR Worth?' An Assessment methodology to Evolve Network Centric Measures and Metrics for Application to FORCEnet – [173](#)
- HUMINT Communication Information Systems for Complex Warfare – [642](#)
- Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – [166](#)
- Joint Synthetic Battlespace: Cornerstone for Predictive Battlespace Awareness – [455](#)
- Lessons Learned from War Room Designs and Implementations – [628](#)
- Managing Responsibility and Information Flow in Dynamic Team Decision-Making – [151](#)
- Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts) – [411](#)
- Modelling a Network of Decision Makers – [610](#)
- Modelling Operational Command Structures Using ORGAHEAD – [451](#)
- Models of Jointness: Infrastructure Issues for Inter-Organisational Working – [642](#)
- Monitoring the Command and Control Weapon System. A Master Caution Panel for C2 System Monitoring – [154](#)
- No Further Action Decision Under CERCLA Study Area 43F Historic Gas Station Sites Fort Devens, Massachusetts – [94](#)

Real Options as a Strategic Management Framework: A Case Study of the Operationally Responsive Space Initiative – 51

Risk Assessment: Evidence Base – 529

Sense Making - Underpinning Concepts and Relation to Military Decision-Making – 617

The Control of Multi-Agent Systems (MAS) – 609

The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367

The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618

Topics in Interoperability: Structural Programmatics in a System of Systems – 465

Towards Dominant Battlespace Comprehension in Network Centric Warfare – 549

Training Coordination Proxy Agents – 616

Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489

'COM as Shooter' Operational Planning using C2 for Confronting and Collaborating – 169

## DECISION SUPPORT SYSTEMS

AI on the Battlefield: An Experimental Exploration (Preprint) – 501

Automatic Generation of Best Emergency Routes and Procedures on a Brazilian Frigate – 467

Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627

Course of Action Analysis for Coalition Operations – 458

Evolution of a Mission Plan – 646

EyeKon: Distributed Augmented Reality for Soldier Teams – 655

IEIST Technologies Enabling TCT Prosecution – 538

Intelligent Agent-Based Software Architecture for Tactical Decision Aid under Overwhelming Information Inflow and Uncertainty – 502

Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503

Joint and Allied Logistics Opportunities and Tools Supporting 21st Century War Fighter Rapid Decisive Operations – 149

Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 460

Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273

New Approaches C4I Data Warehousing for Crisis Action - Synchronization, Replication, Sustainment Design Implications – 645

Optimizing the Allocation of Sensor Assets for the Unit of Action – 531

PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498

Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics – 635

Software Agents as Facilitators of Coherent Coalition Operations – 459

Supporting Effects-Based Operations with Information Technology Tools: Examining Underlying Assumptions of EBO Tool Development Practices – 536

The Combined Aerospace Operations Center (CAOC) of the Future – 160

The Right Information....and Intelligent Nodes – 456

Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489

Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – 469

## DECISION THEORY

A Decision Model for Selecting Energy Efficient Technologies for Low-Sloping Roof Tops Using Value-Focused Thinking – 243

Operational Trust: A New Look at the Human Requirement in Network Centric Warfare – 146

Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics – 635

## DECODING

A Survey of Statistical Machine Translation – 510

## DECOMMISSIONING

Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – 255

## DECOMPOSITION

Decomposition Kinetic of Greases by Thermal Analysis – 127

Role of Thermochemical Decomposition in Energetic Material Initiation Sensitivity and Explosive Performance – 101

Sharp-Looking Geometric Partitioning – 199

Sinodal Decomposition and Order Disorder Transformation in a Water Quenched U-6wtNb Alloy – 70

## DECONDITIONING

Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 419

## DECONTAMINATION

Non-Thermal, On-Site Decontamination and Destruction of Practice Bombs – 141

Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31

## DEFECTS

Defect Prevention and Detection in Software for Automated Test Equipment – 430

Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems – 204

EUV Inspection of Reticle Defect Repair Sites – 599

Skeletal Complications in Neurofibromatosis Type 1: The Role of Neurofibromin Haploinsufficiency in Defective Skeletal Remodeling and Bone Healing in NF1 – 377

Synthesis of One-dimensional Nanosized Defects in High Tc Superconductor – 552

## DEFENSE INDUSTRY

Industrial Base Model Data Requirements (IBMDR) – 650

## DEFENSE PROGRAM

A Comparative Assessment of Knowledge Management Education Across the USA Department of Defense – 636

A Comparative Assessment of Knowledge Management Leadership Approaches within the Department of Defense – 638

Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities – 64

Defense Nanotechnology Research and Development Program – 212

DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – 643

Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues – 618

Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters – 135

Report to Congress on the Activities of the DoD Office of Technology Transition – 651

- The Department of Defense Net-Centric Data Strategy: Implementation Requires a Joint Community of Interest (COI) Working Group and Joint COI Oversight Council – [659](#)
- Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – [243](#)
- DEFLECTION**  
Closed Orbit Distortion and the Beam-Beam Interaction – [556](#)
- DEFOCUSING**  
Development of a 3-D Defocusing Liquid Crystal Particle Thermometry and Velocimetry (3DDLCPVT) System – [111](#)
- DEFORMABLE MIRRORS**  
Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors – [600](#)
- Exploiting Adaptive Optics with Deformable Secondary Mirrors – [231](#)
- DEFORMATION**  
Recrystallization and Grain-Growth Behavior of a Nickel-Base Superalloy During Multi-Hit Deformation (Preprint) – [118](#)
- Theory of (3He alpha) Surrogate Reactions for Deformed Uranium Nuclei – [582](#)
- DEGRADATION**  
Degradation of Polycyclic Aromatic Hydrocarbons by Actinomycetes – [104](#)
- Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – [306](#)
- Investigation of Lattice and Thermal Stress in GaN/AlGaN Field-Effect Transistors – [194](#)
- Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – [113](#)
- Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture – [93](#)
- Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – [122](#)
- Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – [39](#)
- DELAY**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – [395](#)
- DELETION**  
Prostate Cancer Gene Discovery Using ROMA – [371](#)
- DENDRIMERS**  
Hyperbranched Polymers for Resin Transfer Molding – [127](#)
- DENSITY FUNCTIONAL THEORY**  
A Multireference Density Functional Approach to the Calculation of the Excited States of Uranium Ions – [87](#)
- DENTISTRY**  
Dental Considerations in a Unified Medical Command – [402](#)
- Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers – [311](#)
- The Potential Impact of an Auction Based Retention Bonus and Other Factors on Continuation Rates of General Dentists Completing Their Initial Obligation – [525](#)
- DEOXYRIBONUCLEIC ACID**  
Automated STR Analysis for DNA Databases – [429](#)
- Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor kB Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling – [388](#)
- Bioreactive Allosteric Polynucleotides – [69](#)
- Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – [402](#)
- Brain's DNA Repair Response to Neurotoxicants – [317](#)
- BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – [406](#)
- Cloning and Sequence Analysis of the 22-kDa Antigen Genes of Orientia tsutsugamushi Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – [399](#)
- Control of DNA Dehybridization via Nanoparticle Antennas for Antisense Gene Therapy – [383](#)
- DNA Damage and Genomic Instability Induced by Inappropriate DNA Replication – [336](#)
- DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – [383](#)
- Effects of Extracellular Matrix on DNA Repair in Vivo – [363](#)
- Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast – [319](#)
- Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – [329](#)
- Intra-Prostate Cancer Vaccine Inducer – [316](#)
- Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – [63](#)
- Restoration of Wild-Type Activity to Mutant p53 in Prostate Cancer: A Novel Therapeutic Approach – [365](#)
- Self Assembled Nano-Photonic Devices Derived from Marine DNA for Opto-Electronic Applications – [292](#)
- Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – [399](#)
- The Role of RB in the Therapeutic Response of Breast Cancer – [301](#)
- DEPLETION**  
Self-Aligned Body Tie for a Partially Depletion SOI Device Structure – [201](#)
- DEPLOYMENT**  
Boot Camp for Cognitive Systems: A Model for Preparing Systems with Machine Learning for Deployment – [464](#)
- Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – [375](#)
- Environmental Consequences of Large-Scale Deployment of New Energy Systems – [253](#)
- Federally Sponsored Health Care Research Gulf War Illnesses and Beyond – [400](#)
- Impacts of Traveler Information on Transportation Network Operations and Potential Deployment Technologies – [178](#)
- Independent Testing of Iris Recognition Technology (ITIRT) – [475](#)
- Multimodal Biometric Systems – [472](#)
- Privacy and Biometrics: The Human Factors – [477](#)
- Reducing the 'Gap of Pain': A Strategy for Optimizing Federal Resource Availability in Response to Major Incidents – [526](#)
- Security Strategy for a Biometrics Deployment – [474](#)
- Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report – [109](#)
- Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments – [384](#)
- DEPOSITION**  
Advanced Materials Deposition for Semiconductor Nanostructures Using Supercritical Fluids – [185](#)
- Oxygen Plasma Treatment and Deposition of CNx on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – [121](#)
- DEPTH**  
A Value-Focused Thinking Model for the Selection of the Best Rigid Pavement, Partial-Depth Spall Repair Material – [20](#)

- Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – 276
- DERIVATION**
- Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- Semi-Synthesis and In-vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism – 401
- DESCENT**
- On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263
- DESCRIPTIVE GEOMETRY**
- Far Field Approximation in the Generalized Geometry Holdup (GGH) Model – 581
- DESIGN ANALYSIS**
- A System Design Archetype for C4ISR Systems of the 21st Century – 159
- Structural Design and Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile Configurations – 216
- Visible and Infrared Optical Design for the ITER Upper Ports – 599
- DESIGN OPTIMIZATION**
- A Heuristic Design Information Sharing Framework for Hard Discrete Optimization Problems – 542
- Anthropometric Accommodation in Space Suit Design – 424
- DESIGN TO COST**
- The Costs of Not Using Green Design in the USAF: Would Using Green Building Design Have Resulted in Life Cycle Cost – 213
- DESORPTION**
- Adsorption and Desorption of Dinitrotoluene on Activated Carbon – 91
- DESTRUCTION**
- Non-Thermal, On-Site Decontamination and Destruction of Practice Bombs – 141
- Perchlorate Removal, Destruction, and Field Monitoring Demonstration – 101
- Theory for the RF Surface Field for Various Metals at the Destructive Breakdown Limit – 73
- DETECTION**
- A Device for the In-Situ Measurement of Acoustically Stimulated Bioluminescence – 310
- A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77
- Alternatives for Military Space Radar – 223
- Automating the Shadow Method for Aerosol Optical Depth Retrieval – 462
- Bioreactive Allosteric Polynucleotides – 69
- Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224
- Defect Prevention and Detection in Software for Automated Test Equipment – 430
- Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation – 365
- Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10
- Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331
- Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 223
- Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Early Detection of Prostate Cancer – 323
- Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403
- Exploring Early Detection Methods: Using the Intraductal Approach to Predict Breast Cancer – 326
- F-15B QuietSpike(TradeMark) Aerosevoelastic Flight Test Data Analysis – 35
- How Important is Oblique Vision in Aviation? – 596
- Hyperspectral Imagery Target Detection Using Improved Anomaly Detection and Signature Matching Methods – 592
- Hyperspectral Imagery Target Detection Using Principal Component Analysis – 522
- Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – 118
- Integrated Sensing and Processing (ISP) Phase 2: Demonstration and Evaluation for Distributed Sensor Networks and Missile Seeker Systems – 514
- Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – 99
- Making Network Intrusion Detection Work With IPsec – 505
- Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274
- NOAA National Passive Acoustics Workshop, 2006 – 590
- Object Detection in Electro-Optic Sensor Images – 208
- Optimizing the Allocation of Sensor Assets for the Unit of Action – 531
- Particle Filter Based Tracking in a Detection Sparse Discrete Event Simulation Environment – 541
- Platform Camera Aircraft Detection for Approach Evaluation and Training – 29
- Signal Event Detection System – 590
- System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory – 50
- Techniques for the Statistical Analysis of Observer Data – 524
- Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360
- Terahertz Fiber Laser for Explosives Detection – 229
- The Status and Future of the ICRF – 665
- Theory and Applications of Computational Time-Reversal Imaging – 516
- Tools for Ultraspecific Probe/Primer Design – 327
- Validation of Quantitative Multimodality Analysis of Telomerase Activity in Urine Cells as a Noninvasive Diagnostic and Prognostic Tool for Prostate Cancer – 366
- Willow System Demonstration – 449
- Wireless Intrusion Detection – 483
- DETECTORS**
- A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration – 511
- Effect of Atmospheric Background Aerosols on Biological Agent Detectors – 222
- Handheld Broadband Electromagnetic UXO Sensor – 198
- High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor – 119
- MEMS Shear Stress Sensors: Promise and Progress – 190
- Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 23
- Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193

Observation Uncertainty in Gaussian Sensor Networks – 162

Optical and Radio Frequency Refractivity Fluctuations from High Resolution Point Sensors: Sea Breezes and Other Observations – 554

Optimizing the Allocation of Sensor Assets for the Unit of Action – 531

Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Pre-print) – 211

Radon Screening of Buildings at the Umatilla Depot Activity, Hermiston, Oregon – 94

Simultaneous Localization and Tracking in Wireless Ad-hoc Sensor Networks – 188

Using a Shortest Path Algorithm for Identifying Areas of Interest in An Area of Operations – 543

Wave Front Sensor for Solar Concentrator Control – 52

#### **DETERIORATION**

Monitoring and Counteracting Functional Deterioration in Parkinson's Disease: A Multilevel Integrative Approach in a Primate Model System – 320

#### **DETONATION WAVES**

Confined Detonations and Pulse Detonation Engines – 42

#### **DETONATION**

Detonation Nanodiamonds and Related Materials. Bibliography Index, Issue 1 – 103

#### **DEUTERIUM FLUORIDES**

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

Utility of DF-1 for Radioprotection in Lymphocytes – 420

#### **DEUTERIUM**

Feasibility of Measuring <sup>3</sup>He Bubble Diameter Populations in Deuterium-Tritium Ice Layers Using Mie Scattering – 573

#### **DEVICES**

Dynamically Modifiable Polymer Coatings and Devices – 126

#### **DIAGNOSIS**

Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – 338

High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350

Integration of Anatomic and Pathogenetic Bases for Early Lung Cancer Diagnosis – 506

LCLS XTOD Tunnel Vacuum Transport System (XVTS) Final Design Report – 563

Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – 67

National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397

Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106

Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398

Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601

Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers – 34

Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – 601

#### **DIAMONDS**

Detonation Nanodiamonds and Related Materials. Bibliography Index, Issue 1 – 103

Thermal Diffusivity and Conductivity Measurements in Diamond Anvil Cells – 561

#### **DICTIONARIES**

Database Dictionary for Ethiopian National Ground-Water Database (ENGDA) Data Fields – 631

Re-Use of Integrated Dictionary Components for C4ISR Architectures – 148

#### **DIELDRIN**

Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305

Literature Review of Biodegradation in Soil of Selected Rocky Mountain Arsenal Contaminants: Isodrin, Dieldrin, Diisopropylmethyl-Phosphonate, 1,2-Dibromo-3-Chloropropane, and p-Chloro-Phenylmethylsulfonide – 61

#### **DIELECTRIC PROPERTIES**

Infrared and Electrical Properties of Amorphous Sputtered (LaxA11-x)2O3 films – 63

Integrated Plasmon and Dielectric Waveguides – 587

Molecular Volume and Electronic and Vibrational Polarizabilities for Amorphous LaAlO3 – 86

Organic Polymers with Magneto-Dielectric Properties – 124

Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds – 90

#### **DIELECTRIC WAVEGUIDES**

Integrated Plasmon and Dielectric Waveguides – 587

#### **DIELECTRICS**

Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187

Infrared and Electrical Properties of Amorphous Sputtered (LaxA11-x)2O3 films – 63

Non-Electronic Radio Front-End (NERF) – 211

On the Importance of Atomic Packing in Determining Dielectric Permittivities – 553

Substrate/Oxide Interface Interaction in LaAlO3/Si Structures – 96

#### **DIESEL ENGINES**

Diesel Particulate Measurement Research, 2007. Phase 3 – 238

Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 255

Evaluation of Portable Emissions Measurement Systems (PEMS) for Inventory Purposes and the Not-to-Exceed Heavy-Duty Diesel Engine Regulation – 236

Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335

#### **DIESEL FUELS**

Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120

#### **DIETS**

Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 337

Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340

Interactions between Dietary Factors and Inflammation in Prostate Carcinogenesis – 349

PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – 302

#### **DIFFERENTIAL EQUATIONS**

High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations – 527

The Matrix Pencil and its Applications to Speech Processing – 589

#### **DIFFRACTION**

High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 557

Ultra Fast Coherent Diffraction Imaging of Single Particles, Clusters and Biomolecules – 572

WABED Model in the SMS: Part 2. Graphical Interface – 470

## DIFFUSION THEORY

Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet – 221

## DIFFUSION

Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing – 568

Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.) – 126

Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187

Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magneto-sphere – 261

## DIGITAL CAMERAS

Source Camera Identification and Blind Tamper Detections for Images – 505

## DIGITAL DATA

High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77

## DIGITAL SYSTEMS

A High-Performance Communication Service for Parallel Computing on Distributed DSP Systems – 449

Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – 5

Army Digitization Operational Impacts – 661

Can a Self-Diagnostic Digitally Controlled Pacemaker/Defibrillator Device be Used for Alerting Military Personnel When a Soldier Health Condition Becomes Compromised Out in the Field – 426

Digital C4I Interoperability: The EM Protection Issue – 163

Introduction to Synthetic Aperture Radar (SAR) – 175

Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III – 650

## DIGITAL TECHNIQUES

A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296

Army Digitization Operational Impacts – 661

Digital Evidence in the Courtroom: A Guide for Law Enforcement and Prosecutors – 437

## DIGITAL TELEVISION

Digital Convergence Authenticated Video, Voice, & Text – 476

## DILUTION

Heat of Dilution Calculation for 19 Molar Sodium Hydroxide with Water for Use in 241-S-112 – 103

## DIMENSIONAL MEASUREMENT

Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407

## DIMENSIONLESS NUMBERS

Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – 276

## DIODES

Pyroelectric AlGaIn/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 97

## DIRECT CURRENT

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

## DIRECT NUMERICAL SIMULATION

Direct Numerical Simulation and Experimental Validation of Hypersonic Boundary-Layer Receptivity and Instability – 512

## DIRECTIONAL ANTENNAS

A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – 190

## DISASTERS

Hurricane Katrina: Lessons for Army Planning and Operations – 164

Medical Reserve Corps Volunteers' Ability and Willingness to Report to Work for the Department of Health During Catastrophic Disasters – 312

Optimizing the Prioritization of Natural Disaster Recovery Projects – 274

Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement – 181

The Chaos of Katrina – 267

## DISCONTINUITY

The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515

## DISCRETE FUNCTIONS

Discrete Data Transfer Technique for Fluid-Structure Interaction – 478

## DISEASES

Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 309

Brain's DNA Repair Response to Neurotoxicants – 317

Cell-surface Alpha-glucan in Campylobacter jejuni 81-176 – 401

Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386

Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease – 343

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Differential Mechanisms of Androgen Resistance – 313

Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum – 357

Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 396

History of U.S. Military Contributions to the Study of Diarrheal Diseases – 408

HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate – 290

Mechanisms of Alpha-synuclein Aggregation and Toxicity – 330

Mechanisms of Disease Persistence in Chronic Myelogenous Leukemia (CML) – 318

Modeling Phenotypes of Tuberculous Sclerosis in the Mouse – 310

Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289

Monitoring and Counteracting Functional Deterioration in Parkinson's Disease: A Multilevel Integrative Approach in a Primate Model System – 319

National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397

New Structural Approaches to Understanding the Disease Related Forms of the Prion Protein – 348

Program Project on the Pathogenesis and Treatment of Parkinson's Disease – 334

Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360

Testing the Effectiveness of the North Shore - LIJ Health System's Bioterrorism Response Program to Identified Surveillance Data – 345

The Role of CRELD1 Isoform 9B in the Pathogenesis of Breast Cancer – 280

Vasculature-Specific Adenovirus Vectors for Gene Therapy of Prostate Cancer – 352

## DISORDERS

Post Traumatic Stress Disorder: The Facts – 369

Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments – 384

## DISORIENTATION

Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps – 7

## DISPENSERS

Simulation and Analysis of Dart Dispense Events with Collisions – 236

## DISPERSING

Terrorist 'Dirty Bombs': A Brief Primer – 251

## DISPLACEMENT

High Throughput Screening of Potential Displacer Molecules – 73

Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186

Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions – 265

## DISPLAY DEVICES

Counter-Trafficking Integrated Display System (CIDS): A GIS-Based Command & Control Environment for Coalition Nations – 471

Developing the Federal Aviation Administration's Requirements for Color Use in Air Traffic Control Displays – 16

Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153

Method and System for Interactive Modeling of High-Level Network Performance with Low-Level Link Design – 436

Receptive Field Structures for Recognition – 190

Software to Generate 3-Dimensional Displays of Inverse Synthetic Aperture Radar Data – 455

Task Adaptable Display of Information for Training, Maintenance, and Emergency Response – 654

The Interactive DataWall – 209

The Tactile Modality: A Review of Tactile Sensitivity and Human Tactile Interfaces – 423

Visual Simulation S&T: Summary of Accomplishments – 7

## DISSOCIATION

Improving COIL Efficiency By Iodine Pre-Dissociation Via Corona Discharge In The Transonic Section Of The Secondary Flow – 234

## DISTORTION

Closed Orbit Distortion and the Beam-Beam Interaction – 556

Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95

## DISTRIBUTED INTERACTIVE SIMULATION

Performance Measurement for Diagnosing and Debriefing Distributed Command and Control Teams – 150

## DISTRIBUTED PARAMETER SYSTEMS

Distributed Command and Control Research: Networking Multiple Simulation Platforms – 495

Distributed Computing and Collaboration Framework (DCCF) – 466

Performance Measurement for Diagnosing and Debriefing Distributed Command and Control Teams – 150

## DISTRIBUTED PROCESSING

A Distributed Parallel Processing System for Command and Control Imagery – 466

A High-Performance Communication Service for Parallel Computing on Distributed DSP Systems – 449

Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – 448

Distributed Computing and Collaboration Framework (DCCF) – 466

Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448

Proving Atomicity: An Assertional Approach – 487

QoS Negotiation in Real-Time Systems and its Application to Automated Flight Control – 43

Visual Spreadsheets in VisIt – 432

## DISTRIBUTION FUNCTIONS

An Inverse of the Incomplete Beta Function (F-(Variance Ratio) Distribution Function) – 467

Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54

Radiated Susceptibility Test in Reverberation Chamber – 202

## DOCUMENT MARKUP LANGUAGES

Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations – 641

Using a Combination of UML, C2RM, XML, and Metadata Registries to Support Long-Term Development/Engineering – 452

## DOCUMENTATION

IMMR Phase 1 Prototyping Plan Inputs – 663

## DOPAMINE

Ethanol and Mesolimbic Serotonin/Dopamine Interactions via 5HT-1B Receptors – 346

PCBs Alter Dopamine Mediated Function in Aging Workers – 294

## DOPED CRYSTALS

Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 070) – 207

Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 378) – 206

Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – 63

## DOPPLER EFFECT

Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – 669

## DOPPLER RADAR

Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR) – 277

## DOSAGE

Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – 372

Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570

Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – 110

Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy – 286

Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416

Screening Doses for Induction of Cancers Calculated With the Interactive Radio Epidemiological Program (IREP) – 306

Screening Doses for Induction of Cancers Calculated with the Interactive RadioEpidemiological Program (IREP) – 348

Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3 – 358

X-Ray Dose in Microfocus Radiographic Inspections – 137

## DOSIMETERS

Correcting the Response of an Albedo Neutron Dosimeter for Energy – 220

X-Ray Dose in Microfocus Radiographic Inspections – 137

## DRONE AIRCRAFT

Finite Element Solution: Nonlinear Flapping Beams for Use with Micro Air Vehicle Design – 3

## DRONE VEHICLES

A Bold 21st Century Strategy for U.S. Airborne ISR – 24

A Comparison of Trajectory Determination Approaches for Small UAVs – 11



A Review of Recent Algorithms and a New and Improved Cooperative Control Design for Generating a Phantom Track (Preprint) – 26

Autonomous Unmanned Aerial Vehicle Rendezvous for Automated Aerial Refueling – 11

Development of an Experimental Platform for Testing Autonomous UAV Guidance and Control Algorithms – 38

North West Shelf Unmanned Aerial System Trial – 18

Optimal UAV Task Assignment and Scheduling (Preprint) – 24

Research Institute for Autonomous Precision Guided Systems – 31

Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – 19

Unmanned Aerial Vehicles: Background and Issues for Congress – 30

Wide Area Search and Engagement Simulation Validation – 32

## DRUGS

A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – 406

Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations – 60

Atropine and Other Anticholinergic Drugs – 372

Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378

Discovery of Therapeutics for Ricin Toxicosis – 299

Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416

Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – 398

Mosaic Structure of a Multiple-Drug-Resistant, Conjugative Plasmid from *Campylobacter jejuni* – 407

Novel and Efficient Synthesis of the Promising Drug Candidate Discodermolide – 355

pH Triggerable Polymeric Particles – 66

Selenium and Breast Cancer Chemoprevention – 339

Smallpox Antiviral Drug – 285

Structural Studies on Intact Clostridium Botulinum Neurotoxins Complexed with Inhibitors Leading to Drug Design – 304

Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development – 371

## DRUMS (CONTAINERS)

Improving Thermal Performance of Radioactive Material Drum Type Packages by Using Heat Pipes – 131

## DRYING

A Review of the History of Fire Suppression on U.S. DoD Aircraft – 34

## DUCTILITY

Micro and Nano-structure Development and Multiscale Physics at Sliding Metal Interfaces. Final Report May 2006 – 78

The Effect of Inhomogeneous Plastic Deformation on the Ductility and Fracture Behavior of Age Hardenable Aluminum Alloys – 115

## DURABILITY

Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft – 583

## DUST

Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System – 271

Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – 253

Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared – 271

## DWELL

Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122

## DYE LASERS

Novel Two- and Three-Photon Pumped Lasing Dyes: Design, Synthesis, and Characterization – 232

## DYES

Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – 64

## DYNAMIC CHARACTERISTICS

Notes on Longitudinal Dynamics in UMER – 568

## DYNAMIC CONTROL

Dynamic-Active Flow Control - Phase I – 2

## DYNAMIC LOADS

Parametric Dynamic Load Prediction of a Narrow Gauge Rocket Sled – 135

## DYNAMIC MODELS

An Agent-Based Dynamic Information Security Model in Information Warfare – 643

Global Local Dynamic Models – 572

Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – 518

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

## DYNAMIC PROGRAMMING

Multi-Cumulant and Non-Inferior Strategies for Multi-Player Pursuit-Evasion (PREPRINT) – 544

## DYNAMIC RESPONSE

Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53

## DYNAMIC STRUCTURAL ANALYSIS

Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53

## DYNAMICAL SYSTEMS

Global Local Dynamic Models – 572

## E-2 AIRCRAFT

Effects of Using NATEC Services within E-2C and FA-18 Operational Squadrons – 25

## EAR PROTECTORS

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630

## EARLY WARNING SYSTEMS

Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 461

Space Surveillance and Early Warning Radars: Buried Treasure for the Information Grid – 165

## EARPHONES

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630

## EARTH ATMOSPHERE

Gravity-Wave Dynamics in the Atmosphere – 264

## EARTH IONOSPHERE

Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere – 261

## EARTH MOVEMENTS

Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions – 265

## EARTH RESOURCES

European Security in the Wider Black Sea Area – 242

## EARTH SURFACE

CLMT2 User's Guide: A Coupled Model for Simulation of Hydraulic Processes from Canopy to Aquifer – 276

## EARTHQUAKES

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 262

Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – 262

- Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions – 265
- Seismic Response of a Half-Scale Masonry Building with Flexible Diaphragms – 239
- ECHOES**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – 588
- ECLIPTIC**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – 665
- ECONOMETRICS**  
Analysis of Metrics Utilized in U.S. Joint Experimentation of Future C2 Concepts – 171  
Price vs. Performance: The Value of Next Generation Fighter Aircraft – 25
- ECONOMICS**  
Quality-Attribute-Based Economic Valuation of Architectural Patterns – 479
- ECOSYSTEMS**  
Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277  
Ecosystems and Climate Change: Research Priorities for the U.S. Climate Change Science Program. Recommendations from the Scientific Community – 278
- EDDY CURRENTS**  
Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565  
Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Postprint) – 534
- EDEMA**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- EDUCATION**  
A Case Study for the Naval Training Meta-FOM (NTMF): Analyzing the Requirements from MAGTF FOM – 629  
A Comparative Assessment of Knowledge Management Education Across the USA Department of Defense – 636  
A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296  
A Study of Communicating Science and Engineering – 142  
Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS) – 625  
American Competitiveness Initiative: Leading the World in Innovation – 136  
Baylor College of Medicine Saturday Morning Science Workshop – 608
- Critical Review of the U.S. Marine Corps' Space Cadre Strategy – 674
- Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362
- Evaluating an Interactive, Multimedia Education and Decision Program for Early-Stage Prostate Cancer Patients in a Randomized Controlled Trial – 342
- Experimentation with Evolving C2 Operation Centers - Implications for the Human Element – 137
- Helmet-Mounted Displays for Use in Air Force Training and Simulation – 6
- Incorporating New Technology to Create a Comprehensive Realistic Training Environment for the 91W – 343
- Knowledge Tracing and Prediction of Future Trainee Performance – 531
- Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497
- Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 32
- Operator Influence of Unexploded Ordnance Sensor Technologies – 227
- Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III – 650
- Platform Camera Aircraft Detection for Approach Evaluation and Training – 29
- The Effect of Graduate Education on the Performance of Air Force Officers – 526
- The Need for an Aerospace Pharmacy Residency – 419
- Training Coordination Proxy Agents – 616
- UH-USA Agreement - A Telemedicine Research Proposal – 624
- Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- EGYPT**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375
- EIGENVALUES**  
Parallel Eigensolver for H (curl) Problems using H1 Auxiliary Space AMG Preconditioning – 434
- EIGENVECTORS**  
Eigenvector Analysis for Multipath – 549
- ELASTIC ANISOTROPY**  
On the Correlation Between the Self-Organized Island Pattern and Substrate Elastic Anisotropy – 552
- ELASTIC PROPERTIES**  
Compliant Formation Control of an Autonomous Multiple Vehicle System – 507  
Compliant, Nanoscale Free-Standing Multilayer Films – 66  
Elastic-Viscoplastic An Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Text – 117  
High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350  
Leg Muscle Usage Effects on Tibial Elasticity during Running – 295  
On the Correlation Between the Self-Organized Island Pattern and Substrate Elastic Anisotropy – 552  
Software Communications Architecture (SCA) Compliant Software Defined Radio Design for Interim Standard 95B (IS-95B) Transceiver – 463  
Web Enabling HLA Compliant Simulations to Support Network Centric Applications – 444
- ELASTOMERS**  
Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 122
- ELECTRIC BATTERIES**  
Aircraft Battery Design Concept for Improved Ultra Low Temperature Performance (Postprint) – 17  
Battery System – 246  
Complex Processes in Electrochemical Systems – 114  
Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – 246  
Servicing Hawker Vehicle Batteries with Standard Battery Charging and Test Equipment – 248
- ELECTRIC CONDUCTORS**  
Report on the Wisconsin-Stanford-Kansas-Davis-Florida State MURI on Scientific Challenges of Coated Conductors – 555
- ELECTRIC CORONA**  
Improving COIL Efficiency By Iodine Pre-Dissociation Via Corona Discharge In The Transonic Section Of The Secondary Flow – 234
- ELECTRIC CURRENT**  
Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns – 96  
Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186
- ELECTRIC EQUIPMENT**  
M1114 -- Golden HMMWV Power: Electrical Systems Used in Theater – 192

## **ELECTRIC FIELDS**

AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605

Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287

## **ELECTRIC MOTORS**

Motor Frame Cooling with Hot Liquid Refrigerant and Internal Liquid – 76

## **ELECTRIC POTENTIAL**

Incident, Action, Recovery, and Recommissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – 202

Multi-Wall Carbon Nanotubes for Flow-Induced Voltage Generation (Preprint) – 95

Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Postprint) – 534

## **ELECTRIC POWER**

Joint Light Tactical Vehicle Power Requirements – 250

## **ELECTRIC WIRE**

Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53

## **ELECTRICAL MEASUREMENT**

Spatially Resolved Electromagnetic Property Measurement – 556

## **ELECTRICAL PROPERTIES**

Infrared and Electrical Properties of Amorphous Sputtered (LaxA11-x)2O3 films – 63

Studies of Basic Electronic Properties of CdTe-Based Solar Cells and Their Evolution During Processing and Stress. Final Technical Report October 16, 2001-August 31, 2005 – 246

## **ELECTRICITY**

Report to Congress on Assessment of Potential Impact of Concentrating Solar Power for Electricity Generation (EPACT 2005 - Section 934 (c)) – 247

The Costs of Not Using Green Design in the USAF: Would Using Green Building Design Have Resulted in Life Cycle Cost – 212

## **ELECTROCHEMICAL CELLS**

Impedance Analysis of Electrochemical NOx Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247

## **ELECTROCHEMISTRY**

Complex Processes in Electrochemical Systems – 114

Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331

Electrochemical Investigations of the Interface at Li/Li+ Ion Conducting Channel – 90

Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – 230

## **ELECTRODEPOSITION**

Reversible Electrodeposition Optical Modulation Device with Conducting Polymer Counter Electrode – 214

## **ELECTRODES**

Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – 246

Reversible Electrodeposition Optical Modulation Device with Conducting Polymer Counter Electrode – 213

## **ELECTROENCEPHALOGRAPHY**

Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – 110

## **ELECTROLUMINESCENCE**

Nano-Dots Enhanced White Organic Light-Emitting Diodes – 90

Organic Light-Emitting Diodes and Related Hole Transport Compounds – 207

## **ELECTROLYTES**

Charge Transfer Nanocomposites: The Effects of Scale-Hierarchy – 111

Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – 246

## **ELECTROMAGNETIC FIELDS**

Theory for the RF Surface Field for Various Metals at the Destructive Breakdown Limit – 73

Through-the-Wall Imaging from Electromagnetic Scattered Field Measurements – 553

## **ELECTROMAGNETIC INTERFERENCE**

Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – 196

Digital C4I Interoperability: The EM Protection Issue – 163

## **ELECTROMAGNETIC MEASUREMENT**

Spatially Resolved Electromagnetic Property Measurement – 556

## **ELECTROMAGNETIC NOISE**

The Mitigation of Radio Noise from External Sources at Receiving Sites – 163

## **ELECTROMAGNETIC PROPERTIES**

The Joy of Computing with Volume-Integrals – 19

## **ELECTROMAGNETIC PULSES**

Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – 196

High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments – 554

Non-Electronic Radio Front-End (NERF) – 211

Solid State Capacitor Discharge Pulsed Power Supply Design for Railguns – 193

## **ELECTROMAGNETIC RADIATION**

Coherence and Polarization Properties of Far Fields Generated by Quasi-Homogeneous Planar Electromagnetic Sources (Postprint) – 602

Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314

Non-Electronic Radio Front-End (NERF) – 211

Terrorist 'Dirty Bombs': A Brief Primer – 250

Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597

## **ELECTROMAGNETIC SCATTERING**

Through-the-Wall Imaging from Electromagnetic Scattered Field Measurements – 553

## **ELECTROMAGNETIC SPECTRA**

Signal Population in the License-Exempt Wireless-Radio Bands at the MOUT Site – 152

## **ELECTROMAGNETIC WAVE TRANSMISSION**

3D Photonic Crystals Build Up By Self-Organization Of Nanospheres – 450

Simulation of Radiowave Propagation in a Dense Urban Environment – 554

## **ELECTROMAGNETISM**

Spatially Resolved Electromagnetic Property Measurement – 556

## **ELECTROMAGNETS**

Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – 216

## **ELECTROMECHANICAL DEVICES**

Surface-Templated Assembly for Mass-Production of ZnO Nanowire-Based Integrated Devices – 90

## **ELECTROMECHANICS**

Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187

## **ELECTROMIGRATION**

Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns – 96

## **ELECTRON BEAMS**

An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems – 60

Employment of Second Order Ruled Surfaces in Design of Sheet Beam Guns – 579

Fabrication of Nanoscaled Systems – 229

Injector Test Facility for the LCLS. Executive Summary – 566

- Interaction of Intense Electron Beams with Plasma – 582
- Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters – 113
- Quantitative Experiments with Electrons in a Positively Charged Beam – 606
- Self-Consistent Simulations of High-Intensity Beams and E-Fields with WARP POSINST – 568
- ELECTRON CLOUDS**  
Quantitative Experiments with Electrons in a Positively Charged Beam – 606
- ELECTRON DENSITY (CONCENTRATION)**  
Interaction of Intense Electron Beams with Plasma – 582
- On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – 551
- ELECTRON ENERGY**  
Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 604
- ELECTRON GUNS**  
Employment of Second Order Ruled Surfaces in Design of Sheet Beam Guns – 579
- ELECTRON MICROSCOPES**  
Method, System and Device for Microscopic Examination Employing Fiber-Prepared Sample Grasping Element – 206
- ELECTRON MICROSCOPY**  
Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters – 113
- ELECTRON OPTICS**  
Possible Use of Electron Lenses in LHC – 587
- ELECTRON PROBES**  
On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – 551
- ELECTRON STATES**  
Studies of Basic Electronic Properties of CdTe-Based Solar Cells and Their Evolution During Processing and Stress. Final Technical Report October 16, 2001-August 31, 2005 – 246
- ELECTRON TRANSFER**  
Non-Equilibrium Quantum Dots: Transport – 185
- Semiconductor Quantum Dot Resonant Tunneling Spectroscopy – 185
- ELECTRON TRANSITIONS**  
Non-Equilibrium Quantum Dots: Transport – 185
- ELECTRONIC COMMERCE**  
Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – 497
- ELECTRONIC CONTROL**  
Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – 6
- ELECTRONIC EQUIPMENT**  
Atomtronics: Ultracold Atom Analogs of Electronic Devices – 194
- Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint) – 55
- Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint) – 55
- Electronic and Optoelectronic Devices and Methods for Preparing Same – 213
- Motor Frame Cooling with Hot Liquid Refrigerant and Internal Liquid – 76
- Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments – 205
- ELECTRONIC MAIL**  
Pattern Analysis of Directed Graphs Using DEDICOM: An Application to Enroll Email – 439
- The Outlook Y-JBI: An E-Mail Based Approach to Prototyping the Joint Battlespace Infosphere – 152
- ELECTRONIC WARFARE**  
Demonstrator Foer Stoerskydd av GNSS-Mottagare (Demonstrator for Anti-Jamming of GNSS Receivers) – 204
- Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues – 618
- Intelligence Reform and Terrorism Prevention Act of 2004: 'Lone Wolf' Amendment to the Foreign Intelligence Surveillance Act – 664
- ELECTRONS**  
e-/e+ Accelerating Structure with Cyclic Variation of Azimuth Asymmetry – 578
- Quantitative Experiments with Electrons in a Positively Charged Beam – 606
- ELECTRO-OPTICAL PHOTOGRAPHY**  
An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 223
- ELECTRO-OPTICS**  
An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 223
- Chiral Multichromic Single Crystals for Optical Devices – 580
- Electronic and Optoelectronic Devices and Methods for Preparing Same – 213
- Electro-Optic Array Interface – 213
- Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222
- High Performance Polymer Memory and Its Formation – 210
- New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210
- New Materials, Techniques and Device Concepts for Organic NLO Chromophore-based Electrooptic Devices. Part 1 – 291
- Non-Electronic Radio Front-End (NERF) – 211
- Object Detection in Electro-Optic Sensor Images – 208
- Toward Neural Control of Prosthetic Devices – 209
- ELECTROPHORESIS**  
Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388
- Kapillaarelektrofores i Tva Dimensioner. Slutrapport Fran Innovationsprojekt 14215 (Two-Dimensional Capillary Electrophoresis Final Report of the Innovative Project 14215) – 68
- ELECTROPHYSIOLOGY**  
Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – 373
- ELECTROSTATICS**  
Electrostatic Modeling of Vacuum Insulator Triple Junctions – 205
- Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma – 574
- ELEMENTARY PARTICLES**  
Measurements of Top Quark Properties at CDF – 564
- ELEVATION**  
Application of the Unscented Transformation to Obtain Target Range, Bearing, Elevation, Range Rate, Speed and Course Estimates and Errors From Tracks Given in Cartesian Coordinates – 517
- ELLIPSOIDS**  
Outlier Detection in Hyperspectral Imaging Using Closest Distance to Center with Ellipsoidal Multivariate Trimming – 223
- ELLIPTIC FUNCTIONS**  
An Inverse of the Elliptic Coverage Function – 525
- EMBEDDING**  
A Multi-Ring Framework for Survivable Group Communications – 441
- C4I Tactical Applications Utilizing Embedded Simulations – 150
- Digital Convergence Authenticated Video, Voice, & Text – 476

Digital Watermarking Using Syndrome Codes – 516

Real-Time Communication and Coordination in Embedded Sensor Networks – 533

## EMBRYOS

Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease – 343

## EMERGENCIES

Automatic Generation of Best Emergency Routes and Procedures on a Brazilian Frigate – 467

Civil Reserve Air Fleet (CRAF) – 25

Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354

Emergency Preparedness and the Year 2000 Challenge – 443

Forecasting Complex Political and Military Events: The Application of Expected Utility to Crisis Situations – 653

Information Grid in Support of Crisis Management – 625

Integrating Local Public Health Agencies into the Homeland Security Community – 311

Partnerships: The Path to Improving Crisis Communication – 156

Shared Situational Awareness Environment for Tactical Level Humanitarian Emergency Operations – 454

Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement – 181

Task Adaptable Display of Information for Training, Maintenance, and Emergency Response – 654

The Chaos of Katrina – 267

The Multidimensional Measurements of Geographic Information Systems (GIS) Effectiveness in Crisis Management – 611

The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367

The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618

Using Templates to Support Crisis Action Mission Planning – 455

Weathering the Storm. Leading Your Organization Through a Pandemic – 368

## EMISSION

Fabrications and Characterizations of ZnO/Zn1-xMgxO Nanorod Quantum Structures – 186

Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597

## EMITTANCE

Emittance Correction in the 2006 ILC Bunch Compressor – 580

Flash X-ray (FXR) Linear Induction Accelerator(LIA) Optimization Upgrade of the OTR Emittance Diagnostic – 575

Hao Spectral Diagnostic Package for Emitted Radiation (Haos-Diper) Reference Guide. Version 1.0 – 558

## EMITTERS

Electrospray Emitter for Microfluidic Channel – 206

## EMPLOYMENT

Medical Risk in the Future Force Unit of Employment. Results of the Army Medical Department Transformation Workshop V – 304

## ENCLOSURE

Microsystem Enclosure and Method of Hermetic Sealing – 71

## END EFFECTORS

Pneumatically Actuated Flexible Coupling end Effectors for Lapping/Polishing – 34

## ENDANGERED SPECIES

Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – 251

## ENDOCRINE GLANDS

Studies of Prostate Tumor Development Via CRE/LOXP Technology – 309

## ENDOTHELIUM

Anti-Angiogenic Action of Neutral Endopeptidase – 285

Endothelial Progenitors as Vectors for Systemic Gene Therapy of Breast Cancer – 332

Molecular Mechanisms in Compromised Endothelial Barrier during Breast Cancer Metastasis – 377

## ENERGETIC PARTICLES

Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events – 668

## ENERGY CONSERVATION

Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244

Report to Congress on Assessment of Potential Impact of Concentrating Solar Power for Electricity Generation (EPACT 2005 - Section 934 (c)) – 247

## ENERGY CONSUMPTION

Building Alternative-Energy Partnerships with Latin America – 249

M1114 -- Golden HMMWV Power: Electrical Systems Used in Theater – 192

Status and Prospects of the Fast Ignition Inertial Fusion Concept – 571

Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243

## ENERGY CONVERSION

Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204

Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184

Standard-Cell, Open-Architecture Power Conversion Systems – 247

## ENERGY GAPS (SOLID STATE)

3D Photonic Crystals Build Up By Self-Organization Of Nanospheres – 450

Nonclassical Properties of Pulsed Second-Subharmonic Generation in Photonic-Band-Gap Structures – 196

Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184

Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79

## ENERGY POLICY

A Decision Model for Selecting Energy Efficient Technologies for Low-Sloping Roof Tops Using Value-Focused Thinking – 243

AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – 254

Army Facility Energy Demand and the Impact on National Security – 243

China's Energy Security and Its Military Modernization Efforts: How China Plans to Dominate the World – 248

In the Midst of a Fuels Evolution - An Army Perspective – 38

Proceedings of the 1st Army Installation Energy Security and Independence Conference – 245

## ENERGY REQUIREMENTS

Emerging Energy Requirements for Future C4ISR – 244

## ENERGY STORAGE

Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode – 212

Persistent Monitoring Platforms – 36

## ENERGY TRANSFER

Confined Detonations and Pulse Detonation Engines – 42

Emerging Energy Requirements for Future C4ISR – 244

MURI Center for Materials Chemistry in the Space Environment – 112

Ocean Wave Energy Harvesting Devices – 479

## ENGINE CONTROL

Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – 6

- Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 23
- ENGINE PARTS**
- 3-Dimensional Crack Growth Behavior of Turbine Engine Materials (Preprint) – 555
- A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – 550
- An Integrated Approach to Conversion, Verification, Validation and Integrity of AFRL Generic Engine Model and Simulation (Postprint) – 6
- ENGINEERING**
- Symposium on Nano- and Micro-Scale Mechanics of Engineering Materials – 660
- ENGINES**
- Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – 6
- ENRICHMENT**
- Iran's Nuclear Program: Recent Developments – 594
- ENTOMOLOGY**
- Assessing Error in PMI (Post-Mortem Interval) Prediction Using a Forensic Entomological Computer Model – 437
- ENTROPY**
- Quantifying Non-Equilibrium in Hypersonic Flows Using Entropy Generation – 219
- The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515
- ENVIRONMENT EFFECTS**
- Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273
- ENVIRONMENTAL ENGINEERING**
- Fort Holabird Defense Investigative Service (DIS), Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II – 423
- Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425
- ENVIRONMENTAL MONITORING**
- ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual – 469
- ENVIRONMENTAL SURVEYS**
- Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587
- Environmental Impacts of Airport Operations: Maintenance, and Expansion – 44
- Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273
- Sonic Boom Assessment for the Crew Exploration Vehicle – 56
- ENZYME ACTIVITY**
- A BCR-ABL Kinase Activity-Independent Signaling Pathway in Chronic Myelogenous Leukemia – 351
- Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344
- ENZYMES**
- Analysis of p21-Activated Kinase Function in Neurofibromatosis Type 2 – 315
- Bioreactive Allosteric Polynucleotides – 69
- DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – 383
- Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344
- Maintenance of Glucose Homeostasis through Acetylation of the Metabolic Transcriptional Coactivator PGC-1alpha – 343
- Mechanisms of Disease Persistence in Chronic Myelogenous Leukemia (CML) – 318
- Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemo-Resistance - Potential Mechanism of PIM Action – 282
- Program Project on the Pathogenesis and Treatment of Parkinson's Disease – 334
- Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – 352
- EPIDEMIOLOGY**
- ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer – 344
- Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403
- Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285
- Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of Travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan – 375
- Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398
- Screening Doses for Induction of Cancers Calculated With the Interactive Radio Epidemiological Program (IREP) – 306
- Screening Doses for Induction of Cancers Calculated with the Interactive RadioEpidemiological Program (IREP) – 348
- EPILEPSY**
- Preventing Epilepsy after Traumatic Brain Injury – 366
- EPITAXY**
- Dynamics of Epitaxy on the Nano-sized Semiconductor Surfaces – 188
- EPITHELIUM**
- Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 337
- p63 in Development and Maintenance of the Prostate Epithelium – 355
- Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313
- Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy – 316
- The Significance of Focal Basal Cell Layer Disruption-Induced Immuno-Cell Infiltration in Prostate Cancer Invasion – 364
- EPOXY MATRIX COMPOSITES**
- 2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – 82
- High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – 125
- Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113
- Tension-Compression Fatigue Behavior of a Carbon Fiber/Epoxy (IM7/EPON 862) Composite Fabricated Using Vacuum Assisted Resin Transfer Molding Process – 85
- EPOXY RESINS**
- 2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – 82
- High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – 125
- Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121
- Processing of Multifunctional Epoxy Resins Modified with Silicon Based Nanomaterials (POSTPRINT) – 124

## EQUATIONS

Finding Stable Causal Interpretations of Equations – 506

Proceedings of the Quantum Computation for Physical Modeling Workshop Held in North Falmouth, Massachusetts on October 18-19, 2000 – 519

## EQUATORS

Progress Report of the IAU Working Group on Precession and the Ecliptic – 665

## EQUILIBRIUM FLOW

Quantifying Non-Equilibrium in Hypersonic Flows Using Entropy Generation – 219

## EQUIPMENT SPECIFICATIONS

Defect Prevention and Detection in Software for Automated Test Equipment – 430

## EROSION

Oxygen Plasma Treatment and Deposition of CN<sub>x</sub> on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121

## ERROR ANALYSIS

An Inverse of the Circular Coverage Function – 525

An Inverse of the Elliptic Coverage Function – 525

An Inverse of the Generalized Circular Error Function – 525

Prediction and Classification of Operational Errors and Routine Operations Using Sector Characteristics Variables – 12

Relationship of Complexity Factor Ratings With Operational Errors – 513

Simulation of Coherent Signals with Forward Error Correction Coding – 540

## ERROR CORRECTING CODES

Digital Watermarking Using Syndrome Codes – 516

Simulation of Coherent Signals with Forward Error Correction Coding – 540

## ERROR FUNCTIONS

An Inverse of the Generalized Circular Error Function – 525

## ERROR SIGNALS

The Matrix Pencil and its Applications to Speech Processing – 589

## ERRORS

Assessing Error in PMI (Post-Mortem Interval) Prediction Using a Forensic Entomological Computer Model – 437

Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model – 514

Human Error Investigation Software Tool (HEIST) – 427

Relationship of Complexity Factor Ratings With Operational Errors – 513

The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618

## ESCHERICHIA

Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331

New Structural Approaches to Understanding the Disease Related Forms of the Prion Protein – 352

Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385

Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379

## ESSENTIALLY NON-OSCILLATORY SCHEMES

A High Order WENO Scheme for a Hierarchical Size-Structured Model – 549

A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model – 508

Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – 515

Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4

## ESTERS

A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125

Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor κB Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling – 388

Development of ASTM Precision Bearing Grease Guide – 64

Immobilized Iminophosphatranes Useful for Transesterification – 70

## ESTIMATES

Application of the Unscented Transformation to Obtain Target Range, Bearing, Elevation, Range Rate, Speed and Course Estimates and Errors From Tracks Given in Cartesian Coordinates – 517

Spread Spectrum Signal Characteristic Estimation Using Exponential Averaging and an AD-HOC Chip rate Estimator – 195

## ESTIMATING

An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234

Estimating Runflat Stiffness – 552

Guidance for Estimating VOC and NO<sub>x</sub> Emission Changes from MACT Rules – 257

## ESTROGENS

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357

cSrc and Her2 Signaling Pathways Cooperate with Estrogen to Promote ER Phosphorylation, Ubiquitination and Proteolysis in ER Negative Breast Cancers – 356

Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on Hormonal Responsiveness of Breast Cancer – 362

Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – 324

## ETCHING

Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope – 140

Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196

## ETHERS

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 114

## ETHICS

Lethality and Autonomous Robots: An Ethical Stance – 504

## ETHIOPIA

Database Dictionary for Ethiopian National Ground-Water Database (ENGDA) Data Fields – 631

## ETHNIC FACTORS

Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285

## ETHYL ALCOHOL

AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – 255

Ethanol and Mesolimbic Serotonin/Dopamine Interactions via 5HT-1B Receptors – 346

## ETHYL COMPOUNDS

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 114

## ETHYLENE

Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100

## EUROPE

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265

Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – 262

## EUROPIUM ISOTOPES

Progress on the Europium Neutron-Capture Study Using DANCE – 673

## EUROPIUM

Progress on the Europium Neutron-Capture Study Using DANCE – 673

## EUTECTIC ALLOYS

Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99

## EUTECTIC COMPOSITES

Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99

## EUTECTICS

Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99

## EVALUATION

A Methodology for End-to-End Evaluation of Arabic Document Image Processing Software – 469

Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – 453

Defense Logistics: Army and Marine Corps' Body Armor Requirements, Controls, and Other Issues – 425

Distributed Simulation Run Automation Capability for the Navy PRA Testbed – 453

Joint Essential Tasks and a Framework for Evaluation – 136

NAC Off-Vehicle Brake Testing Project – 139

Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – 38

Performance Measurement of the Upgraded D0 Central Track Trigger – 558

Systematic Procedure for Assigning Uncertainties to Data Evaluations – 567

Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140

## EVAPOTRANSPIRATION

Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – 273

## EXCIMER LASERS

Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233

## EXCIMERS

Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233

## EXCITATION

A Multireference Density Functional Approach to the Calculation of the Excited States of Uranium Ions – 87

Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 604

## EXCITONS

Fabrications and Characterizations of ZnO/Zn1-xMgxO Nanorod Quantum Structures – 186

## EXHAUST EMISSION

Diesel Particulate Measurement Research, 2007. Phase 3 – 238

Guidance for Estimating VOC and NOx Emission Changes from MACT Rules – 257

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 – 259

Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 237

Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335

Reduced Exhaust Emissions Gas Turbine Engine Combustor – 39

Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237

The Supreme Court's Climate Change Decision: Massachusetts v. EPA – 263

## EXHAUST GASES

Fuel Property Effects on T700 Exhaust Particulates – 132

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 – 259

Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52

Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 237

Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335

Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237

## EXPERIMENT DESIGN

Computational Experimentation with the Virtual Design Team: Bridging the Chasm between Laboratory and Field Research in C2 – 445

Design of Experiments Study of the Initial Extended Area Protection and Survivability (EAPS) Projectile System – 527

New Column Designs for MicroGC (Preprint) – 197

Preliminary Findings: Design of Experiments University XXI (FY05) Research and Support for the US Army – 621

The Costs of Not Using Green Design in the USAF: Would Using Green Building Design Have Resulted in Life Cycle Cost – 212

## EXPERIMENTATION

Experimenting with C2 Applications and Federated Infrastructures for Integrated Full-Spectrum Operational Environments in Support of Collaborative Planning and Interoperable Execution – 144

## EXPERT SYSTEMS

Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS) – 625

Link Analysis for Dynamic Planning and Scheduling – 502

The Critical Role of Intelligent Software Agents in Enabling Net-Centric Command and Control – 444

## EXPLOITATION

Different Approaches for the Creation and Exploitation of 3D Urban Models – 159

Field Level Computer Exploitation Package – 464

Large Synoptic Survey Telescope and Foundations for Data Exploitation of Petabyte Data Sets – 673

Rapid C4I High Performance Computing for Hyperspectral Imaging Exploitation – 598

## EXPLOSIVES DETECTION

Adaptive and Iterative Processing Techniques for Overlapping Signatures – 556

Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10

Evaluation of airborne Electromagnetic Systems for Detection and Characterization of unexploded ordnance (uXo) – 12

Terahertz Fiber Laser for Explosives Detection – 229

## EXPLOSIVES

Adsorption and Desorption of Dinitrotoluene on Activated Carbon – 91

Characterization Of Commonly Encountered Explosives Using Highfield Asymmetric Waveform Ion Mobility Spectrometry Coupled With Mass Spectrometry – 594

Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10

Insensitive High-Performance Replacements for RDX in Explosive and Propellant Formulations – 59

Role of Thermochemical Decomposition in Energetic Material Initiation Sensitivity and Explosive Performance – 101



## EXPOSURE

A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 375

Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – 255

Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402

Evaluation of Daphnia Magna Neonate Viability under Low Temperature Exposure Conditions – 310

Feasibility of Biomonitoring of Exposure to Permethrin Through Analysis of Long-Lived (Metabolite) Adducts to Proteins – 320

Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379

Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model – 375

Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool – 600

Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 418

NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252

Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373

Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333

Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335

PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – 302

USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling – 277

## EXTERNAL STORE SEPARATION

Advances in Modeling and Simulation Capabilities for Predicting Store Trajectories - Past Success and Future Challenges – 5

## EXTRACTION

Application of Morse Theory to Analysis of Rayleigh Taylor Topology – 569

Automated Information Extraction System (AIES) Capability Enhancement and Support – 614

Critiquing: A Methodology to Extract C2 Expertise – 166

Improving Analysis with Information Extraction Technology – 630

## EXTRASOLAR PLANETS

Creating the Core Conditions of Extrasolar and Solar Giant Planets – 672

High Contrast Imaging Using Adaptive Optics for Extrasolar Planet Detection – 666

## EXTRATERRESTRIAL LIFE

Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – 675

## EXTRATERRESTRIAL RADIATION

Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676

Operational Aspects of Space Radiation Analysis – 676

## EXTREME ULTRAVIOLET RADIATION

EUV Inspection of Reticule Defect Repair Sites – 600

Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool – 600

## EXTREMELY LOW FREQUENCIES

Autonomous Virtual Mobile Nodes – 535

Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121

## EXTRUDING

Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion – 117

## EYE (ANATOMY)

Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233

## FABRICATION

Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237

Compliant, Nanoscale Free-Standing Multilayer Films – 66

Damascene Process for Use in Fabricating Semiconductor Structures Having Micro/Nano Gaps – 213

Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope – 140

Fabrication of Nanoscaled Systems – 229

Fabrications and Characterizations of ZnO/Zn<sub>1-x</sub>Mg<sub>x</sub>O Nanorod Quantum Structures – 186

Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92

Materials and Fabrication Issues for Large Machined Germanium Immersion Gratings – 575

Method for Constructing Antennas from Textile Fabrics and Components – 179

Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – 230

Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint) – 92

New Column Designs for MicroGC (Preprint) – 197

Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196

Surface-Templated Assembly for Mass-Production of ZnO Nanowire-Based Integrated Devices – 89

Tension-Compression Fatigue Behavior of a Carbon Fiber/Epoxy (IM7/EPON 862) Composite Fabricated Using Vacuum Assisted Resin Transfer Molding Process – 85

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

## FABRICS

Method for Constructing Antennas from Textile Fabrics and Components – 179

Permeability Prediction of Three-Dimensional Woven Fabrics – 89

Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89

## FACE (ANATOMY)

Facial Recognition Evaluation Project Passport Office of Canada - The Methodology and Findings – 228

## FAIL-SAFE SYSTEMS

Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 24

## FAILURE ANALYSIS

Classifying Failing States – 528

## FAILURE MODES

Type B Radioactive Material Package Failure Modes and Contents Compliance – 239

## FAILURE

2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – 82

A Theory of Interoperability Failures – 651

Comanche Helicopter Program - A Strategic Failure – 30

- Critical Infrastructure: Control Systems and the Terrorist Threat – 496
- First Principles and Multi-Scale Modeling of the Roles of Impurities and Dopants on Thermal Barrier Coating Failure – 88
- Investigation of the Effect of Fuselage Dents on Compressive Failure Load – 23
- Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 23
- Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667
- FAIRINGS**  
Chamber Core Structures for Fairing Acoustic Mitigation – 50
- FAN BLADES**  
Double Near-Net Forging of Article – 41
- FAR FIELDS**  
Coherence and Polarization Properties of Far Fields Generated by Quasi-Homogeneous Planar Electromagnetic Sources (Postprint) – 602  
Far Field Approximation in the Generalized Geometry Holdup (GGH) Model – 581
- FAR ULTRAVIOLET RADIATION**  
Nonequilibrium Stagnation-Line Radiative Heating for Fire II – 221
- FAST NEUTRONS**  
Superconducting High Resolution Fast-Neutron Spectrometers – 565
- FATIGUE LIFE**  
A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division – 20  
Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – 240  
The Effect of As-Large-As (ALA) Grains on the High-Temperature Fatigue Life of Waspaloy – 117
- FATTY ACIDS**  
Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340
- FAULT TOLERANCE**  
A Practical Example of Applying Application-Driven Design (ADD), Version 2.0 – 545  
Distributed Fault-Tolerant Quality Of Service Routing in Hybrid Directional Wireless Networks – 182  
Exploiting Data-Flow for Fault-Tolerance in a Wide-Area Parallel System – 447  
Fault Tolerance in Autonomous Acoustic Arrays – 185  
Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48
- Fault-Tolerant Parallel Algorithms for Adaptive Matched-Field Processing on Distributed Array Systems – 509
- FEASIBILITY**  
A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – 551  
Feasibility Study of H(sub2)S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California – 259  
Feasibility Study of Variance Reduction in the Logistics Composite Model – 522  
Feasibility Study on Magnetic Content Addressable Memory – 196  
Preliminary Low Frequency Electromagnetic Analysis of a Flux Concentrator – 569  
Single Cell Chromatography, LDRD, Feasibility Study – 105
- FEDERAL BUDGETS**  
The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities – 481
- FEEDBACK CONTROL**  
Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18  
Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187
- FEEDBACK**  
An Approach to Integrating Query Refinement in SQL – 530  
Cooperative Solutions in Multi-Person Quadratic Decision Problems: Finite-Horizon and State-Feedback Cost-Cumulant Control Paradigm – 516  
Skin Temperature Feedback Optimizes Microclimate Cooling – 272
- FEMALES**  
Efficacy of Calcium and Vitamin D Supplementation for the Prevention of Stress Fractures in Female Naval Recruits – 289  
Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens – 405  
The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy – 361
- FERMENTATION**  
Microbial Dynamics during Barley Temp Fermentation – 104
- Ferroelectricity**  
Proceedings of the Symposium on Ferroelectricity and Piezoelectricity (IMRC 2005) – 76
- FERROMAGNETIC MATERIALS**  
Feasibility Study on Magnetic Content Addressable Memory – 196
- FETUSES**  
Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333
- FEVER**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394  
Human Spotted Fever Rickettsial Infections – 386  
Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- FIBER COMPOSITES**  
2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – 82  
Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 16  
Characterization of the Structure-Processing-Performance Relations of Phenylethynyl Phthalic Anhydride Crosslinked Fluorinated Polyimides (AFR-PEPA-N) and Their Carbon Fiber Composites – 84  
Effects of Temperature and Environment on Creep Behavior of an Oxide-Oxide Ceramic Matrix Composite – 103  
Probabilistic Analysis for the Mechanical Properties of Cross-Ply Fiber-Reinforced Composite Laminate (Postprint) – 115  
Tension-Compression Fatigue Behavior of a Carbon Fiber/Epoxy (IM7/EPON 862) Composite Fabricated Using Vacuum Assisted Resin Transfer Molding Process – 85  
Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86
- FIBER LASERS**  
Terahertz Fiber Laser for Explosives Detection – 229
- FIBER OPTICS**  
Assured Reference Technology Research (ARTHR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – 596  
Terahertz Fiber Laser for Explosives Detection – 229

- Thermally Compensated Fiber Bragg Grating Mount – 236
- FIBROBLASTS**  
Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – 301
- FIELD EFFECT TRANSISTORS**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184  
Investigation of Lattice and Thermal Stress in GaN/AlGaIn Field-Effect Transistors – 194  
Novel Organic Field Effect Transistors via Nano-Modification – 197
- FIELD OF VIEW**  
Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – 225
- FIELD STRENGTH**  
Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92
- FIELD TESTS**  
System and Method for Field Testing a Tack Coat Layer – 75
- FIELD THEORY (PHYSICS)**  
Assessment of Detection and Refinement Strategies for de novo Protein Structures using Force Field and Statistical Potentials – 353  
Physical Renormalization of Quantum Field Theories – 556
- FIGHTER AIRCRAFT**  
A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37  
Effects of Using NATEC Services within E-2C and FA-18 Operational Squadrons – 24  
Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 32  
Price vs. Performance: The Value of Next Generation Fighter Aircraft – 25  
Sizing Mobility Readiness Spares Packages for Today's Warfighting Units – 21
- FILLERS**  
Acoustic Identification of Filler Materials in Unexploded Ordnance – 82  
Use of Saltcedar and Utah Juniper as Fillers in Wood-Plastic Composites – 82
- FINANCE**  
Information Security: Federal Deposit Insurance Corporation Needs to Sustain Progress Improving Its Program – 167
- FINANCIAL MANAGEMENT**  
Cooperative Solutions in Multi-Person Quadratic Decision Problems: Finite-Horizon and State-Feedback Cost-Cumulant Control Paradigm – 517  
Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States – 439
- FINE STRUCTURE**  
Resuspension Physics of Fine Particles – 260
- FINITE DIFFERENCE THEORY**  
Summary of LLNL Russian Projects – 573
- FINITE ELEMENT METHOD**  
FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures – 29  
Finite Element Solution: Nonlinear Flapping Beams for Use with Micro Air Vehicle Design – 3  
Numerical Investigation for the Microstructural Effects on the Crack Growth Behavior of Particulate Composite Materials – 79  
Quick-Turn Finite Element Analysis for Plug-and-Play Satellite Structures – 520  
Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Post-print) – 534
- FINITE VOLUME METHOD**  
Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – 515
- FIRE EXTINGUISHERS**  
Firefighting Agent Research, Phase I – 10
- FIRE FIGHTING**  
Firefighting Agent Research, Phase I – 10
- FIRES**  
A Review of the History of Fire Suppression on U.S. DoD Aircraft – 34  
Army Fire Support Investment Framework – 472  
CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 226  
Experimental Characterization of Turbulent Flow Around Cylinder Arrays – 219  
Terrorism Information Management Within the New York City Fire Department: Past, Present and Future – 634
- FIRING (IGNITING)**  
Development of Subscale Fast Cookoff Test – 135
- FISCHER-TROPSCH PROCESS**  
Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – 105
- FSSIONABLE MATERIALS**  
Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash – 580  
Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – 59
- FITTING**  
Comparison of Isoconversional and Model Fitting Approaches to Kinetic Parameter Estimation and Application Predictions – 108  
Techniques for the Statistical Analysis of Observer Data – 524
- FIXED POINTS (MATHEMATICS)**  
Towards Multi Level Optimization. Space Mapping and Manifold Mapping – 433
- FIXED WINGS**  
V-22 Osprey Tilt-Rotor Aircraft – 17
- FLAME RETARDANTS**  
Development and Testing of Flame Retardant Additives and Polymers – 67
- FLAMES**  
A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 113  
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77  
Experimental and Detailed Numerical Studies of Fundamental Flame Properties of Gaseous and Liquid Fuels – 37
- FLAMMABILITY**  
Development and Testing of Flame Retardant Additives and Polymers – 67
- FLAPPING**  
Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4  
Experimental Methods to Characterize Nonlinear Vibration of Flapping Wing Micro Air Vehicles – 32  
Finite Element Solution: Nonlinear Flapping Beams for Use with Micro Air Vehicle Design – 3
- FLIGHT CONTROL**  
QoS Negotiation in Real-Time Systems and its Application to Automated Flight Control – 43
- FLIGHT CREWS**  
Flight Attendant Fatigue – 412  
Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8  
The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8
- FLIGHT FATIGUE**  
Flight Attendant Fatigue – 412
- FLIGHT PATHS**  
A Comparison of Trajectory Determination Approaches for Small UAVs – 11
- FLIGHT SIMULATION**  
Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8  
Helmet-Mounted Displays for Use in Air Force Training and Simulation – 6
- FLIGHT SIMULATORS**  
Visual Simulation S&T: Summary of Accomplishments – 7

## **FLIGHT STRESS (BIOLOGY)**

Flight Attendant Fatigue – 412

## **FLIGHT SURGEONS**

Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415

Johnson Space Center Flight Medicine Clinic Experience – 413

## **FLIGHT TESTS**

Air Force-Navy Team Achieves Important Flight Test Milestone for Responsive Space Lift – 50

F-15B QuietSpike(TradeMark) Aerose-voelastic Flight Test Data Analysis – 35

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

Shuttle Entry Imaging Using Infrared Thermography – 57

Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight – 41

Use of Statistical Tools to Improve Modeling and Simulation of Store Separation – 4

V-22 Osprey Tilt-Rotor Aircraft – 17

## **FLIGHT TRAINING**

Helmet-Mounted Displays for Use in Air Force Training and Simulation – 6

Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 32

The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8

## **FLOATING**

Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214

## **FLOW CHARACTERISTICS**

Characteristics of Runback Ice Accretions and Their Aerodynamic Effects – 1

## **FLOW DISTRIBUTION**

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 227

Dynamic-Active Flow Control - Phase I – 2

Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4

Filtered Rayleigh Scattering Measurements in a Buoyant Flowfield – 544

Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – 216

Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215

Nonequilibrium Stagnation-Line Radiative Heating for Fire II – 220

SparkJet Actuators for Flow Control – 235

Technologies for Propelled Hypersonic Flight, Volume 1 - Subgroup 1: Plug Nozzles – 40

## **FLOW VELOCITY**

Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215

## **FLOW VISUALIZATION**

Dynamic-Active Flow Control - Phase I – 2

## **FLOW**

Dataflow Integration and Simulation Techniques for DSP System Design Tools – 468

The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515

## **FLUCTUATION THEORY**

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 589

## **FLUE GASES**

Removal of Elemental Mercury from a Gas Stream Facilitated by a Non-Thermal Plasma Device. Final Report – 258

## **FLUID DYNAMICS**

Adaptive Identification of Fluid-Dynamic Systems – 215

Gravity-Wave Dynamics in the Atmosphere – 264

Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet – 221

Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – 518

Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions – 217

The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193

Tip Clearance Control Using Plasma Actuators – 16

## **FLUID FLOW**

Controls of Fluid Chemistry on Fracture Growth – 106

Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns – 96

Qualitative Reasoning about Fluids and Mechanics – 446

## **FLUID INJECTION**

Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions – 217

## **FLUID MECHANICS**

Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling – 220

Qualitative Reasoning about Fluids and Mechanics – 446

## **FLUORESCENCE**

Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376

Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems – 354

## **FLUOROPOLYMERS**

Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – 582

Oxygen Plasma Treatment and Deposition of CNx on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121

## **FLUX DENSITY**

Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – 91

Smart Fuel Cell C20-MP Hybrid Fuel Cell Power Source – 249

The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515

## **FLUX (RATE)**

Summary of LLNL Russian Projects – 573

## **FOCAL PLANE DEVICES**

An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 223

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

## **FOG**

A Detailed Study of Advection Sea Fog Formation to Reduce the Operational Impacts Along the Northern Gulf of Mexico – 268

Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270

Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250

Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – 253

## FOOD

Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403

## FORBIDDEN BANDS

Venturing Through the Forbidden Band – 194

## FORBUSH DECREASES

Imaging Interplanetary Disturbances Causing Forbush Decreases – 670

## FORECASTING

A Detailed Study of Advection Sea Fog Formation to Reduce the Operational Impacts Along the Northern Gulf of Mexico – 268

A Weighted Consensus Approach to Tropical Cyclone 96-H and 120-H Track Forecasting – 268

Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – 47

Evaluation of High Density Surface Observations in Complex Terrain and Their Contribution to the MM5 Model – 268

Forecasting Complex Political and Military Events: The Application of Expected Utility to Crisis Situations – 653

Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27

Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8

Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270

Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273

Long-Range Operational Military Forecasts for Afghanistan – 271

Long-Range Operational Military Forecasts for Iraq – 269

Mission Support for the Communications/Navigation Outage Forecast Satellite – 49

Problem representation and variation in the forecasts of 'political experts' – 543

Severe Weather Forecasting for Laughlin AFB, TX – 267

Study of the Utility of NWP Forecast Guidance and Simple Ocean Modeling as a Tool for Planning During Reactive Situations – 269

## FOREIGN POLICY

Building Alternative-Energy Partnerships with Latin America – 249

Foreign Policy Effects on Strategic Communications and the Ability to Influence – 180

The Iran Sanctions Act (ISA) – 593

## FORESTS

Climate Change Impact on Forest Resources. White Paper – 277

## FORGING

Double Near-Net Forging of Article – 41

## FORTTRAN

An Inverse of the Circular Coverage Function – 525

An Inverse of the Elliptic Coverage Function – 525

An Inverse of the Generalized Circular Error Function – 525

An Inverse of the Incomplete Beta Function (F-(Variance Ratio) Distribution Function) – 467

## FOURIER TRANSFORMATION

High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – 72

## FRACTURE MECHANICS

The Effect of Inhomogeneous Plastic Deformation on the Ductility and Fracture Behavior of Age Hardenable Aluminum Alloys – 116

## FRACTURES (MATERIALS)

Controls of Fluid Chemistry on Fracture Growth – 106

Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287

Efficacy of Calcium and Vitamin D Supplementation for the Prevention of Stress Fractures in Female Naval Recruits – 288

Leg Muscle Usage Effects on Tibial Elasticity during Running – 295

Skeletal Complications in Neurofibromatosis Type 1: The Role of Neurofibromin Haploinsufficiency in Defective Skeletal Remodeling and Bone Healing in NF1 – 377

## FRACTURING

Controls of Fluid Chemistry on Fracture Growth – 106

Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287

Leg Muscle Usage Effects on Tibial Elasticity during Running – 295

Molecular Mechanisms of Soft Tissue Regeneration and Bone Formation in Mice: Implications in Fracture Repair and Wound Healing in Humans – 298

## FRAGMENTATION

Modeling Damage and Fragmentation in Concrete – 122

## FRAGMENTS

fRMSDPred: Predicting Local RMSD Between Structural Fragments Using Sequence Information – 369

## FRAMING CAMERAS

An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 223

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

## FREE ELECTRON LASERS

Fermi Timing and Synchronization System – 606

Gas Detector LCLS Engineering Specifications Document – 573

Injector Test Facility for the LCLS. Executive Summary – 566

## FREEZING

Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270

## FREQUENCIES

Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 225

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 223

Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters – 113

## FREQUENCY DISTRIBUTION

Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224

## FRETTING

Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44

## FRICTION REDUCTION

In-Track Demonstration of Laser-Treated Rail to Reduce Friction and Wear – 74

## FRICTION

Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – 591

## FUEL CELLS

Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249

Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244

Smart Fuel Cell C20-MP Hybrid Fuel Cell Power Source – 249

## FUEL COMBUSTION

Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120

## FUEL CONSUMPTION

Army Fuels: Policies, Regulations, and Executive Orders – 129

Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244

## FUEL OILS

No Further Action Decision Under CERCLA, Fort Devens Study Area 58, Buildings 2648 and 2650 Fuel Oil Spills – 128

## FUEL PRODUCTION

Constraints on JP-900 Jet Fuel Production Concepts – 128

## FUEL TANK PRESSURIZATION

Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – 97

## FUEL TANKS

A Review of the History of Fire Suppression on U.S. DoD Aircraft – 34

## FUELS

Army Fuels: Policies, Regulations, and Executive Orders – 129

In the Midst of a Fuels Evolution - An Army Perspective – 38

Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100

Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120

No Further Action Decision Under CERCLA, Fort Devens Study Area 58, Buildings 2648 and 2650 Fuel Oil Spills – 128

Summary of the Study of E85 Fuel in the USA, Winter 2006-2007 – 257

Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243

## FULLERENES

Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorene-carbonyl Methano[60]Fullerene Pentaads – 88

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

Utility of DF-1 for Radioprotection in Lymphocytes – 420

## FUMIGATION

Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 32

## FUNCTION GENERATORS

Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer – 513

## FUNCTIONAL ANALYSIS

Functional Genomic Analysis of Breast Cancer Cell Tumorigenicity Using a Novel Gene Silencing Resource – 325

## FURNACES

Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – 59

## FUSELAGES

Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing – 36

Investigation of the Effect of Fuselage Dents on Compressive Failure Load – 23

## FUSION REACTORS

Summary Report--FY2006 ITER Work Accomplished – 575

Visible and Infrared Optical Design for the ITER Upper Ports – 599

## GALAXIES

All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets – 674

## GALERKIN METHOD

Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – 515

L2 Stability Analysis of the Central Discontinuous Galerkin Method and a Comparison between the Central and Regular Discontinuous Galerkin Methods – 523

## GALLIUM NITRIDES

GaN Wide Band Power Integrated Circuits (Preprint) – 96

Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192

Pyroelectric A1GaN/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 96

Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196

## GALVANIC SKIN RESPONSE

Galvanic Skin Response as a Measure of Soldier Stress – 410

## GAME THEORY

Automated Run-Time Mission and Dialog Generation – 632

Updating Optimal Decisions Using Game Theory and Exploring Risk Behavior Through Response Surface Methodology – 534

Using Gaming and Agent Technology to Explore C2 – 537

## GAMMA RAY ASTRONOMY

Exploring the High Energy Universe: GLAST Mission and Science – 667

## GAMMA RAY BURSTS

Exploring the High Energy Universe: GLAST Mission and Science – 667

## GAMMA RAY TELESCOPES

Exploring the High Energy Universe: GLAST Mission and Science – 667

## GAMMA RAYS

Exploring the High Energy Universe: GLAST Mission and Science – 667

High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 556

Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations – 370

Self Attenuation Correction for Holdup Measurements. An Historical Perspective – 581

Utility of DF-1 for Radioprotection in Lymphocytes – 420

## GANGLIA

Structural Studies on Intact Clostridium Botulinum Neurotoxins Complexed with Inhibitors Leading to Drug Design – 304

## GARMENTS

Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments – 205

Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83

## GAS ANALYSIS

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

## GAS CHROMATOGRAPHY

A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 113

A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 113

## GAS DETECTORS

Gas Detector LCLS Engineering Specifications Document – 574

Pyroelectric A1GaN/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 96

## GAS FLOW

IHRPRT Improvements to the Solid Performance Program (SPP) – 542

## GAS GIANT PLANETS

Creating the Core Conditions of Extrasolar and Solar Giant Planets – 672

## GAS IONIZATION

A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 113

## **GAS STREAMS**

Removal of Elemental Mercury from a Gas Stream Facilitated by a Non-Thermal Plasma Device. Final Report – 258

## **GAS TURBINE ENGINES**

Double Near-Net Forging of Article – 41

Gas Turbine Engine Including a Low Pressure Sump Seal Buffer Source and Thermally Isolated Sump – 41

Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Post-print) – 23

Reduced Exhaust Emissions Gas Turbine Engine Combustor – 39

## **GAS TURBINES**

An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems – 60

## **GASEOUS FUELS**

Experimental and Detailed Numerical Studies of Fundamental Flame Properties of Gaseous and Liquid Fuels – 38

## **GASES**

A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Pre-print) – 113

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

Pyroelectric A1GaN/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 96

## **GASIFICATION**

Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor. Semi-Annual Technical Progress Report for April 1, 2006 to September 30, 2006 – 68

## **GASOLINE**

Guidelines for Oxygenated Gasoline Credit Programs under Section 211(m) of the Clean Air Act as Amended – 252

## **GASTROINTESTINAL SYSTEM**

Cell-surface Alpha-glucan in *Campylobacter jejuni* 81-176 – 402

Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386

## **GEARS**

High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction – 35

## **GENE EXPRESSION**

Disruption of the Circadian Rhythms of Gene Expression and the Development of Breast Cancer – 314

FGFR4 Downregulation of Cell Adhesion in Prostate Cancer – 376

Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – 329

High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain – 409

Microarray Analysis of Transposon Insertion Mutants in *Bacillus Anthracis*: Global Identification of Genes Required for Sporulation and Germination – 335

Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

The Effect of COX-2 Inhibitors on the Aromatase Gene (CYP19) Expression in Human Breast Cancer – 347

Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404

## **GENE THERAPY**

Control of DNA Dehybridization via Nanoparticle Antennas for Antisense Gene Therapy – 383

Endothelial Progenitors as Vectors for Systemic Gene Therapy of Breast Cancer – 332

Vasculature-Specific Adenovirus Vectors for Gene Therapy of Prostate Cancer – 352

## **GENERAL AVIATION AIRCRAFT**

Homeland Security: Protecting Airspace in the National Capital Region – 25

## **GENERAL OVERVIEWS**

ISO/IEC JTC1 SC37 Overview – 474

## **GENES**

BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – 407

Cloning and Sequence Analysis of the 22-kDa Antigen Genes of *Orientia tsutsugamushi* Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – 399

Deciphering the Molecular Mechanisms of Breast Cancer – 324

Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer – 364

Detection of *Staphylococcus aureus* Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340

Disruption of the Circadian Rhythms of Gene Expression and the Development of Breast Cancer – 313

Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes – 341

Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379

Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles – 381

High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain – 409

HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate – 290

Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285

Identification, Cloning, Expression, and Characterization of the Gene for *Plasmodium knowlesi* Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389

Mechanism of Tumor Metastasis Suppression by the KA11 Gene – 318

Microarray Analysis of Transposon Insertion Mutants in *Bacillus Anthracis*: Global Identification of Genes Required for Sporulation and Germination – 335

Molecular Mechanisms of Soft Tissue Regeneration and Bone Formation in Mice: Implications in Fracture Repair and Wound Healing in Humans – 298

PARK2, a Large Common Fragile Site Gene, is Part of a Stress Response Network in Normal Cells That is Disrupted During the Development of Ovarian Cancer – 359

Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy – 316

Transcriptional Analysis of In vivo *Plasmodium yoelii* Liver Stage Gene Expression – 404

## **GENETIC ALGORITHMS**

A Comparison of Trajectory Determination Approaches for Small UAVs – 11

## **GENETICS**

2006 In Vitro Biology Meeting. Volume 42 – 291

- Deciphering the Molecular Mechanisms of Breast Cancer – 324
- Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340
- Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum – 357
- Expression and Genomic Profiling of Minute Breast Cancer Samples – 281
- Genetic and Molecular Analysis of the Mechanisms by Which TSC Regulates Neuronal Differentiation – 321
- Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 352
- Methods and Program Products for Optimizing Problem Clustering – 435
- Modeling Phenotypes of Tuberous Sclerosis in the Mouse – 310
- Protein Transduction Based Therapies for Breast Cancer – 315
- GENOME**
- A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389
- DNA Damage and Genomic Instability Induced by Inappropriate DNA Replication – 336
- Evaluation of Genomic Instability in the Abnormal Prostate – 405
- Expression and Genomic Profiling of Minute Breast Cancer Samples – 281
- Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379
- Genomic Approaches for Detection and Treatment of Breast Cancer – 346
- Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles – 381
- Prognostic Significance of Telomere Attrition in Ductal Carcinoma in Situ of the Breast – 390
- GEOCHEMISTRY**
- Infrared Spectroscopy and Stable Isotope Geochemistry of Hydrated Silicate Glasses – 254
- GEODESIC LINES**
- Development of a Geospatial Data-Sharing Method for Unmanned Vehicles Based on the Joint Architecture for Unmanned Systems (JAUS) – 662
- GEOGRAPHIC INFORMATION SYSTEMS**
- Integration of SATURN System and VGIS – 530
- The Multidimensional Measurements of Geographic Information Systems (GIS) Effectiveness in Crisis Management – 611
- GEOGRAPHY**
- Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node – 642
- GEOMETRY**
- Sharp-Looking Geometric Partitioning – 199
- GERMANIUM**
- Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP<sub>2</sub> – 234
- Materials and Fabrication Issues for Large Machined Germanium Immersion Gratings – 575
- GERMINATION**
- Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335
- Role of Superoxide in the Germination of Bacillus Anthracis Endospores – 380
- GEYSERS**
- Feasibility Study of H<sub>2</sub>S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California – 259
- GIRDERS**
- Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – 240
- GLASS**
- Infrared Spectroscopy and Stable Isotope Geochemistry of Hydrated Silicate Glasses – 254
- Preliminary Assessment of Stroboscopic Shutter Glasses on Motion Sickness in Helicopter Passengers – 30
- GLASSY CARBON**
- Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – 100
- GLIDERS**
- Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – 505
- Interim Heavy Airlift: Sea Base Logistics Glider Concept – 14
- Simulating Candidate Missions for a Novel Glider Unmanned Underwater Vehicle – 464
- GLOBAL POSITIONING SYSTEM**
- Determining Logistics Ground Support Manpower Requirements for a Reusable Military Launch Vehicle – 58
- Global Climate Change: National Security Implications – 266
- Sustaining Air Force Space Systems: A Model for the Global Positioning System – 26
- GLOBULINS**
- Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles – 381
- Human Spotted Fever Rickettsial Infections – 386
- GLUCOSE**
- Artificial Pancreas for Control of BG and Insulin Levels in Hospitalized Patients with Diabetes and Stress Hyperglycemia – 328
- Maintenance of Glucose Homeostasis through Acetylation of the Metabolic Transcriptional Coactivator PGC-1 $\alpha$  – 343
- Third Annual Clinical Diabetes Technology Meeting – 647
- GLUONS**
- National Software Infrastructure for Lattice Quantum Chromodynamics – 582
- GOGGLES**
- Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – 225
- GOVERNMENT PROCUREMENT**
- Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426
- VXX Presidential Helicopter: Background and Issues for Congress – 29
- GRADIENTS**
- Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing – 568
- Integration of Soluble and Adhesive Gradient Signals in Directed Cell Migration – 310
- GRAFTING**
- Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72
- Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease – 343
- GRAIN BOUNDARIES**
- Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint) – 118
- GRAIN SIZE**
- The Effect of As-Large-As (ALA) Grains on the High-Temperature Fatigue Life of Waspaloy – 117
- GRAPH THEORY**
- A Strong Zero-One Law for Connectivity in One-Dimensional Geometric Random Graphs With Non-Vanishing Densities – 527



- Pattern Analysis of Directed Graphs Using DEDICOM: An Application to Enroll Email – [439](#)
- Time varying Reeb Graphs. A Topological Framework Supporting the Analysis of Continuous Time varying Data – [438](#)
- GRAPHIC ARTS**
- Pictorial Display Design to Enhance Spatial Awareness of Operators in Unmanned Aviation – [28](#)
- GRAPHICAL USER INTERFACE**
- An Experimental 3-D Framework to Support C2 – [458](#)
- Towards a Computational Model of Sketching – [450](#)
- WABED Model in the SMS: Part 2. Graphical Interface – [470](#)
- GRAPHITE-EPOXY COMPOSITES**
- 2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – [82](#)
- GRAPHS (CHARTS)**
- Semantic Graph Query Language – [434](#)
- GRASSLANDS**
- Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – [252](#)
- GRATINGS (SPECTRA)**
- Compact Imaging Spectrometer Utilizing Immersed Gratings – [602](#)
- Electro-Optic Array Interface – [213](#)
- GRAVITATIONAL EFFECTS**
- Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – [411](#)
- Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint) – [55](#)
- Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – [418](#)
- GRAVITATIONAL PHYSIOLOGY**
- Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – [417](#)
- Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – [411](#)
- Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – [415](#)
- GRAVITY WAVES**
- Gravi-Leptogenesis: Leptogenesis from Gravity Waves in Pseudo-Scalar Driven Inflation Models – [673](#)
- Gravity-Wave Dynamics in the Atmosphere – [264](#)
- Infra-Gravity Wave Input Toolbox (IGWT): User's Guide – [470](#)
- On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – [263](#)
- GRAZING INCIDENCE**
- High Efficiency Grazing Incidence Pumped X ray Laser – [601](#)
- GREASES**
- Decomposition Kinetic of Greases by Thermal Analysis – [127](#)
- Development of ASTM Precision Bearing Grease Guide – [64](#)
- GREENHOUSE EFFECT**
- Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 – [259](#)
- The Supreme Court's Climate Change Decision: Massachusetts v. EPA – [263](#)
- U.S. Climate Change Technology Program: Vision and Framework for Strategy and Planning – [258](#)
- GRID COMPUTING (COMPUTER NETWORKS)**
- Grid Computing for High Performance Computing (HPC) Data Centers – [452](#)
- GROUND HANDLING**
- Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing – [36](#)
- GROUND TRUTH**
- Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – [262](#)
- GROUND WATER**
- Crevice Repassivation Potentials for Alloy 22 in Simulated Concentrated Ground Waters – [119](#)
- Database Dictionary for Ethiopian National Ground-Water Database (ENGDA) Data Fields – [631](#)
- Electronically Induced Redox Barriers for Treatment of Groundwater – [198](#)
- Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD – [139](#)
- Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – [138](#)
- Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – [138](#)
- No Further Action Decision Under CERCLA Study Area 43F Historic Gas Station Sites Fort Devens, Massachusetts – [94](#)
- Perchlorate Removal, Destruction, and Field Monitoring Demonstration – [101](#)
- Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons – [101](#)
- Quarterly Groundwater Monitoring First Quarter Sampling Results fort Dix, New Jersey – [61](#)
- GROUP DYNAMICS**
- A Quantum Approach to Multi-Agent Systems (MAS), Organizations, and Control – [535](#)
- Information Age Architectures Must Be Enterprise Architecture – [171](#)
- GROUP THEORY**
- Database Manipulations Using Group Theory – [436](#)
- GROUT**
- Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – [45](#)
- GROWTH**
- Role of Growth Hormone in Prostate Cancer – [342](#)
- GUINEA PIGS**
- Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – [110](#)
- Effects of Sarin on the Operant Behavior of Guinea Pigs – [382](#)
- Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – [330](#)
- GULF OF MEXICO**
- A Detailed Study of Advection Sea Fog Formation to Reduce the Operational Impacts Along the Northern Gulf of Mexico – [268](#)
- GULFS**
- Federally Sponsored Health Care Research Gulf War Illnesses and Beyond – [400](#)
- Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – [350](#)
- GYROSCOPES**
- Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope – [140](#)
- Fine Pointing of Military Spacecraft – [51](#)
- Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – [667](#)
- HABITABILITY**
- Revitalization of Space-Related Human Factors, Environmental and Habitability Data – [425](#)
- HABITATS**
- A Study of the Attraction Forces of Lunar Dust Simulant – [664](#)
- Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – [378](#)
- Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – [250](#)
- HADRONS**
- AdS/CFT and QCD – [572](#)
- B0 to K0K0bar and Other Hadronic b to d Decays – [567](#)

- Charmless B Decays – 577
- Measurements of the B Production Cross Section in Proton-Antiproton Collisions at  $s^{1/2} = 1.96$  TeV using Semileptonic Decays of b Hadrons – 586
- Preliminary Study of Using ‘Pipetron’-Type Magnets for a Pre-Accelerator for the LHC – 566
- Some Aspects of Hadron-Hadron Collisions in High Energy Interactions (B(O)s Mixing Oscillations in Semileptonic Decay at D0 Experiment) – 557
- Spectroscopy and Decay of B Hadrons at the Tevatron – 576
- HALL EFFECT**
- Characterization of a Hall Effect Thruster Using Thermal Imaging – 608
- Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52
- HALL THRUSTERS**
- Characterization of a Hall Effect Thruster Using Thermal Imaging – 608
- Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52
- HALOGENS**
- Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapic Self-complementary Tecton Tailored to Halogen Bonding – 98
- HALOS**
- Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – 669
- HAMILTONIAN FUNCTIONS**
- Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates – 513
- HANDBOOKS**
- Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183
- Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425
- HANGARS**
- Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan ASSF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI – 87
- HARDNESS**
- Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99
- HARMONIC GENERATIONS**
- Nonclassical Properties of Pulsed Second-Subharmonic Generation in Photonic-Band-Gap Structures – 196
- HARNESSES**
- Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53
- HAZARDOUS MATERIALS**
- U.S. Army Toxic and Hazardous Materials Agency Quality Assurance Program – 93
- HAZARDS**
- A System of Systems Interface Hazard Analysis Technique – 541
- Aircraft Downwind Hazard Distance After a Chemical Attack – 34
- Health Effects Support Document for Terbacil – 73
- NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252
- Nuclear Safety: DOE’s Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened – 131
- HEAD DOWN TILT**
- Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 419
- HEALING**
- A Geometric Investigation of Acoustical Wavefront Scattering and Healing Induced by Ocean Internal Waves – 588
- Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287
- Skeletal Complications in Neurofibromatosis Type 1: The Role of Neurofibromin Haploinsufficiency in Defective Skeletal Remodeling and Bone Healing in NF1 – 377
- Vulnerable Factors to Improve Bone Healing – 347
- HEALTH**
- A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 340
- A Collaborative Study of Sleep, Performance and Health Relationships – 382
- Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 336
- Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – 255
- Automating Behavioral Health Screening - Addressing Risk Communication Electronically – 306
- Behavioral Health Program Element – 417
- Can a Self-Diagnostic Digitally Controlled Pacemaker/Defibrillator Device be Used for Alerting Military Personnel When a Soldier Health Condition Becomes Compromised Out in the Field – 426
- COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care – 368
- Consumer Control of Electronic Personal Health Information: What Does It Mean. Why Is it Important. A Report on Three Consumer Focus Group Meetings Convened October 2005 by the Office of the Assistant Secretary for Planning and Evaluation – 662
- Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
- Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – 417
- Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233
- Exploration Medical Capability (ExMC) Program – 417
- Federally Sponsored Health Care Research Gulf War Illnesses and Beyond – 400
- FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures – 29
- Final Site Safety and Health Plan for Phase II RCRA Facility Investigation Fort Benjamin Harrison Marion County, Indiana – 308
- Health Information Exchange in Post-Acute and Long-Term Care – 663
- HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397
- Medical Reserve Corps Volunteers’ Ability and Willingness to Report to Work for the Department of Health During Catastrophic Disasters – 312
- National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397
- Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Post-print) – 23
- NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252
- Nuclear Safety: DOE’s Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened – 131

PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498

Public Health Assessment for Galena Airport (A.K.A. USAF Galena Air Force Station), Galena, Yukon-Koyukuk County, Alaska, May 21, 2007. EPA Facility ID: AK9570028655 – 257

Risk Assessment: Evidence Base – 529

Selenium and Breast Cancer Chemoprevention – 339

Smog: Who Does it Hurt. What You Need to Know about Ozone and Your Health – 259

Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – 415

Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers – 312

Technology Review of Smart Sensors with Wireless Networks for Applications in Hazardous Work Environments – 168

Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360

Testing the Effectiveness of the North Shore - LIJ Health System's Bioterrorism Response Program to Identified Surveillance Data – 345

The Demise of Russian Health Capital: The Continuity of Ineffective Government Policy – 323

Translational Research from an Informatics Perspective – 416

Truck Driver Occupational Safety and Health. 2003 Conference Report and Selective Literature Review – 238

Utility of DF-1 for Radioprotection in Lymphocytes – 420

## HEARING

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630

## HEART DISEASES

Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360

## HEART RATE

Skin Temperature Feedback Optimizes Microclimate Cooling – 272

## HEAT EXCHANGERS

High Temperature Heat Exchanger Development – 216

## HEAT FLUX

Development of Subscale Fast Cookoff Test – 135

Experimental and Numerical Investigations of RP-2 Under High Heat Fluxes – 130

Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – 437

Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – 130

## HEAT GENERATION

Heat Generation during Overcharge in Sealed Cells – 248

## HEAT MEASUREMENT

Design and Application of the Reconstruction Software for the BaBar Calorimeter – 584

## HEAT PIPES

Improving Thermal Performance of Radioactive Material Drum Type Packages by Using Heat Pipes – 131

## HEAT RESISTANT ALLOYS

Recrystallization and Grain-Growth Behavior of a Nickel-Base Superalloy During Multi-Hit Deformation (Preprint) – 118

The Effect of As-Large-As (ALA) Grains on the High-Temperature Fatigue Life of Waspaloy – 117

## HEAT SHIELDING

Analysis of the Thermal Shielding Properties of Camouflage Materials Brief – 192

Analysis of the Thermal Shielding Properties of Camouflage Materials – 191

## HEAT STORAGE

Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237

## HEAT TRANSFER COEFFICIENTS

Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59

## HEAT TRANSFER

Code Validation of CFD Heat Transfer Models for Liquid Rocket Engine Combustion Devices – 217

Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – 437

Numerical Analysis of Chamber Wall Heat Transfer in a GH2/GO2 Sub-Scale Combustor – 98

Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58

## HEATING

Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – 431

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

## HEAT

Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 82

## HEAVY ELEMENTS

LDRD Final Report: Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057) – 563

## HEIGHT

A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 516

Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica – 240

## HELICOPTER ENGINES

Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – 39

## HELICOPTERS

Comanche Helicopter Program - A Strategic Failure – 30

Military Helicopter Modernization: Background and Issues for Congress – 28

Preliminary Assessment of Stroboscopic Shutter Glasses on Motion Sickness in Helicopter Passengers – 30

Solutions Analysis for Helicopter Brownout – 33

VXX Presidential Helicopter: Background and Issues for Congress – 29

## HELIOSPHERE

Acceleration and Propagation in the Heliosphere – 670

## HELIUM

Feasibility of Measuring 3He Bubble Diameter Populations in Deuterium-Tritium Ice Layers Using Mie Scattering – 573

## HELMET MOUNTED DISPLAYS

Helmet-Mounted Displays for Use in Air Force Training and Simulation – 6

Visual Simulation S&T: Summary of Accomplishments – 7

## HELMETS

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630

## HEMATOLOGY

Mechanisms of Disease Persistence in Chronic Myelogenous Leukemia (CML) – 318

## HEMOGLOBIN

A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395

Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385

## HEMORRHAGES

Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394

- The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314
- HEPARINS**  
The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402
- HEPATITIS**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 404
- HERMETIC SEALS**  
Microsystem Enclosure and Method of Hermetic Sealing – 71
- HETEROCYCLIC COMPOUNDS**  
PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – 303
- HETEROGENEITY**  
Key Establishment in Heterogeneous Self-Organized Networks – 484  
Symposium on Nano- and Micro-Scale Mechanics of Engineering Materials – 660  
Symposium Q: Magnetic Thin Films, Heterostructures, and Device Materials – 197  
The Benefit of Ontologies for Interoperability of CCIS. (Easy, Quick and Cheap Solutions are Impossible, if Semantics of CCIS are Affected.) – 620
- HEURISTIC METHODS**  
A Heuristic Design Information Sharing Framework for Hard Discrete Optimization Problems – 542  
Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node – 641  
Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 32
- HIERARCHIES**  
A High Order WENO Scheme for a Hierarchical Size-Structured Model – 549  
A Model for Effective Organization and Communication of Homeland Security Activity at the State Level – 157  
Charge Transfer Nanocomposites: The Effects of Scale-Hierarchy – 111
- HIGGS BOSONS**  
Search for Higgs at CDF – 564  
Weak Mixing and Rare Decays in the Littlest Higgs Model – 563
- HIGH ALTITUDE**  
High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments – 554
- HIGH ELECTRON MOBILITY TRANSISTORS**  
GaN Wide Band Power Integrated Circuits (Preprint) – 96  
Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95  
Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192  
Pyroelectric AlGaN/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 96
- HIGH ENERGY INTERACTIONS**  
Combined muon-neutrino and electron-neutrino Oscillation Search at Mini-BooNE – 558  
First NNLL Prediction of  $B(\text{bar}B \text{ right arrow } Xs \text{ gamma})$  – 567  
HEND: A Database for High Energy Nuclear Data – 559  
New Results on  $X(3872)$  from CDF – 585  
Overview of the Pulse Line Ion Accelerator – 577  
Science & Technology Review January/February 2007 – 575  
Some Aspects of Hadron Hadron Collisions in High Energy Interactions ( $B(O)(s)$  Mixing Oscillations in Semileptonic Decay at D0 Experiment) – 557  
Some Searches for New Physics with the D0 Detector – 585  
W + Jet Production at CDF – 585
- HIGH FREQUENCIES**  
Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227
- HIGH LEVEL LANGUAGES**  
Next Generation Systems Languages – 455
- HIGH POLYMERS**  
High Performance Polymer Memory and Its Formation – 210
- HIGH POWER LASERS**  
High-Energy Laser Weapon Integration with Ground Vehicles – 234
- HIGH PRESSURE**  
Composite Materials Containing a Nanostructured Carbon Binder Phase and High Pressure Process for Making the Same – 83
- HIGH RESOLUTION**  
A Verification of Optical Depth Retrievals From High Resolution Satellite Imagery – 225  
An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222  
Automating the Shadow Method for Aerosol Optical Depth Retrieval – 462
- Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592  
Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222  
Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144  
High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350  
High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – 71  
High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133  
High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 556  
Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – 675  
New Strategic Plan Takes the ALS into the Future – 576  
Optical and Radio Frequency Refractivity Fluctuations from High Resolution Point Sensors: Sea Breezes and Other Observations – 554  
Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441  
Superconducting High Resolution Fast-Neutron Spectrometers – 564  
Very High Resolution SAR and Multichannel SAR/MTI – 175  
X-Ray Absorption Edge Detector for High-Resolution Measurement of Undulator Effective K-Parameter – 577
- HIGH REYNOLDS NUMBER**  
Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4
- HIGH SPEED**  
An Evaluation of High Velocity Wear – 142  
Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – 216  
High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77  
High-Speed-/Hypersonic-Weapon-Development-Tool Integration – 22

Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer – 513

Multicast Performance Analysis for High-Speed Torus Networks – 484

#### HIGH TEMPERATURE GASES

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

#### HIGH TEMPERATURE SUPERCONDUCTORS

Synthesis of One-dimensional Nano-sized Defects in High Tc Superconductor – 552

#### HIGH TEMPERATURE

A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184

Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear – 80

High Temperature Heat Exchanger Development – 215

High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor – 119

The Effect of As-Large-As (ALA) Grains on the High-Temperature Fatigue Life of Waspaloy – 117

#### HIGH VOLTAGES

Final Task Report on NRF Measurements of Photon Scattering Resonances in Plutonium at the High Voltage Research Laboratory of MIT – 561

Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses – 203

#### HIGHWAYS

Research Plan for Measuring Noise Levels in Highway Pavements in Texas – 259

#### HISTOLOGY

Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes – 341

Integration of Anatomic and Pathogenic Bases for Early Lung Cancer Diagnosis – 506

Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313

#### HISTORIES

Military Airpower: A Revised Digest of Airpower Opinions and Thoughts – 14

Self Attenuation Correction for Holdup Measurements. An Historical Perspective – 581

#### HOMEOSTASIS

Maintenance of Glucose Homeostasis through Acetylation of the Metabolic Transcriptional Coactivator PGC-1alpha – 343

#### HOMING DEVICES

Integrated Sensing and Processing (ISP) Phase 2: Demonstration and Evaluation for Distributed Sensor Networks and Missile Seeker Systems – 515

#### HORIZON

Cooperative Solutions in Multi-Person Quadratic Decision Problems: Finite-Horizon and State-Feedback Cost-Cumulant Control Paradigm – 517

Defense Horizons. I-Power: The Information Revolution and Stability Operations. Number 55 – 619

#### HORMONES

A Novel Mechanism of Androgen Receptor Action – 288

Differential Mechanisms of Androgen Resistance – 313

Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on Hormonal Responsiveness of Breast Cancer – 362

Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – 329

Identifying Molecular Factors in Androgen Receptor Nuclear Export – 282

Knockout AR in Prostate – 280

Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – 324

Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer – 302

Role of Growth Hormone in Prostate Cancer – 342

Selective Androgen Receptor Downregulators (SARDs): A New Prostate Cancer Therapy – 303

Studies of Prostate Tumor Development Via CRE/LOXP Technology – 309

Unique Approaches to Androgen Effects on Prostate Cancer – 334

#### HOSPITALS

Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

Hospital Quality Data: HHS Should Specify Steps and Time Frame for Using Information Technology to Collect and Submit Data – 428

#### HOT ISOSTATIC PRESSING

Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint) – 92

#### HOUSTON (TX)

Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 256

#### HUBBLE SPACE TELESCOPE

Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667

#### HUMAN BEINGS

Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313

Short-Term Exercise and Prostate Cancer Prevention in African American Men – 359

#### HUMAN BODY

Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10

#### HUMAN FACTORS ENGINEERING

Anthropometric Accommodation in Space Suit Design – 424

Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – 422

Behavioral Health Program Element – 417

Experimentation with Evolving C2 Operation Centers - Implications for the Human Element – 137

Eyekon: Distributed Augmented Reality for Soldier Teams – 655

Human Engineering Design Data Digest – 22

Human Error Investigation Software Tool (HEIST) – 427

Human Factors and Privacy – 476

Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel – 424

Human Factors Evaluation of the High Mobility Artillery Rocket System (HIMARS) in the Combined HIMARS-Guided Multiple Launch Rocket System (GMLRS) Initial Operational Test – 423

Human Factors Evaluation of the XM30 Guided Multiple Launch Rocket System (GMLRS) in the Combined High Mobility Artillery Rocket System (HIMARS)-GMLRS Initial Operational Test – 423

Human Systems Integration Assessment of Network Centric Command and Control – 421

Privacy and Biometrics: The Human Factors – 477

- Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425
- Usability and Acceptability of Biometric Security Systems – 473
- HUMAN IMMUNODEFICIENCY VIRUS**
- Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- HUMAN PERFORMANCE**
- ‘How Much is a Pound of C4ISR Worth?’ An Assessment methodology to Evolve Network Centric Measures and Metrics for Application to FORCenet – 173
- Human Error Investigation Software Tool (HEIST) – 427
- Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503
- HUMAN-COMPUTER INTERFACE**
- Method and System for Interactive Modeling of High-Level Network Performance with Low-Level Link Design – 436
- HURRICANES**
- Hurricane Katrina: Lessons for Army Planning and Operations – 164
- Survey of Hurricane Katrina and Hurricane Rita Contracts and Grants. Public Release – 279
- The Chaos of Katrina – 267
- HYBRID STRUCTURES**
- The Hybrid Tree: An Index Structure for High Dimensional Feature Spaces (Preprint) – 530
- HYDRAULIC FLUIDS**
- Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – 123
- HYDRAULICS**
- A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California – 222
- HYDRAZINES**
- Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- HYDROCARBONS**
- Development of ASTM Precision Bearing Grease Guide – 64
- High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77
- Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78
- No Further Action Decision Under CERCLA, Study Area 43P Historic Gas Station Sites, Fort Devens, Massachusetts – 62
- Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons – 101
- HYDRODYNAMICS**
- Characterization of VSW Environment for UUV-N Operations – 214
- High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133
- Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – 505
- Studies on Three-Dimensional Slamming on Slender Ships – 221
- HYDROGEN PEROXIDE**
- Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 32
- HYDROGEN PRODUCTION**
- Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor. Semi-Annual Technical Progress Report for April 1, 2006 to September 30, 2006 – 68
- Hydrogen Technology Research at the Savannah River National Laboratory. Center for Hydrogen Research and the Hydrogen Technology Research Laboratory – 109
- HYDROGEN SULFIDE**
- Conversion of Hydrogen Sulfide in Coal Gases to Liquid Elemental Sulfur with Monolithic Catalysts. (Annual Report, October 1, 2005-September 30, 2006) – 107
- HYDROGEN**
- Emerging Energy Requirements for Future C4ISR – 244
- Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – 97
- Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor. Semi-Annual Technical Progress Report for April 1, 2006 to September 30, 2006 – 68
- Storage, Generation, and Use of Hydrogen – 69
- HYDROGRAPHY**
- Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407
- HYDROLOGY**
- CLMT2 User’s Guide: A Coupled Model for Simulation of Hydraulic Processes from Canopy to Aquifer – 276
- HYDROLYSIS**
- Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374
- Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – 384
- HYDROPHOBICITY**
- Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79
- HYPERGLYCEMIA**
- Artificial Pancreas for Control of BG and Insulin Levels in Hospitalized Patients with Diabetes and Stress Hyperglycemia – 328
- HYPERSONIC AIRCRAFT**
- Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight – 41
- HYPERSONIC BOUNDARY LAYER**
- Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4
- HYPERSONIC FLIGHT**
- Technologies for Propelled Hypersonic Flight, Volume 2 - Subgroup 2: Scram Propulsion – 41
- Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight – 41
- Technologies for Propelled Hypersonic Flight – 40
- HYPERSONIC FLOW**
- Direct Numerical Simulation and Experimental Validation of Hypersonic Boundary-Layer Receptivity and Instability – 512
- Quantifying Non-Equilibrium in Hypersonic Flows Using Entropy Generation – 219
- Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – 430
- HYPERSONIC INLETS**
- Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet – 221
- HYPERSONIC SPEED**
- An Evaluation of High Velocity Wear – 142
- HYPERSONIC VEHICLES**
- Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237
- High-Speed-/Hypersonic-Weapon-Development-Tool Integration – 22
- Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – 21
- HYPERSONICS**
- Boundary Layer Transition Experiments in Support of the Hypersonics Program – 1
- Direct Numerical Simulation and Experimental Validation of Hypersonic Boundary-Layer Receptivity and Instability – 512

- Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – 437
- High-Speed-/Hypersonic-Weapon-Development-Tool Integration – 22
- HYPOTENSION**
- The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314
- HYPOTHERMIA**
- Far Forward Treatment of Hemorrhagic Shock – 378
- Hypothermia Induction and Recovery in Free-Ranging Rats – 409
- HYPOTHESES**
- Army Intelligence Analysis and Interpretation: Assessing the Utility and Limitations of Computational Diagnostic Reasoning – 652
- C3X: Correlation, Causation and Controlled Experimentation for C2 – 146
- Examining Clandestine Social Networks for the Presence of Non-Random Structure – 523
- Hypothesis of the Magnetostatic Turbulence and its Implications for Astrophysics – 671
- Information Fusion for Hypothesis Generation under Uncertain and Partial Information Access Situation – 499
- Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion – 622
- Program Project on the Pathogenesis and Treatment of Parkinson's Disease – 334
- ICE**
- Characteristics of Runback Ice Accretions and Their Aerodynamic Effects – 1
- Feasibility of Measuring 3He Bubble Diameter Populations in Deuterium-Tritium Ice Layers Using Mie Scattering – 573
- IDENTIFYING**
- An Enterprise Solution for Biometric Authentication and Identification – 473
- Identifying Battlefield Metrics Through Experimentation – 158
- Identifying Molecular Factors in Androgen Receptor Nuclear Export – 282
- Real Time Identification – 475
- Tag Device, Luggage Tag, and Method of Manufacturing a Tag Device – 200
- Using a Shortest Path Algorithm for Identifying Areas of Interest in An Area of Operations – 543
- IDENTITIES**
- Communication Security Establishment Briefing on Government of Canada Biometrics Reports – 477
- The President's Identity Theft Task Force: Combating Identity Theft a Strategic Plan – 652
- Ukraine's Search for its Place in Europe: The East or the West? – 548
- IGNITION SYSTEMS**
- Energy Efficient Transient: Plasma Ignition: Physics and Technology – 111
- IGNITION**
- Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors – 600
- Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions – 603
- Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- Isochoric Implosions for Fast Ignition – 570
- Particle Splitting for Monte-Carlo Simulation of the National Ignition Facility – 561
- Status and Prospects of the Fast Ignition Inertial Fusion Concept – 571
- ILLUMINATING**
- An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234
- Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597
- IMAGE ANALYSIS**
- Development of an Automated Modality-Independent Elastographic Image Analysis System for Tumor Screening – 357
- IMAGE PROCESSING**
- A Distributed Parallel Processing System for Command and Control Imagery – 466
- A Methodology for End-to-End Evaluation of Arabic Document Image Processing Software – 468
- Advanced Technologies in Safe and Efficient Operating Rooms – 309
- High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77
- Method and Apparatus for Providing an Asymmetric Watermark Carrier – 430
- Next-Generation Image and Sound Processing Strategies: Exploiting the Biological Model – 598
- Object Detection in Electro-Optic Sensor Images – 208
- Polarimetric Thermal Imaging – 540
- Video Enabling the Combatant Commander's Headquarters – 48
- IMAGE RECONSTRUCTION**
- Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376
- Image Reconstruction Based Modeling of 3D Textile Composite (Post-print) – 127
- IMAGERY**
- A Distributed Parallel Processing System for Command and Control Imagery – 466
- Development and Assessment of a Complete ATR Algorithm Based on ISAR Euler Imagery – 468
- Hyperspectral Imagery Target Detection Using Improved Anomaly Detection and Signature Matching Methods – 592
- Hyperspectral Imagery Target Detection Using Principal Component Analysis – 522
- Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – 675
- Outlier Detection in Hyperspectral Imaging Using Closest Distance to Center with Ellipsoidal Multivariate Trimming – 223
- Preflight and Vicarious Calibration of Hyperspectral Imagers – 598
- Rapid C4I High Performance Computing for Hyperspectral Imaging Exploitation – 598
- The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- IMAGES**
- Bisphosphonate-Based Contrast Agents for Radiological Imaging of Microcalcifications – 362
- Imaging Primary Prostate Cancer and Bone Metastasis – 325
- Methods and Computer-Readable Medium for Navigating between a Plurality of Discrete Images – 432
- Next-Generation Image and Sound Processing Strategies: Exploiting the Biological Model – 598
- Receptive Field Structures for Recognition – 190
- Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227
- IMAGING SPECTROMETERS**
- Compact Imaging Spectrometer Utilizing Immersed Gratings – 602
- IMAGING TECHNIQUES**
- A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296
- Bisphosphonate-Based Contrast Agents for Radiological Imaging of Microcalcifications – 362

Center for Coastline Security Technology, Year-2 – 228

Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391

Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391

Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376

Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation – 365

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Fusion of Imaging and Inertial Sensors for Navigation – 228

GISMO – 231

High Contrast Imaging Using Adaptive Optics for Extrasolar Planet Detection – 666

High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 556

High-Energy Neutron Imaging Development at LLNL – 567

Imaging Interplanetary Disturbances Causing Forbush Decreases – 670

Imaging Primary Prostate Cancer and Bone Metastasis – 325

IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345

Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging – 355

Introduction to Synthetic Aperture Radar (SAR) – 175

Measuring 'Impossible' Intermolecular Cross-Peaks to Improve Selectivity and Sensitivity in Breast MRI – 396

Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – 675

Model Based Statistical Estimation of Sandia RF Ohmic Switch Dynamic Operation from Stroboscopic X-ray Imaging – 207

MR Imaging Based Treatment Planning for Radiotherapy of Prostate Cancer – 349

Neutron Generators Developed at LBNL for Homeland Security and Imaging Applications – 566

Outlier Detection in Hyperspectral Imaging Using Closest Distance to Center with Ellipsoidal Multivariate Trimming – 223

Polarimeter in a Pixel – 195

Potential Applications of Microtesla Resonance Imaging Detected Using a Superconducting Quantum Interference Device – 560

Rapid C4I High Performance Computing for Hyperspectral Imaging Exploitation – 598

Shuttle Entry Imaging Using Infrared Thermography – 57

Simulated Performance of a Second Generation Compact Compton Imaging Detector – 569

Theory and Applications of Computational Time-Reversal Imaging – 516

Through-the-Wall Imaging from Electromagnetic Scattered Field Measurements – 553

Ultra Fast Coherent Diffraction Imaging of Single Particles, Clusters and Biomolecules – 572

## IMMUNE SYSTEMS

A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389

Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium falciparum Malaria in Peru – 380

Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis – 344

HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400

Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379

The Distribution, Levels, and Relevance of the Interleukin-1 Family of Cytokines and Receptors in Human Breast Carcinoma-Induced Osteolysis – 300

The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401

White Blood Cell Counts and Malaria – 400

## IMMUNITY

Development of In Vitro Correlate Assays of Immunity to Infection with Yersinia Pestis – 327

Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum – 357

Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 396

HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400

Radiation-Induced Immune Modulation in Prostate Cancer – 325

Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399

The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites – 404

Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332

## IMMUNOLOGY

Immunology, Systems Biology, and Immunotherapy of Breast Cancer – 360

Mandatory Vaccinations: Precedent and Current Laws – 393

Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340

Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332

## IMPACT DAMAGE

Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – 212

Towards the Development of a Defensive Cyber Damage and Mission Impact Methodology – 641

## IMPACT LOADS

Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – 212

The Effect of Increasing Mass on Locomotion – 413

## IMPACT PREDICTION

A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 516

## IMPACT TESTS

Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10

Elastic-Viscoplastic An Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Test – 117



## **IMPACT VELOCITY**

Probabilistic Modeling of Space Shuttle Debris Impact – [58](#)

## **IMPEDANCE**

Impedance Analysis of Electrochemical NO<sub>x</sub> Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – [247](#)

## **IMPLANTATION**

Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof – [72](#)

Toward Neural Control of Prosthetic Devices – [209](#)

## **IMPLOSIONS**

Isochoric Implosions for Fast Ignition – [570](#)

## **IMPREGNATING**

Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – [45](#)

## **IMPULSES**

Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – [4](#)

## **IMPURITIES**

First Principles and Multi-Scale Modeling of the Roles of Impurities and Dopants on Thermal Barrier Coating Failure – [88](#)

## **IN SITU MEASUREMENT**

A Device for the In-Situ Measurement of Acoustically Stimulated Bioluminescence – [310](#)

## **IN VITRO METHODS AND TESTS**

2006 In Vitro Biology Meeting. Volume 42 – [291](#)

Development of In Vitro Correlate Assays of Immunity to Infection with *Yersinia Pestis* – [327](#)

Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – [403](#)

Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations – [370](#)

p63 in Development and Maintenance of the Prostate Epithelium – [355](#)

Semi-Synthesis and In-vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism – [401](#)

Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – [384](#)

## **IN VIVO METHODS AND TESTS**

Development of Methodology to Maintain Primary Cultures of Normal and Malignant Human Prostatic Epithelial Cells in Vivo – [342](#)

DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – [383](#)

Effect of COX-2 (PGE2) and IL-6 on Prostate Cancer Bone Mets – [294](#)

Effects of Extracellular Matrix on DNA Repair in Vivo – [363](#)

In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents – [77](#)

p63 in Development and Maintenance of the Prostate Epithelium – [355](#)

Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – [404](#)

## **INCINERATORS**

Feasibility Study of H<sub>2</sub>S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California – [259](#)

Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – [252](#)

## **INDEPENDENT VARIABLES**

Global Local Dynamic Models – [572](#)

Parameter Space: The Final Frontier. Certified Reduced Basis Methods for Real-Time Reliable Solution of Parameterized Partial Differential Equations – [512](#)

## **INDIANA**

Final Site Safety and Health Plan for Phase II RCRA Facility Investigation Fort Benjamin Harrison Marion County, Indiana – [308](#)

## **INDIA**

India's Nuclear Separation Plan: Issues and Views – [595](#)

## **INDIUM GALLIUM ARSENIDES**

Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – [186](#)

## **INDIUM PHOSPHIDES**

Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters – [113](#)

## **INDOOR AIR POLLUTION**

IAQ Tools for Schools. Managing Asthma in the School Environment – [260](#)

## **INDUSTRIAL PLANTS**

Closed Orbit Distortion and the Beam-Beam Interaction – [556](#)

Radiative Penguin Decays at the B Factories – [578](#)

## **INDUSTRIES**

DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – [644](#)

Electronic Vehicle Identification: Industry Standards, Performance, and Privacy Issues – [178](#)

In-Track Demonstration of Laser-Treated Rail to Reduce Friction and Wear – [74](#)

Oil Vulnerabilities and USA Strategy – [241](#)

Pager Phones: Installation – [167](#)

The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – [193](#)

## **INERTIAL CONFINEMENT FUSION**

Status and Prospects of the Fast Ignition Inertial Fusion Concept – [571](#)

## **INERTIAL NAVIGATION**

Fusion of Imaging and Inertial Sensors for Navigation – [228](#)

## **INERTIA**

On-Orbit Identification of Inertia Properties of Spacecraft using Robotics Technology – [49](#)

## **INFECTIOUS DISEASES**

A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – [414](#)

Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations – [60](#)

Building Collaborative Capacity for Biosecurity at the Georgia Seaports – [638](#)

Cell-surface Alpha-glucan in *Campylobacter jejuni* 81-176 – [401](#)

Cross-Serotype Neutralization of Dengue Virus in *Aotus nancymae* Monkeys – [387](#)

Development of Antigen Presenting Cells for Adoptive Immunotherapy in Prostate Cancer – [286](#)

Development of In Vitro Correlate Assays of Immunity to Infection with *Yersinia Pestis* – [327](#)

Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – [378](#)

Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – [394](#)

Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – [380](#)

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – [403](#)

Establishment of a Non-human Primate *Campylobacter* Disease Model for the Pre-clinical Evaluation of *Campylobacter* Vaccine Formulations – [396](#)

Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – 398

Human Spotted Fever Rickettsial Infections – 386

Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377

Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389

Identification of a Protein for Prostate-Specific Infection – 301

Mandatory Vaccinations: Precedent and Current Laws – 393

Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335

Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – 394

Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393

Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army – 282

Role of Superoxide in the Germination of Bacillus Anthracis Endospores – 380

Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389

Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385

Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340

Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

Testing the Effectiveness of the North Shore - LIJ Health System's Bioterrorism Response Program to Identified Surveillance Data – 345

The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites – 404

The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401

Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development – 371

#### **INFILTRATION**

The Significance of Focal Basal Cell Layer Disruption-Induced Immuno-Cell Infiltration in Prostate Cancer Invasion – 364

#### **INFLUENZA**

Weathering the Storm. Leading Your Organization Through a Pandemic – 368

#### **INFORMATION ANALYSIS**

Information Technology: When is Enough? – 663

#### **INFORMATION FLOW**

Exploiting Data-Flow for Fault-Tolerance in a Wide-Area Parallel System – 447

Managing Responsibility and Information Flow in Dynamic Team Decision-Making – 151

Modeling the Structure and Effectiveness of Intelligence Organizations: Dynamic Information Flow Simulation – 626

Multinational Information Sharing and Collaborative Planning Limited Objective Experiments – 655

#### **INFORMATION MANAGEMENT**

A Comparative Assessment of Knowledge Management Education Across the USA Department of Defense – 636

A Comparative Assessment of Knowledge Management Leadership Approaches within the Department of Defense – 638

Active Conceptual Modeling of Learning Workshop 10-12 May 2006 – 656

Assessing Perceptions of Knowledge Management Maturity/Capabilities: A Case Study of SAF/FM – 649

Command Control and Information Systems in the Age of Knowledge-Centricity – 143

Defense Infrastructure. Actions Needed to Guide DOD's Efforts to Identify, Prioritize, and Assess Its Critical Infrastructure – 657

Defense Science Board 2006 Summer Study of Information Management for Net-Centric Operations. Volume 2. Operations Panel Report – 158

Defense Science Board 2006 Summer Study on Information Management for Net-Centric Operations. Volume 1: Main Report – 158

Information Grid in Support of Crisis Management – 625

Integrated Information Management (IIM) – 484

Knowledge Management in an Information Age Army – 547

Modeling the Structure and Effectiveness of Intelligence Organizations: Dynamic Information Flow Simulation – 626

Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics – 635

Refinement of an Instrument to Assess Readiness for Knowledge Management – 641

Sense Making - Underpinning Concepts and Relation to Military Decision-Making – 617

Terrorism Information Management Within the New York City Fire Department: Past, Present and Future – 634

Understanding and Improving Knowledge Transactions in Command and Control – 624

#### **INFORMATION RETRIEVAL**

A Methodology for End-to-End Evaluation of Arabic Document Image Processing Software – 469

A New Perspective on Use of the Critical Decision Method with Intelligence Analysts – 609

An Approach to Integrating Query Refinement in SQL – 530

Army Intelligence Analysis and Interpretation: Assessing the Utility and Limitations of Computational Diagnostic Reasoning – 652

Automated Information Extraction System (AIES) Capability Enhancement and Support – 614

Automatic Author Profiling of Online Chat Logs – 503

Comparing the Performance of Collection Selection Algorithms – 613

Content Based Retrieval Database Management System with Support for Similarity Searching and Query Refinement – 622

Data Mining and Homeland Security: An Overview – 647

Data Mining Techniques Applied to Urban Terrain Command and Control Experimentation – 615

Field Level Computer Exploitation Package – 464

Locally Dimensionality Reduction: A New Approach to Indexing High Dimensional Spaces (Preprint) – 612

New Metrics for Blog Mining – 622

Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III – 650

The Hybrid Tree: An Index Structure for High Dimensional Feature Spaces (Pre-print) – 529

## INFORMATION SYSTEMS

A Model of Trust for Developing Trustworthy Systems From Untrustworthy Actors – 660

A Reference Architecture for Network-Centric Information Systems – 619

Army Digitization Operational Impacts – 661

Assessing an Automated, Information Sharing Technology in the Post '9-11' Era: Do Local Law Enforcement Officers Think It Meets Their Needs – 658

Automated Information Extraction System (AIES) Capability Enhancement and Support – 614

Building Information Systems for Network-Centric Warfare – 615

C2 Product-Centric Approach to Transforming Current C4ISR Information Architectures – 612

Coalition CINC 21 - Leading-Edge Information Technologies to Support Coalition Operations – 627

Coalition Information Sharing: Lessons from Kosovo – 183

Coalition Operations with the Combined Enterprise Regional Information Exchange System (CENTRIXS) – 483

Combined Enterprise Regional Information Exchange System (CENTRIXS): Supporting Coalition Warfare World-Wide – 486

Command Control and Information Systems in the Age of Knowledge-Centricity – 143

Comparing the Performance of Collection Selection Algorithms – 613

Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627

Consumer Control of Electronic Personal Health Information: What Does It Mean. Why Is It Important. A Report on Three Consumer Focus Group Meetings Convened October 2005 by the Office of the Assistant Secretary for Planning and Evaluation – 662

Critical Infrastructure Information Disclosure and Homeland Security – 656

Defense Horizons. I-Power: The Information Revolution and Stability Operations. Number 55 – 619

Defense Science Board 2006 Summer Study of Information Management for Net-Centric Operations. Volume 2. Operations Panel Report – 158

Defense Science Board 2006 Summer Study on Information Management for Net-Centric Operations. Volume 1: Main Report – 158

Developing an Information Superiority-Command and Control Joint Experimentation Strategy – 648

Efficient Hierarchic Management for Re-configuration of Networked Information Systems – 485

Elicitation of British Army Commanders' Personal Constructs – 621

Enhancing Information Systems Security through Biometrics – 472

Framework for Information Age Assessment Metrics – 171

Generic Organisation Data Integration Solution: The Fast and Convenient Way to Integrate Data – 644

Grid Computing for High Performance Computing (HPC) Data Centers – 451

Hospital Quality Data: HHS Should Specify Steps and Time Frame for Using Information Technology to Collect and Submit Data – 428

HUMINT Communication Information Systems for Complex Warfare – 642

Impact of Information Technology-For Strategic Leaders – 181

Improving Analysis with Information Extraction Technology – 630

Information Grid in Support of Crisis Management – 625

Information Superiority through Data Warehousing – 655

Information Technology and Knowledge Distribution in C3I teams – 627

Information Technology: When is Enough? – 663

Integrated Information Management (IIM) – 484

Integration of Information Operations into Effects-Based Operations: Some Observations – 648

Interoperability -- An Australian View – 639

Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497

Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478

Modeling the Joint Battlespace Infosphere – 644

Multi-Sensor Information Fusion Technology Applied to the Development of Smart Aircraft – 8

New Approaches C4I Data Warehousing for Crisis Action - Synchronization, Replication, Sustainment Design Implications – 645

Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III – 650

Requirements and Information Metadata System – 632

Supporting Effects-Based Operations with Information Technology Tools: Examining Underlying Assumptions of EBO Tool Development Practices – 536

S&T Implications for Net Centric Operations – 611

System-of-Systems Governance: New Patterns of Thought – 465

Task Adaptable Display of Information for Training, Maintenance, and Emergency Response – 654

Terrorism Information Management Within the New York City Fire Department: Past, Present and Future – 634

Testing the Effectiveness of the North Shore - LIJ Health System's Bioterrorism Response Program to Identified Surveillance Data – 345

The Benefit of Ontologies for Interoperability of CCIS. (Easy, Quick and Cheap Solutions are Impossible, if Semantics of CCIS are Affected.) – 620

The Critical Role of Intelligent Software Agents in Enabling Net-Centric Command and Control – 444

The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities – 480

The Interactive DataWall – 209

The Quest for Effective Interoperability - Issues in Achieving a Naval Coalition Force Virtual Combat System – 645

Toward an Interoperability Architecture – 646

Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – 469

Using Work-Centered Support System Technology to Enhance Command and Control – 488

Willow System Demonstration – 449

## INFORMATION THEORY

Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26

Russian and Chinese Information Warfare: Theory and Practice – 628

Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86

## INFORMATION TRANSFER

A Roadmap for Developing Architectures in a Net-Centric World – 609

Active Conceptual Modeling of Learning Workshop 10-12 May 2006 – 656

Building an Experimental Joint Battlespace Inosphere (YJBI-CB) – 460

Communication of Context in Multi-Echelon Information Exchange Environments – 656

Degrees of Shared Awareness – 657

Global Broadcast Service Security Classification/Declassification Guide (SCG) – 160

Journalists' Privilege: Overview of the Law and 109th Congress Legislation – 657

Metrics for Command in an NEC Era: Operational Analysis of Way of Command in the Era of Network Enabled Capability – 170

Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers – 312

UH-USA Agreement - A Telemedicine Research Proposal – 624

Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489

## **INFORMATION**

Translational Research from an Informatics Perspective – 416

## **INFRARED DETECTORS**

Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – 48

Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – 118

Integrated Stereo Infrared and Color Human Detection on the ART platform – 226

Outlier Detection in Hyperspectral Imaging Using Closest Distance to Center with Ellipsoidal Multivariate Trimming – 223

## **INFRARED FILTERS**

Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597

## **INFRARED IMAGERY**

Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – 675

Polarimetric Thermal Imaging – 540

Shuttle Entry Imaging Using Infrared Thermography – 57

Three-Dimensional near Infrared Imaging of Pathophysiological Changes within the Breast – 363

## **INFRARED INSTRUMENTS**

Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226

## **INFRARED LASERS**

A Hybrid Nano-Imprinting Lithography Method for Nano-Patterning Based on Infrared Pulsed Laser Heating – 233

## **INFRARED RADIATION**

An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234

Analysis of the Thermal Shielding Properties of Camouflage Materials Brief – 192

Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226

Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – 130

Infrared and Electrical Properties of Amorphous Sputtered (LaxA11-x)2O3 films – 63

Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – 118

Observation of Tidal Effects on LWIR Radiance Above the Mesopause – 262

Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared – 271

Visible and Infrared Optical Design for the ITER Upper Ports – 599

## **INFRARED SPECTROSCOPY**

Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592

Infrared and Electrical Properties of Amorphous Sputtered (LaxA11-x)2O3 films – 63

Infrared Spectroscopy and Stable Isotope Geochemistry of Hydrous Silicate Glasses – 254

## **INFRASONIC FREQUENCIES**

Detection of Atmospheric Explosions at IMS Monitoring Stations using Infrared Sound Techniques – 265

## **INGESTION (ENGINES)**

Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – 39

## **INHIBITORS**

Atropine and Other Anticholinergic Drugs – 372

Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor κB Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling – 388

Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells – 303

Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer – 364

IDO Inhibitors for Combination Therapy of Prostate Cancer – 317

In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents – 77

Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer – 302

Pulmonary Toxicity of Cholinesterase Inhibitors – 382

Radio-sensitizing Effects of Novel Histone De-Acetylase Inhibitors in Prostate Cancer – 283

Structural Studies on Intact Clostridium Botulinum Neurotoxins Complexed with Inhibitors Leading to Drug Design – 304

Structure-Based Approach for Discovery of Small Molecule Inhibitors Targeted at AKT – 296

Structure-Based Design of Cdk4/6-Specific Inhibitors – 290

The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway through High-Throughput Cell-Based Screens – 329

The Effect of COX-2 Inhibitors on the Aromatase Gene (CYP19) Expression in Human Breast Cancer – 347

## **INJECTION**

Preliminary Study of Using 'Pipetron'-Type Magnets for a Pre-Accelerator for the LHC – 566

Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions – 217

## **INJECTORS**

A Method to Predict Atomization Performance in Gas-Centered Swirl-Coaxial Injectors – 218

A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT) – 218

Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors – 216

Dark Core Analysis of Coaxial Injectors at Sub-, Near-, and Supercritical Conditions in a Transverse Acoustic Field – 589

Injector Test Facility for the LCLS. Executive Summary – 566

Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions – 217

## **INJURIES**

A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395

Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10

Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354

Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396

Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

Preventing Epilepsy after Traumatic Brain Injury – 366

The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314

The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367

Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments – 384

Truck Driver Occupational Safety and Health. 2003 Conference Report and Selective Literature Review – 238

Voice Recognition Interface in the Rehabilitation of Combat Amputees – 307

## **INORGANIC PEROXIDES**

Role of Superoxide in the Germination of Bacillus Anthracis Endospores – 380

## **INOSITOLS**

Prevention of Prostate Cancer by Inositol Hexaphosphate – 361

## **INSECTS**

Behavioral Responses to DDT and Pyrethroids Between Anopheles Minimus Species A and C Malaria Vectors in Thailand – 393

Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – 253

## **INSOMNIA**

Prevalence and Outcomes of Restless Legs Syndrome Among Veterans – 346

## **INSPECTION**

Aviation Security: Foreign Airport Assessments and Air Carrier Inspections Help Enhance Security, but Oversight of These Efforts Can Be Strengthened – 13

EUV Inspection of Reticle Defect Repair Sites – 599

Iran's Nuclear Program: Recent Developments – 594

On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – 551

Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan ASSF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI – 87

X-Ray Dose in Microfocus Radiographic Inspections – 137

## **INSTALLING**

Biodegradation of DIMP, Dieltrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305

Novel Technology Evaluation for Volatile Organic Compounds Emission Control – 60

Pager Phones: Installation – 167

Proceedings of the 1st Army Installation Energy Security and Independence Conference – 245

Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – 252

## **INSTRUMENTS**

Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226

Refinement of an Instrument to Assess Readiness for Knowledge Management – 641

## **INSULATORS**

Electrostatic Modeling of Vacuum Insulator Triple Junctions – 205

Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses – 203

## **INSULIN**

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357

Artificial Pancreas for Control of BG and Insulin Levels in Hospitalized Patients with Diabetes and Stress Hyperglycemia – 328

## **INSURANCE (CONTRACTS)**

Information Security: Federal Deposit Insurance Corporation Needs to Sustain Progress Improving Its Program – 167

## **INTEGRAL EQUATIONS**

The Joy of Computing with Volume-Integrals – 19

## **INTEGRALS**

The Joy of Computing with Volume-Integrals – 19

## **INTEGRATED CIRCUITS**

Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214

GaN Wide Band Power Integrated Circuits (Preprint) – 95

Meso-Scale Self-Assembly Pilot Study – 199

## **INTELLECTUAL PROPERTY**

Advancing Software Security - The Software Protection Initiative – 626

## **INTELLIGENCE**

A Bold 21st Century Strategy for U.S. Airborne ISR – 24

A New Perspective on Use of the Critical Decision Method with Intelligence Analysts – 609

A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620

A Study of Autonomous Micro-Robots and Their Application to Complex Environments, Volume 1 – 543

Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308

Army Intelligence Analysis and Interpretation: Assessing the Utility and Limitations of Computational Diagnostic Reasoning – 652

Data Alignment between Army C4I Databases and Army Simulations – 653

Data Mining and Homeland Security: An Overview – 648

Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144

Intelligence Reform and Terrorism Prevention Act of 2004: 'Lone Wolf' Amendment to the Foreign Intelligence Surveillance Act – 664

Libraries and the USA PATRIOT Act – 635

Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – 450

Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461

Modeling the Structure and Effectiveness of Intelligence Organizations: Dynamic Information Flow Simulation – 626

Modeling the U.S. Military Intelligence Process – 448

National Security Letters in Foreign Intelligence Investigations: A Glimpse of the Legal Background and Recent Amendments – 633

National Security Letters in Foreign Intelligence Investigations: Legal Background and Recent Amendments – 634

Requirements and Information Metadata System – 632

Signals Intelligence Support to the Cockpit – 504

Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers – 312

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective – 621

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective – 623

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective – 623

The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164

Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System – 271

## INTELLIGIBILITY

A Model for Predicting Intelligibility of Binaurally Perceived Speech – 153

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630

## INTERCALATION

Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – 246

## INTERFACES

HPC-Colony: Services and Interfaces to Support Systems with Very Large Numbers of Processors. (2006 Annual Report, January-December 2006) – 432

## INTERFEROMETRY

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 262

The Status and Future of the ICRF – 665

## INTERFERON

Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 403

## INTERLEUKINS

Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis – 344

The Distribution, Levels, and Relevance of the Interleukin-1 Family of Cytokines and Receptors in Human Breast Carcinoma-Induced Osteolysis – 300

## INTERMETALLICS

Molecular Volume and Electronic and Vibrational Polarizabilities for Amorphous LaAlO<sub>3</sub> – 86

Topological Close Packing in Structurally Complex Intermetallics (Crystalline, Quasicrystalline and Noncrystalline) – 116

## INTERMODULATION

Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95

## INTERNAL COMBUSTION ENGINES

Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 238

Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237

## INTERNAL WAVES

A Geometric Investigation of Acoustical Wavefront Scattering and Healing Induced by Ocean Internal Waves – 588

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 588

## INTERNATIONAL COOPERATION

Changing the Cultural Paradigm to Meet Emerging Requirements – 56

Integrated Crew Health Care System for Space Flight – 412

Multinational Information Sharing and Collaborative Planning Limited Objective Experiments – 655

## INTERNATIONAL RELATIONS

Ukraine's Search for its Place in Europe: The East or the West? – 548

## INTERNATIONAL SPACE STATION

Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54

Synthesis and Characterization of Space-Survivable POSS-Kapton (Trade-mark) Polyimides (Preprint) – 52

## INTERNATIONAL TRADE

America's Energy Security Policy: Goals for 2025 – 129

China: Possible Missile Technology Transfers from U.S. Satellite Export Policy - Actions and Chronology – 637

Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631

Identifying Molecular Factors in Androgen Receptor Nuclear Export – 282

The Iran Sanctions Act (ISA) – 593

## INTERNETS

Ada County Sheriff's Office Internet Site – 429

Analysis of USA's Broadband Policy – 491

Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488

Dominating Cyberspace – 660

Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – 497

Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node – 641

Investigations Involving the Internet and Computer Networks – 438

Mediators in Infrastructure Survivability Enhancement – 449

Network Centric Operations: Background and Oversight Issues for Congress – 486

Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457

Route Optimization for Mobile IPV6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis – 489

Towards Next Generation WWW: Push, Reuse and Classification – 614

User-Level QoS-Adaptive Resource Management in Server End-Systems – 485

## INTEROPERABILITY

A Case Study for the Naval Training Meta-FOM (NTMF): Analyzing the Requirements from MAGTF FOM – 629

A Cultural Framework for the Interoperability of C2 Systems – 150

A Pragmatic C4ISR Approach From the US Army CECOM Security Assistance Perspective – 614

A Reference Architecture for Network-Centric Information Systems – 619

A Roadmap for Developing Architectures in a Net-Centric World – 609

A System Design Archetype for C4ISR Systems of the 21st Century – 159

A Theory of Interoperability Failures – 651

Agile Coalition Environment (ACE) – 613

An Examination of a Structural Modeling Risk Probe Technique – 544

Army and Air Force Transformation - Are They Synchronized? – 157

Bilateral Interoperability through Enterprise Architecture – 493

C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security – 629

C2 Interoperability: Simulation, Architecture and Information Security – 642

C4I-Simulation Interoperability Using the DII COE and HLA – 468

Coalition Interoperability Ontology: Sharing Situational Awareness with Allies and Agents – 619

Command and Control Automation - MIP and MSC2 FOSC – 161

Data Alignment between Army C4I Databases and Army Simulations – 653

Evaluation of Organisational Interoperability in a Network Centric Warfare Environment – 146

Finishing Together: Coalition End-State Development Since 1990 – 161

From the Battlefield to the Homeland: Building the Case for Network-Centric Response – 636

Independent Testing of Iris Recognition Technology (ITIRT) – 475

Information Engineering in Support of Multilateral Joint Operational Interoperability – 611

Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters – 135

Interoperability -- An Australian View – 639

Levels of Interoperability in Coalition Systems – 646

Making the Mix Work: Coalition C2 Interoperability during Recent Operations – 161

Models of Jointness: Infrastructure Issues for Inter-Organisational Working – 642

Multinational C2 Experiments Supported by C2 Systems and Modeling and Simulations Addressing Army Transformation of Collaborative Planning and Interoperable Execution in a Coalition Environment – 615

Multinational Interoperability Requirements -- A Core Competency – 645

Multipurpose Activity Definitions and Interfaces to Support Operational Needs (MADISON) – 542

Operational Agility: Composing and Orchestrating Mission Capability Packages Through Business Process Execution Language (BPEL) – 444

Organisational Interoperability: Evaluation and Further Development of the OIM Model – 651

Report Out of the C4I Study Group – 162

Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations – 640

Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement – 181

System-of-Systems Governance: New Patterns of Thought – 465

The Benefit of Ontologies for Interoperability of CCIS. (Easy, Quick and Cheap Solutions are Impossible, if Semantics of CCIS are Affected.) – 620

The Coalition Aerial Surveillance and Reconnaissance (CAESAR) Approach to Enhancing the Interoperability of Coalition Ground Surveillance Systems – 224

The Quest for Effective Interoperability - Issues in Achieving a Naval Coalition Force Virtual Combat System – 645

Topics in Interoperability: Structural Programmatic in a System of Systems – 465

Toward an Interoperability Architecture – 646

Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489

US/UK Sensor-To-Shooter Multinational C4 Interoperability Study Force-On-Force Effectiveness Methodology – 179

## INTERPLANETARY MAGNETIC FIELDS

Near-Relativistic Electron  $c/v$  Onset Plots – 668

## INTERPLANETARY MEDIUM

Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – 669

## INTERPLANETARY SPACE

Imaging Interplanetary Disturbances Causing Forbush Decreases – 670

## INTERPOLATION

Evaluation of High Density Surface Observations in Complex Terrain and Their Contribution to the MM5 Model – 268

## INTERPROCESSOR COMMUNICATION

Efficient Hierarchic Management for Reconfiguration of Networked Information Systems – 485

Multicast Performance Analysis for High-Speed Torus Networks – 484

The USA PATRIOT Act: A Legal Analysis – 638

The USA PATRIOT Act: A Sketch – 633

User-Level QoS-Adaptive Resource Management in Server End-Systems – 485

## INTERROGATION

Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570

## INTESTINES

Cell-surface Alpha-glucan in *Campylobacter jejuni* 81-176 – 402

Mosaic Structure of a Multiple-Drug-Resistant, Conjugative Plasmid from *Campylobacter jejuni* – 407

## INTRUSION DETECTION (COMPUTERS)

Intrusion and Misuse Deterrence System Employing a Virtual Network – 432

## INTRUSION

Intrusion Deception in Defense of Computer Systems – 462

## INVARIANCE

Measurements of CP-Violating Asymmetries in  $B_0$  to  $a_{1+}(1260) \pi^+ \pi^-$  Decays – 578

## INVENTORIES

A Comparable Market Study of RFID for Manual Item-Level Accountability Inventory and Tracking Systems – 156

Evaluation of Portable Emissions Measurement Systems (PEMS) for Inventory Purposes and the Not-to-Exceed Heavy-Duty Diesel Engine Regulation – 236

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 – 259

## INVENTORY CONTROLS

A Comparable Market Study of RFID for Manual Item-Level Accountability Inventory and Tracking Systems – 156

## INVENTORY MANAGEMENT

PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498

## INVERSIONS

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 262

Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere – 260

Through-the-Wall Imaging from Electromagnetic Scattered Field Measurements – 553

## IODINE

Improving COIL Efficiency By Iodine Pre-Dissociation Via Corona Discharge In The Transonic Section Of The Secondary Flow – 234

## ION ACCELERATORS

Overview of the Pulse Line Ion Accelerator – 577

## ION BEAMS

Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – 584

Quantitative Experiments with Electrons in a Positively Charged Beam – 606

- Self-Consistent Simulations of High-Intensity Beams and E-Coulds with WARP POSINST – 568
- Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127
- ION CYCLOTRON RADIATION**  
High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – 72  
The Status and Future of the ICRF – 665
- ION EXCHANGE RESINS**  
Perchlorate Removal, Destruction, and Field Monitoring Demonstration – 101
- ION IRRADIATION**  
Collaborations in Nuclear Reactors – 559
- IONIZATION CHAMBERS**  
Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – 582
- IONIZED GASES**  
Piezoelectric AlGaN/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 97
- IONIZING RADIATION**  
Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381
- IONOSPHERES**  
On the Relationship of SAPS to Storm-Enhanced Density – 263
- IONS**  
A Multireference Density Functional Approach to the Calculation of the Excited States of Uranium Ions – 87  
Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115  
Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103  
Pentazole-Based Energetic Ionic Liquids: A Computational Study (Preprint) – 97
- IRAN**  
Iran's Nuclear Program: Recent Developments – 594  
The Iran Sanctions Act (ISA) – 593
- IRAQ**  
Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of Travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan – 375  
Long-Range Operational Military Forecasts for Iraq – 269  
The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367
- The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618
- IRIDIUM**  
Superconductors on Iridium Substrates and Buffer Layers – 606
- IRON**  
Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – 105  
Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69  
Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107  
High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe49.7Cr17.7Mn1.9Mo7.4W1.6B15.2C3.8Si2.4 – 107
- IRRADIATION**  
Changes in Delta-Plutonium Due to Self-Irradiation Aging Observed by Continuous In-Situ X-ray Scattering – 120
- ISCHEMIA**  
Human Platelets Exhibit Chemotaxis using Functional N-Formyl Peptide Receptors – 386
- ISOCHORIC PROCESSES**  
Isochoric Implosions for Fast Ignition – 570
- ISOLATION**  
Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – 398  
Payload Isolation System for Launch Vehicles – 54
- ISOTOPES**  
Infrared Spectroscopy and Stable Isotope Geochemistry of Hydrated Silicate Glasses – 254  
Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode – 212  
Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106
- ISOTROPISM**  
Impact Location for a Multilayer Transversely Isotropic Plate – 604
- ISOTROPY**  
2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – 82
- Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Text – 117
- Impact Location for a Multilayer Transversely Isotropic Plate – 604
- ITERATIVE SOLUTION**  
Implicit Solvers for Large Scale Nonlinear Problems – 434
- JAMMING**  
Demonstratore Foer Stoerskydd av GNSS-Mottagare (Demonstrator for Anti-Jamming of GNSS Receivers) – 204
- JAPAN**  
Microsystems Research in Japan – 191
- JAVA (PROGRAMMING LANGUAGE)**  
Experiments with the Sun Java Real-Time System -- Part 2 – 467
- JET AIRCRAFT**  
Price vs. Performance: The Value of Next Generation Fighter Aircraft – 25
- JET CONTROL**  
Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems – 2
- JET ENGINE FUELS**  
Constraints on JP-900 Jet Fuel Production Concepts – 128  
Experimental and Detailed Numerical Studies of Fundamental Flame Properties of Gaseous and Liquid Fuels – 37
- JET ENGINES**  
Fuel Property Effects on T700 Exhaust Particulates – 132  
High Temperature Heat Exchanger Development – 215
- JET FLOW**  
Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling – 220
- JOINTS (JUNCTIONS)**  
Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds – 90
- JP-8 JET FUEL**  
Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120
- KALMAN FILTERS**  
Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica – 241  
Fusion of Imaging and Inertial Sensors for Navigation – 228  
Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – 39  
Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667



## **KAPTON (TRADEMARK)**

Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 53

## **KEPLER LAWS**

Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666

## **KERNEL FUNCTIONS**

Risk Bounds for Regularized Least-Squares Algorithm with Operator-Value Kernels – 524

## **KEROSENE**

Experimental and Numerical Investigations of RP-2 Under High Heat Fluxes – 130

## **KINEMATICS**

A Qualitative Approach to Rigid Body Mechanics – 501

Qualitative Kinematics of Linkages – 500

Qualitative Reasoning about Fluids and Mechanics – 446

Scale-Independent Biomechanical Optimization – 521

## **KINETIC ENERGY**

Downstream Impacts Due to the Extratropical Transition of Tropical Cyclones Over the Western North Pacific – 267

## **KINETICS**

Comparison of Isoconversional and Model Fitting Approaches to Kinetic Parameter Estimation and Application Predictions – 108

Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187

Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns – 96

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99

## **KITS**

Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403

Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – 225

## **KNOWLEDGE BASED SYSTEMS**

Applying the Concept of Minimal Essential to Maintain Operational Continuity and Attain Mission Assurance During Internal and External Attacks on the Information Environment – 495

Assessing Perceptions of Knowledge Management Maturity/Capabilities: A Case Study of SAF/FM – 649

Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 460

Refinement of an Instrument to Assess Readiness for Knowledge Management – 641

Towards a Computational Model of Sketching – 450

Yet Another Role for Team Building and Work Motivation -Enabler of Knowledge Creation and Knowledge Sharing – 457

## **KRIGING**

Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica – 241

## **LABORATORIES**

1958-2006 Precipitation Climatology for Lawrence Livermore National Laboratory, Livermore Site and Site 300 – 275

Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488

## **LACTIC ACID**

Microbial Dynamics during Barley Tempeh Fermentation – 104

## **LAGOONS**

Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – 252

## **LAKES**

Feasibility Study of H(sub2)S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California – 259

## **LAMINATES**

2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – 82

Probabilistic Analysis for the Mechanical Properties of Cross-Ply Fiber-Reinforced Composite Laminate (Postprint) – 115

Stab Sensitivity of Energetic Nanolaminates – 84

Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86

## **LAND ICE**

Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica – 241

## **LAND USE**

Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – 632

## **LANDING SITES**

A Value-Focused Thinking Model for the Selection of the Best Rigid Pavement, Partial-Depth Spall Repair Material – 20

Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – 45

## **LANGUAGES**

A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 375

Next Generation Systems Languages – 455

## **LANTHANUM**

Molecular Volume and Electronic and Vibrational Polarizabilities for Amorphous LaAlO3 – 86

Substrate/Oxide Interface Interaction in LaAlO3/Si Structures – 96

## **LARGE EDDY SIMULATION**

Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling – 220

## **LASER CAVITIES**

Vertical Cavity Surface Emitting Laser Having a Gain Guide Aperture Interior to an Oxide Confinement Layer – 599

## **LASER DAMAGE**

Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP2 – 234

## **LASER HEATING**

A Hybrid Nano-Imprinting Lithography Method for Nano-Patterning Based on Infrared Pulsed Laser Heating – 233

## **LASER INDUCED FLUORESCENCE**

High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77

## **LASER INTERFEROMETRY**

Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry – 603

## **LASER PLASMA INTERACTIONS**

Laser Plasma Interactions in High Energy Density Plasmas – 602

## **LASER PLASMAS**

Development of Technologies to Utilize Laser Plasma Radiations Sources for Radiation Effects Sciences – 600

Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites – 123

## **LASER TARGETS**

An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234

## **LASER WEAPONS**

High-Energy Laser Weapon Integration with Ground Vehicles – 234

## **LASER-INDUCED BREAKDOWN SPECTROSCOPY**

Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – 99

## LASERS

An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234

Development of Technologies to Utilize Laser Plasma Radiations Sources for Radiation Effects Sciences – 600

Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233

Exploiting Adaptive Optics with Deformable Secondary Mirrors – 231

High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350

In-Track Demonstration of Laser-Treated Rail to Reduce Friction and Wear – 74

Photonic Crystal Fibers – 232

Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites – 123

Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – 63

Terahertz Fiber Laser for Explosives Detection – 229

Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – 601

## LASING

Novel Two- and Three-Photon Pumped Lasing Dyes: Design, Synthesis, and Characterization – 232

## LAUNCH VEHICLES

Air Force-Navy Team Achieves Important Flight Test Milestone for Responsive Space Lift – 50

Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 43

Chamber Core Structures for Fairing Acoustic Mitigation – 50

Determining Logistics Ground Support Manpower Requirements for a Reusable Military Launch Vehicle – 57

Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48

Investigation of Advanced Propellants to Enable Single Stage to Orbit Launch Vehicles – 51

Payload Isolation System for Launch Vehicles – 54

The Independent Readiness Team (IRRT) of SMC – 49

## LAUNCHING

Human Factors Evaluation of the High Mobility Artillery Rocket System (HIMARS) in the Combined HIMARS-Guided Multiple Launch Rocket System (GMLRS) Initial Operational Test – 424

Human Factors Evaluation of the XM30 Guided Multiple Launch Rocket System (GMLRS) in the Combined High Mobility Artillery Rocket System (HIMARS)-GMLRS Initial Operational Test – 423

## LAW (JURISPRUDENCE)

Access to Government Information in the USA – 650

Assessing an Automated, Information Sharing Technology in the Post '9-11' Era: Do Local Law Enforcement Officers Think It Meets Their Needs – 658

Assessing Error in PMI (Post-Mortem Interval) Prediction Using a Forensic Entomological Computer Model – 437

Assessing Technology, Methods, and Information for Committing and Combating Cyber Crime – 428

Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10

Digital Evidence in the Courtroom: A Guide for Law Enforcement and Prosecutors – 437

Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – 398

Homeland Security Act of 2002: Critical Infrastructure Information Act – 639

Homeland Security: Protecting Airspace in the National Capital Region – 25

Information Security: Federal Deposit Insurance Corporation Needs to Sustain Progress Improving Its Program – 167

Journalists' Privilege: Overview of the Law and 109th Congress Legislation – 657

Libraries and the USA PATRIOT Act – 635

Mandatory Vaccinations: Precedent and Current Laws – 393

National Security Letters in Foreign Intelligence Investigations: A Glimpse of the Legal Background and Recent Amendments – 633

National Security Letters in Foreign Intelligence Investigations: Legal Background and Recent Amendments – 634

Privacy: An Abbreviated Outline of Federal Statutes Governing Wiretapping and Electronic Eavesdropping – 156

Real Time Identification – 475

Requirements and Information Metadata System – 632

Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers – 312

Technical and Non-Technical Problems in Biometric Physical Access Control Systems – 473

Testing and Evaluation of Dynasig Biometric Pen in Support of Tactical Military and Law Enforcement Missions – 422

The President's Identity Theft Task Force: Combating Identity Theft a Strategic Plan – 652

The USA PATRIOT Act: A Legal Analysis – 638

The USA PATRIOT Act: A Sketch – 633

## LAWS

A Strong Zero-One Law for Connectivity in One-Dimensional Geometric Random Graphs With Non-Vanishing Densities – 527

Mandatory Vaccinations: Precedent and Current Laws – 393

## LEAD ACID BATTERIES

Heat Generation during Overcharge in Sealed Cells – 248

## LEADERSHIP

A Comparative Assessment of Knowledge Management Education Across the USA Department of Defense – 636

A Comparative Assessment of Knowledge Management Leadership Approaches within the Department of Defense – 638

Assessing Perceptions of Knowledge Management Maturity/Capabilities: A Case Study of SAF/FM – 649

Defense Acquisitions. Improved Management and Oversight Needed to Better Control DOD's Acquisition of Services – 492

Impact of Information Technology-For Strategic Leaders – 181

Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics – 635

The Effects of Social Network Centrality on Group Satisfaction – 477

Yet Another Role for Team Building and Work Motivation -Enabler of Knowledge Creation and Knowledge Sharing – 457

## LEADING EDGES

Coalition CINC 21 - Leading-Edge Information Technologies to Support Coalition Operations – 627

Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4

Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet – 221

## LEAKAGE

GaN Wide Band Power Integrated Circuits (Preprint) – 96

Self Limiting Gate Leakage Driver – 200

Using Cyclic Memory Allocation to Eliminate Memory Leaks – 442

## LEARNING

Active Conceptual Modeling of Learning Workshop 10-12 May 2006 – 656

Learning Robustly From Instructions – 519

- Simulation-Based Learning: Workshops for Researchers and Educators in the Western USA, and the Pacific Rim – 619
- Yet Another Role for Team Building and Work Motivation -Enabler of Knowledge Creation and Knowledge Sharing – 457
- LEAST SQUARES METHOD**
- Empirical Effective Dimension and Optimal Rates for Regularized Least Squares Algorithm – 524
- Risk Bounds for Regularized Least-Squares Algorithm with Operator-Value Kernels – 524
- LEGAL LIABILITY**
- The Supreme Court's Climate Change Decision: Massachusetts v. EPA – 263
- LENSES**
- High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 557
- How the Car Affects the Activity patterns of Children and Youth – 170
- Possible Use of Electron Lenses in LHC – 586
- LEPTONS**
- Gravi-Leptogenesis: Leptogenesis from Gravity Waves in Pseudo-Scalar Driven Inflation Models – 673
- Radiative Penguin Decays at the B Factories – 578
- Resonant Second Generation Slepton Production at the Tevatron – 586
- SUSY Multilepton Signatures at Tevatron – 576
- LESIONS**
- Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis – 322
- LETHALITY**
- Lethality and Autonomous Robots: An Ethical Stance – 504
- Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3 – 358
- LEUKEMIAS**
- A BCR-ABL Kinase Activity-Independent Signaling Pathway in Chronic Myelogenous Leukemia – 351
- Mechanisms of Disease Persistence in Chronic Myelogenous Leukemia (CML) – 318
- LEUKOCYTES**
- Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285
- Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110
- White Blood Cell Counts and Malaria – 400
- LIBRARIES**
- A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296
- Charting a Course for the 21st Century: NLM's (National Library of Medicine's) Long Range Plan, 2006-2016 – 658
- Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31
- Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer – 364
- Grid Computing for High Performance Computing (HPC) Data Centers – 451
- Libraries and the USA PATRIOT Act – 635
- POINT 2007: A Temperature Dependent ENDF/B-VII.0 Data Cross Section Library – 562
- LIFE CYCLE COSTS**
- The Costs of Not Using Green Design in the USAF: Would Using Green Building Design Have Resulted in Life Cycle Cost – 213
- LIFE (DURABILITY)**
- A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389
- A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – 550
- Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 23
- LIGANDS**
- Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells – 303
- Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92
- LIGHT EMITTING DIODES**
- Final Scientific/Technical Phase I Report on Sliding Mode Pulsed Current Averaging IC Drivers for High-Brightness Light Emitting Diodes – 603
- Nano-Dots Enhanced White Organic Light-Emitting Diodes – 90
- Organic Light-Emitting Diodes and Related Hole Transport Compounds – 207
- Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79
- LIGHT IONS**
- Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – 584
- LIGHT MODULATION**
- Reversible Electrodeposition Optical Modulation Device with Conducting Polymer Counter Electrode – 214
- LIGHT MODULATORS**
- Coherence and Polarization Properties of Far Fields Generated by Quasi-Homogeneous Planar Electromagnetic Sources (Postprint) – 602
- LIGHT SOURCES**
- Gas Detector LCLS Engineering Specifications Document – 574
- High Efficiency Grazing Incidence Pumped X ray Laser – 601
- New Strategic Plan Takes the ALS into the Future – 576
- LIGHTHILL GAS MODEL**
- A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model – 509
- LIGHTNING**
- Pager Phones: Circuit Protection – 168
- LINEAR ACCELERATORS**
- Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – 584
- Flash X-ray (FXR) Linear Induction Accelerator(LIA) Optimization Upgrade of the OTR Emittance Diagnostic – 575
- Gas Detector LCLS Engineering Specifications Document – 573
- Injector Test Facility for the LCLS. Executive Summary – 566
- LINEAR ARRAYS**
- Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 225
- Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193
- Reconfigurable Linear Sensor Arrays for Reduced Channel Count – 208
- LINEAR EQUATIONS**
- High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations – 527
- Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer – 513
- Learning Robustly From Instructions – 519
- LINEAR PROGRAMMING**
- A Method for Including Control Effector Interactions in the Control Allocation Problem (Preprint) – 461
- Optimal UAV Task Assignment and Scheduling (Preprint) – 24

UAV Scheduling via the Vehicle Routing Problem with Time Windows (Preprint) – 20

#### LINEAR SYSTEMS

Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer – 513

Parallel Auxiliary Space AMG for Definite Maxwell Problems – 436

#### LINEARITY

Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95

Proving Atomicity: An Assertional Approach – 487

Reconfigurable Linear Sensor Arrays for Reduced Channel Count – 208

#### LINKAGES

Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 353

Qualitative Kinematics of Linkages – 500

#### LIPID METABOLISM

Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340

#### LIPIDS

A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – 406

Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204

Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof – 72

#### LIQUEFACTION

Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns – 96

#### LIQUEFIED GASES

Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – 582

#### LIQUEFIED NATURAL GAS

Consequence Assessment Methods for Incidents Involving Releases From Liquefied Natural Gas Carriers – 607

Improving the Resiliency of the Natural Gas Supply and Distribution Network – 129

Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety and Regulation – 129

#### LIQUID CHROMATOGRAPHY

Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388

#### LIQUID COOLING

Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83

#### LIQUID CRYSTALS

Development of a 3-D Defocusing Liquid Crystal Particle Thermometry and Velocimetry (3DDLCPTV) System – 111

Polymers for Orientation and Stability of Liquid Crystals – 75

#### LIQUID FUELS

Experimental and Detailed Numerical Studies of Fundamental Flame Properties of Gaseous and Liquid Fuels – 38

Experimental and Numerical Investigations of RP-2 Under High Heat Fluxes – 130

#### LIQUID OXYGEN

Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – 97

#### LIQUID PROPELLANT ROCKET ENGINES

Code Validation of CFD Heat Transfer Models for Liquid Rocket Engine Combustion Devices – 217

Dark Core Analysis of Coaxial Injectors at Sub-, Near-, and Supercritical Conditions in a Transverse Acoustic Field – 589

Experimental and Numerical Investigations of RP-2 Under High Heat Fluxes – 130

Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – 99

Numerical Analysis of Chamber Wall Heat Transfer in a GH<sub>2</sub>/GO<sub>2</sub> Sub-Scale Combustor – 98

#### LIQUID ROCKET PROPELLANTS

Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – 97

Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100

Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions – 217

#### LIQUIDS

Pentazole-Based Energetic Ionic Liquids: A Computational Study (Preprint) – 97

Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface – 102

#### LITHIUM NIOBATES

Nonclassical Properties of Pulsed Second-Subharmonic Generation in Photonic-Band-Gap Structures – 196

#### LITHIUM

Battery System – 246

#### LITHOGRAPHY

A Hybrid Nano-Imprinting Lithography Method for Nano-Patterning Based on Infrared Pulsed Laser Heating – 233

Fabrication of Nanoscaled Systems – 229

Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121

#### LIVER

Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 309

The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404

#### LOADS (FORCES)

Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – 240

Incident, Action, Recovery, and Recommissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – 202

Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing – 36

Topology of On/Off Marx Modulator with Protection of Load and Solid State Switches – 579

#### LOCAL AREA NETWORKS

A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492

Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273

Multi-Agent Systems in Mobile Ad hoc Networks – 626

Wireless Intrusion Detection – 483

#### LOCOMOTION

The Effect of Increasing Mass on Locomotion – 414

The Role of TSC Proteins in Regulating Cell Adhesion and Motility – 281

#### LOGISTICS MANAGEMENT

Determining Logistics Ground Support Manpower Requirements for a Reusable Military Launch Vehicle – 58

The Chaos of Katrina – 267

#### LOGISTICS

An Expose of Autonomous Agents in Command and Control Planning – 499

Feasibility Study of Variance Reduction in the Logistics Composite Model – 522

Interim Heavy Airlift: Sea Base Logistics Glider Concept – 14

- Joint and Allied Logistics Opportunities and Tools Supporting 21st Century War Fighter Rapid Decisive Operations – 149
- PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498
- Puzzle-Based Storage Systems – 518
- Reducing the 'Gap of Pain': A Strategy for Optimizing Federal Resource Availability in Response to Major Incidents – 526
- Sizing Mobility Readiness Spares Packages for Today's Warfighting Units – 21
- LONG DURATION SPACE FLIGHT**
- Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411
- Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 418
- LONG WAVE RADIATION**
- Observation of Tidal Effects on LWIR Radiance Above the Mesopause – 262
- LONGITUDINAL CONTROL**
- Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 581
- LONGITUDINAL STABILITY**
- Notes on Longitudinal Dynamics in UMER – 568
- LOSSES**
- Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385
- LOW CONCENTRATIONS**
- The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402
- LOW COST**
- Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – 505
- Low Cost Parachute – 2
- LOW FREQUENCIES**
- Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587
- Preliminary Low Frequency Electromagnetic Analysis of a Flux Concentrator – 569
- LOW PRESSURE**
- Gas Turbine Engine Including a Low Pressure Sump Seal Buffer Source and Thermally Isolated Sump – 41
- LOW TEMPERATURE**
- Aircraft Battery Design Concept for Improved Ultra Low Temperature Performance (Postprint) – 17
- Evaluation of *Daphnia Magna* Neonate Viability under Low Temperature Exposure Conditions – 310
- Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 604
- LUBRICATION**
- Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – 591
- LUMINAIRES**
- Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597
- LUNAR DUST**
- A Study of the Attraction Forces of Lunar Dust Simulant – 664
- Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – 417
- LUNAR SURFACE**
- A Study of the Attraction Forces of Lunar Dust Simulant – 664
- An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415
- LUNGS**
- A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 340
- Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – 417
- Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379
- IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345
- Integration of Anatomic and Pathogenic Bases for Early Lung Cancer Diagnosis – 506
- Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333
- Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335
- Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418
- LYMPHOCYTES**
- Are Anti-Inflammatory Lymphocytes Able to Induce Remission of Breast Cancer. Addendum – 364
- HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397
- HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Intra-Prostate Cancer Vaccine Inducer – 354
- MACH NUMBER**
- Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 44
- MACHINE LEARNING**
- A Survey of Statistical Machine Translation – 510
- Boot Camp for Cognitive Systems: A Model for Preparing Systems with Machine Learning for Deployment – 463
- MACHINE TRANSLATION**
- A Survey of Statistical Machine Translation – 510
- MACROPHAGES**
- Murine Macrophages Kill the Vegetative Form of *Bacillus anthracis* – 395
- MAGNESIUM ALLOYS**
- Ballistic Evaluation of Magnesium Alloy AZ31B – 117
- MAGNETIC FIELD RECONNECTION**
- Observational Properties of Coronal Mass Ejections – 671
- MAGNETIC FIELDS**
- Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates – 513
- On the Relationship of SAPS to Storm-Enhanced Density – 263
- Understanding Magnetic Eruptions in the Sun and Their Interplanetary Consequences – 667
- MAGNETIC FILMS**
- Symposium Q: Magnetic Thin Films, Heterostructures, and Device Materials – 197
- MAGNETIC INDUCTION**
- Adaptive and Iterative Processing Techniques for Overlapping Signatures – 556
- MAGNETIC MATERIALS**
- Symposium Q: Magnetic Thin Films, Heterostructures, and Device Materials – 197
- MAGNETIC MEASUREMENT**
- Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD – 139

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – 138

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – 138

#### **MAGNETIC PROPERTIES**

Organic Polymers with Magneto-Dielectric Properties – 124

Radiation Damage Effects on the Magnetic Properties of  $\text{Pu}(1-x)\text{Am}(x)$  ( $x=0.224$ ) – 562

Spin Electronics – 189

#### **MAGNETIC RESONANCE**

Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376

Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation – 365

Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging – 355

Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – 67

Measuring 'Impossible' Intermolecular Cross-Peaks to Improve Selectivity and Sensitivity in Breast MRI – 396

MR Imaging Based Treatment Planning for Radiotherapy of Prostate Cancer – 349

Potential Applications of Microtesla Resonance Imaging Detected Using a Superconducting Quantum Interference Device – 560

#### **MAGNETIC STORAGE**

Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438

Feasibility Study on Magnetic Content Addressable Memory – 196

High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor – 119

#### **MAGNETOHYDRODYNAMIC STABILITY**

Mission Support for the Communications/Navigation Outage Forecast Satellite – 49

#### **MAGNETOHYDRODYNAMIC TURBULENCE**

Broken Symmetries and Magnetic Dynamos – 220

#### **MAGNETO-OPTICS**

Spin Electronics – 189

#### **MAGNETORESISTIVITY**

Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193

Symposium Q: Magnetic Thin Films, Heterostructures, and Device Materials – 197

#### **MAGNETOSPHERES**

Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere – 261

#### **MAGNETOSTATICS**

Hypothesis of the Magnetostatic Turbulence and its Implications for Astrophysics – 672

#### **MAGNETS**

Preliminary Study of Using 'Pipetron'-Type Magnets for a Pre-Accelerator for the LHC – 566

#### **MAINTAINABILITY**

Building the Readiness Data Warehouse – 479

Effects of Using NATEC Services within E-2C and FA-18 Operational Squadrons – 24

Refinement of an Instrument to Assess Readiness for Knowledge Management – 641

#### **MAINTENANCE TRAINING**

Task Adaptable Display of Information for Training, Maintenance, and Emergency Response – 654

#### **MAINTENANCE**

Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS) – 625

Capability Based Resourcing for DPEM – 9

Environmental Impacts of Airport Operations: Maintenance, and Expansion – 44

FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures – 29

Maintenance of Glucose Homeostasis through Acetylation of the Metabolic Transcriptional Coactivator PGC-1 $\alpha$  – 343

p63 in Development and Maintenance of the Prostate Epithelium – 355

PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498

Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability – 33

Rapid Runway Repair (RRR): An Optimization for Minimum Operating Strip (MOS) Selection – 45

Thermal Applications for Advanced Metallic Materials (Preprint) – 18

#### **MALES**

A Novel Mechanism of Androgen Receptor Action – 288

Differential Mechanisms of Androgen Resistance – 313

Identifying Molecular Factors in Androgen Receptor Nuclear Export – 282

Knockout AR in Prostate – 280

Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313

Selective Androgen Receptor Downregulators (SARDs): A New Prostate Cancer Therapy – 303

Short-Term Exercise and Prostate Cancer Prevention in African American Men – 359

Unique Approaches to Androgen Effects on Prostate Cancer – 334

#### **MAMMALS**

NMR Analysis of Thiodiglycol Oxidation by Mammalian Alcohol Dehydrogenases – 372

Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407

Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – 384

#### **MAMMARY GLANDS**

A Biophysico-computational Perspective of Breast Cancer Pathogenesis and Treatment Response – 325

A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – 406

A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358

A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296

A Rat Model for Human Ductal Carcinoma In Situ – 392

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357

Antagonism of Taxol Cytotoxicity by Pro-lactin: Implications for Patient Resistance to Chemotherapy – 364

Are Anti-Inflammatory Lymphocytes Able to Induce Remission of Breast Cancer. Addendum – 364

Association between Microtubule Associated Protein -2 and the EGRF Signaling in Breast Cancer – 296

BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – 406

Cellular Senescence and Breast Cancer – 292

Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391

Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391

Characterization of the Role of Breast Tumor Kinase (BRK) in Breast Cancer Cells Non-responsive to EGFR-targeted Agents – 329

Chemokine Blockade in Combination with Cytoreductive Conditioning in Metastatic Breast Cancer – 290

Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376

Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314

cSrc and Her2 Signaling Pathways Cooperate with Estrogen to Promote ER Phosphorylation, Ubiquitination and Proteolysis in ER Negative Breast Cancers – 356

Deciphering the Molecular Mechanisms of Breast Cancer – 324

Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation – 365

Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer – 364

Development of an Automated Modality-Independent Elastographic Image Analysis System for Tumor Screening – 357

Disruption of the Circadian Rhythms of Gene Expression and the Development of Breast Cancer – 313

Domain Specific Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on erbB Positive Breast Cancer – 348

Effects of Extracellular Matrix on DNA Repair in Vivo – 363

Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on Hormonal Responsiveness of Breast Cancer – 362

Endothelial Progenitors as Vectors for Systemic Gene Therapy of Breast Cancer – 332

Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast – 319

Exploring Early Detection Methods: Using the Intraductal Approach to Predict Breast Cancer – 326

Expression and Genomic Profiling of Minute Breast Cancer Samples – 281

Functional Genomic Analysis of Breast Cancer Cell Tumorigenicity Using a Novel Gene Silencing Resource – 325

Genomic Approaches for Detection and Treatment of Breast Cancer – 346

Hot Flashes and Quality of Life Among Breast Cancer Patients – 288

Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285

Immunology, Systems Biology, and Immunotherapy of Breast Cancer – 360

Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – 301

Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens – 405

Measuring 'Impossible' Intermolecular Cross-Peaks to Improve Selectivity and Sensitivity in Breast MRI – 396

Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287

Mechanisms of p53-Mediated Apoptosis – 350

Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – 324

Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289

Molecular Mechanisms in Compromised Endothelial Barrier during Breast Cancer Metastasis – 377

Multiple Aperture Radiation Therapy (MART) for Breast Cancer – 292

Physiological Stress Reactivity and Breast Cancer – 391

Platelet Activating Factor: A Growth Factor for Breast Cancer – 341

Prognostic Significance of Telomere Attrition in Ductal Carcinoma in Situ of the Breast – 390

Protein Transduction Based Therapies for Breast Cancer – 315

Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers – 322

Regulation of Apoptosis by AFG3L2, a Potential Oncogene – 293

Screening Doses for Induction of Cancers Calculated with the Interactive RadioEpidemiological Program (IREP) – 348

Selenium and Breast Cancer Chemoprevention – 339

Semi-Synthesis and In-vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism – 401

Structure-Based Approach for Discovery of Small Molecule Inhibitors Targeted at AKT – 296

Structure-Based Design of Cdk4/6-Specific Inhibitors – 290

Structural Determination of Certain Novel ER Complexes – 304

Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3 – 358

The Distribution, Levels, and Relevance of the Interleukin-1 Family of Cytokines and Receptors in Human Breast Carcinoma-Induced Osteolysis – 300

The Effect of COX-2 Inhibitors on the Aromatase Gene (CYP19) Expression in Human Breast Cancer – 347

The Impact of Tyrosine Kinase Signaling on Breast Cancer Development – 289

The Opposing Roles of Nucleophosmin and the ARF Tumor Suppressor in Breast Cancer – 283

The Role of CRELD1 Isoform 9B in the Pathogenesis of Breast Cancer – 280

The Role of RB in the Therapeutic Response of Breast Cancer – 301

The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy – 361

Three-Dimensional near Infrared Imaging of Pathophysiological Changes within the Breast – 363

## MAN MACHINE SYSTEMS

Design and Implementation of a Modular Manipulator Architecture – 546

Design and Implementation of an Intelligent Primitive Driver – 550

The Challenge of New and Emerging Information Operations – 649

## MANAGEMENT ANALYSIS

Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics – 635

## MANAGEMENT INFORMATION SYSTEMS

Defense Transportation. DOD Needs a Comprehensive Approach to Planning for Implementing Its New Personal Property Program – 659

Efficient Hierarchic Management for Reconfiguration of Networked Information Systems – 485

Knowledge Management in an Information Age Army – 547

## MANAGEMENT METHODS

Forecasting Complex Political and Military Events: The Application of Expected Utility to Crisis Situations – 654

Information Grid in Support of Crisis Management – 625

Integrating Local Public Health Agencies into the Homeland Security Community – 311

Partnerships: The Path to Improving Crisis Communication – 156

The Chaos of Katrina – 267

The Multidimensional Measurements of Geographic Information Systems (GIS) Effectiveness in Crisis Management – 611

Using Templates to Support Crisis Action Mission Planning – 455

Weathering the Storm. Leading Your Organization Through a Pandemic – 368

## MANAGEMENT PLANNING

A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620

Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – 471

Conditions for Achieving Network-Centric Operations in Systems of Systems – 465

Defense Infrastructure. Actions Needed to Guide DOD's Efforts to Identify, Prioritize, and Assess Its Critical Infrastructure – 657

Development of a Battlefield Management System: How to Use the User – 172

Nanoscience and Technology at the Air Force Research Laboratory (AFRL) – 54

Regaining the High Ground: The Challenges of Perception Management in National Strategy and Military Operations – 661

Risk Advised Course of Action (COA) Analysis – 532

Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan ASSF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI – 87

Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans – 640

System-of-Systems Governance: New Patterns of Thought – 465

The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities – 480

Topics in Interoperability: Structural Programmatic in a System of Systems – 465

U.S. Climate Change Technology Program: Vision and Framework for Strategy and Planning – 258

## MANAGEMENT SYSTEMS

PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498

Systems and Capability Relation Management in Defence Systems-of-System Context – 616

## MANAGEMENT

Chemical Management Resource Guide for School Administrators – 75

Developing the Federal Aviation Administration's Requirements for Color Use in Air Traffic Control Displays – 16

## MANEUVERS

A Centripetal Acceleration Statistic for Tracking Maneuvering Targets with Radar – 225

## MANGANESE ALLOYS

High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor – 119

## MANIFOLDS (MATHEMATICS)

Towards Multi Level Optimization. Space Mapping and Manifold Mapping – 433

## MANIPULATORS

Design and Implementation of a Modular Manipulator Architecture – 546

Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale – 188

## MANNED MARS MISSIONS

Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – 675

## MANNED SPACE FLIGHT

A Study of the Attraction Forces of Lunar Dust Simulant – 664

Operational Aspects of Space Radiation Analysis – 676

## MANPOWER

Determining Logistics Ground Support Manpower Requirements for a Reusable Military Launch Vehicle – 58

Effects of the Global War on Terror on Medical Service Corps Retention Rates – 311

Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel – 424

Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers – 311

The Potential Impact of an Auction Based Retention Bonus and Other Factors on Continuation Rates of General Dentists Completing Their Initial Obligation – 525

## MANUALS

CCG-LCONE CT Reconstruction Code User and Programmers Guide – 571

ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual – 469

## MANUFACTURING

Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – 6

Development and Manufacture of Cost Effective Composite Drill Pipe. 2006 Annual Technical Progress Report – 84

Development of Nanocomposite Reinforced Polymeric Materials to be Used for Racks for Retorting Polymeric Trays – 123

Experience Scaling-Up Manufacturing and Emerging Photovoltaic Technologies – 245

Tag Device, Luggage Tag, and Method of Manufacturing a Tag Device – 200

## MAPPING

Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion – 623

Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – 262

## MAPS

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265

## MARIJUANA

Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer – 321

## MARINE BIOLOGY

Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587

Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407

## MARINE ENVIRONMENTS

Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277

Ocean Wave Energy Harvesting Devices – 479

## MARINE MAMMALS

Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587

## MARINE METEOROLOGY

Meteorological Factors That Lead to Separation of the California Coastal Jet from the Central Coast – 271

## MARINE PROPULSION

Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244

## MARINE TECHNOLOGY

Studies on Three-Dimensional Slamming on Slender Ships – 221

## MARKERS

A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 340

Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – 338

Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388



- IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345
- Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy – 363
- Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers – 322
- Selenium and Breast Cancer Chemoprevention – 339
- Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy – 316
- MARKOV PROCESSES**
- Effects-Based Design of Robust Organizations – 520
- Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – 523
- MARS RECONNAISSANCE ORBITER**
- Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59
- MASKS**
- EUV Inspection of Reticle Defect Repair Sites – 600
- MASONRY**
- Seismic Response of a Half-Scale Masonry Building with Flexible Diaphragms – 239
- MASS SPECTROMETERS**
- Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388
- MASS SPECTROSCOPY**
- Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 309
- Characterization Of Commonly Encountered Explosives Using Highfield Asymmetric Waveform Ion Mobility Spectrometry Coupled With Mass Spectrometry – 594
- High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – 71
- Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites – 123
- Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335
- Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers – 322
- Strategic Partnership for Research in Nanotechnology – 210
- MASSIVELY PARALLEL PROCESSORS**
- Purple Computational Environment with Mappings to Ace Requirements for the General Availability User Environment Capabilities. Version 2.0 – 433
- MATHEMATICAL MODELS**
- A Model for Predicting Intelligibility of Binaurally Perceived Speech – 153
- A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37
- A Quantum Approach to Multi-Agent Systems (MAS), Organizations, and Control – 534
- Advances in Modeling and Simulation Capabilities for Predicting Store Trajectories - Past Success and Future Challenges – 5
- An Analysis of Small Navy Tactics Using a Modified Hughes' Salvo Model – 541
- Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237
- Characterization of VSW Environment for UUV-N Operations – 214
- Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model – 514
- Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381
- Enhancement of the Computational Efficiency of Membrane Computing Models – 550
- F-15B QuietSpike(TradeMark) Aerosevoelastic Flight Test Data Analysis – 35
- Finding Stable Causal Interpretations of Equations – 506
- Knowledge Tracing and Prediction of Future Trainee Performance – 531
- Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215
- Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – 518
- Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Modelling Information Age Warfare: Work In Progress – 654
- Numerical Investigation for the Microstructural Effects on the Crack Growth Behavior of Particulate Composite Materials – 79
- Optimizing the Allocation of Sensor Assets for the Unit of Action – 531
- Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448
- Probabilistic Modeling of Space Shuttle Debris Impact – 58
- Results on QCD Physics from the CDF-II Experiment – 559
- Resuspension Physics of Fine Particles – 260
- Survey of Probabilistic Models for Relational Data – 435
- The GeoGraph 3D Computational Laboratory – 538
- Workforce Configuration of a Canadian Forces Gematics Division – 539
- MATHEMATICAL PROGRAMMING**
- Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 33
- Optimizing the Allocation of Sensor Assets for the Unit of Action – 531
- MATRICES (MATHEMATICS)**
- Reconfigurable Matrix Multiplier Architecture and Extended Borrow Parallel Counter and Small-Multiplier Circuits – 209
- MATRIX MATERIALS**
- Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint) – 80
- MAXIMUM LIKELIHOOD ESTIMATES**
- Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509
- MAXWELL EQUATION**
- Parallel Auxiliary Space AMG for Definite Maxwell Problems – 436
- MEASURE AND INTEGRATION**
- Dataflow Integration and Simulation Techniques for DSP System Design Tools – 468
- MEASUREMENT**
- Evolution of Time Scales – 666
- Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597
- Galvanic Skin Response as a Measure of Soldier Stress – 410
- Joint Essential Tasks and a Framework for Evaluation – 136
- MEASURING INSTRUMENTS**
- Parametric Dynamic Load Prediction of a Narrow Gauge Rocket Sled – 135
- MECHANICAL ENGINEERING**
- Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237
- Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18
- MECHANICAL PROPERTIES**
- Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18
- Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 83
- High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – 125

Image Reconstruction Based Modeling of 3D Textile Composite (Postprint) – 127

Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99

Novel Continuous Carbon Nanofibers for the Next Generation Lightweight Structural Nanocomposites – 112

Probabilistic Analysis for the Mechanical Properties of Cross-Ply Fiber-Reinforced Composite Laminate (Postprint) – 115

#### **MEDICAL EQUIPMENT**

Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305

The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402

#### **MEDICAL PERSONNEL**

An Analysis of Robust Workforce Scheduling Models for a Nurse Rostering Problem – 300

Effects of the Global War on Terror on Medical Service Corps Retention Rates – 311

Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415

MDS MIC Catalog Inputs – 416

Medical Reserve Corps Volunteers' Ability and Willingness to Report to Work for the Department of Health During Catastrophic Disasters – 312

#### **MEDICAL SCIENCE**

2006 In Vitro Biology Meeting. Volume 42 – 291

Can GWOT Primary Prevention Strategy More Effectively Impede Religious Extremism? – 390

Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403

MDS MIC Catalog Inputs – 416

Military Nutrition Research: Four Tasks to Address Personnel Readiness and Warfighter Performance – 366

Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305

State of the Science Meeting: Burn Care: Goals for Treatment and Research – 370

Support for the Resident Research Associateship Program with the U.S. Army Medical Research and Materiel Command – 338

Vulnerability Factors to Improve Bone Healing – 347

#### **MEDICAL SERVICES**

Advanced Technologies in Safe and Efficient Operating Rooms – 333

Children's Hospice – 293

COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care – 368

Dental Considerations in a Unified Medical Command – 402

Effects of the Global War on Terror on Medical Service Corps Retention Rates – 311

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403

Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233

Hospital Quality Data: HHS Should Specify Steps and Time Frame for Using Information Technology to Collect and Submit Data – 428

Incorporating New Technology to Create a Comprehensive Realistic Training Environment for the 91W – 343

Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415

Mapping of WDMET in AIS 2005 and AIS 2005 Military – 644

Medical Reserve Corps Volunteers' Ability and Willingness to Report to Work for the Department of Health During Catastrophic Disasters – 312

Medical Risk in the Future Force Unit of Employment. Results of the Army Medical Department Transformation Workshop V – 304

Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289

Observation on the Joint Service Military Medical Facility What Does the Future Hold – 398

Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army – 282

Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers – 311

Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers – 312

The Demise of Russian Health Capital: The Continuity of Ineffective Government Policy – 323

Voice Recognition Interface in the Rehabilitation of Combat Amputees – 307

#### **MEDICINE**

Charting a Course for the 21st Century: NLM's (National Library of Medicine's) Long Range Plan, 2006-2016 – 658

MDS MIC Catalog Inputs – 416

#### **MEDITERRANEAN SEA**

BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 280

#### **MEMBRANES**

Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204

Enhancement of the Computational Efficiency of Membrane Computing Models – 550

Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor. Semi-Annual Technical Progress Report for April 1, 2006 to September 30, 2006 – 68

Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344

Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of *Plasmodium falciparum* – 379

Oxygen Transport Ceramic Membranes. Quarterly Report from October 2006 through December 2006 – 126

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

#### **MEMORY (COMPUTERS)**

Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438

Molecular Random Access Memory Cell – 441

Two Bit/Four Bit SONOS Flash Memory Cell – 200

#### **MENTAL HEALTH**

Automating Behavioral Health Screening - Addressing Risk Communication Electronically – 306

Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments – 384

#### MENTAL PERFORMANCE

Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459

Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water – 409

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

Pharmacological and Nonpharmacological Methods of Treatment for Fragile – 410

The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367

The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618

#### MERCURY CADMIUM TELLURIDES

Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – 102

#### MESAS

Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – 273

#### MESONS

Closed Orbit Distortion and the Beam-Beam Interaction – 556

#### MESOPAUSE

Observation of Tidal Effects on LWIR Radiance Above the Mesopause – 262

#### MESOSCALE PHENOMENA

Evaluation of High Density Surface Observations in Complex Terrain and Their Contribution to the MM5 Model – 268

Ultrafast, In Situ Probing of Shocked Solids at the Mesoscale and Beyond: a New Paradigm for Materials Dynamics – 573

#### MESOSPHERE

On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263

#### MESSAGE PROCESSING

A High-Performance Communication Service for Parallel Computing on Distributed DSP Systems – 449

Self-Stabilizing Mobile Node Location Management and Message – 511

#### MESSAGES

An Efficient Metaheuristic for Dynamic Network Design and Message Routing – 617

Self-Stabilizing Mobile Node Location Management and Message – 511

#### METABOLIC DISEASES

Artificial Pancreas for Control of BG and Insulin Levels in Hospitalized Patients with Diabetes and Stress Hyperglycemia – 328

Diabetes Care and Treatment Project: A Joslin Telemedicine Initiative – 373

Medical Vanguard Diabetes Management – 390

Third Annual Clinical Diabetes Technology Meeting – 647

#### METABOLISM

Maintenance of Glucose Homeostasis through Acetylation of the Metabolic Transcriptional Coactivator PGC-1alpha – 343

Skin Temperature Feedback Optimizes Microclimate Cooling – 272

Third Annual Clinical Diabetes Technology Meeting – 647

#### METABOLITES

Feasibility of Biomonitoring of Exposure to Permethrin Through Analysis of Long-Lived (Metabolite) Adducts to Proteins – 320

Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model – 375

Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110

#### METADATA

Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460

Requirements and Information Metadata System – 632

Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations – 640

Using a Combination of UML, C2RM, XML, and Metadata Registries to Support Long-Term Development/Engineering – 452

#### METAL COATINGS

Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 131

#### METAL FILMS

Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127

#### METAL IONS

Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115

#### METAL OXIDE SEMICONDUCTORS

A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184

Self Limiting Gate Leakage Driver – 200

#### METAL OXIDES

Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

#### METALLIC GLASSES

Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 115

#### METALLIZING

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99

#### METALS

Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 131

Corrosion Resistance of Structural Amorphous Metal – 104

Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69

Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107

Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – 109

Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Test – 117

High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe49.7Cr17.7Mn1.9Mo7.4W1.6B15.2C3.8Si2.4 – 107

Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78

Supported Metal Catalyst with Improved Thermal Stability – 64

Theory for the RF Surface Field for Various Metals at the Destructive Breakdown Limit – 73

Thermal Applications for Advanced Metallic Materials (Preprint) – 18

## **METASTASIS**

Chemokine Blockade in Combination with Cytoreductive Conditioning in Metastatic Breast Cancer – 290

Effect of COX-2 (PGE2) and IL-6 on Prostate Cancer Bone Mets – 294

Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes – 341

Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – 329

Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis – 344

Imaging Primary Prostate Cancer and Bone Metastasis – 325

Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – 301

Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344

Mechanism of Tumor Metastasis Suppression by the KA11 Gene – 318

Molecular Mechanisms in Compromised Endothelial Barrier during Breast Cancer Metastasis – 377

Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy – 363

Targeted Therapies for Myeloma and Metastatic Bone Cancers – 328

The Distribution, Levels, and Relevance of the Interleukin-1 Family of Cytokines and Receptors in Human Breast Carcinoma-Induced Osteolysis – 300

## **METEOROLOGICAL PARAMETERS**

Meteorological Factors That Lead to Separation of the California Coastal Jet from the Central Coast – 271

Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274

On the Relationship of SAPS to Storm-Enhanced Density – 263

Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System – 271

USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling – 277

## **METEOROLOGICAL RADAR**

Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR) – 277

## **METEOROLOGY**

A Weighted Consensus Approach to Tropical Cyclone 96-H and 120-H Track Forecasting – 269

Catalog of Air Force Weather Technical Documents, 1941-2006 – 266

## **METHANE**

Fully Reusable Access to Space Technology (FAST) Methane Rocket – 46

New Column Designs for MicroGC (Preprint) – 197

## **METHOD OF MOMENTS**

The Joy of Computing with Volume-Integrals – 19

## **METHODOLOGY**

A Systematic Approach to Optimize Organizations Operating in Uncertain Environments: Design Methodology and Applications – 169

Facial Recognition Evaluation Project Passport Office of Canada - The Methodology and Findings – 228

## **METHYL ALCOHOL**

Smart Fuel Cell C20-MP Hybrid Fuel Cell Power Source – 249

## **METHYL COMPOUNDS**

Health Effects Support Document for Terbacil – 73

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 113

## **METHYLATION**

Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast – 319

## **METROLOGY**

Developing Metrics in Systems Integration (ISS Program COTS Integration Model) – 608

Massive Metrology: Development and Implementation of a 3D Reference Frame for the Realignment of Fermilab's Tevatron – 606

## **MICE**

Characterization of Neurofibromas of the Skin and Spinal Roots in a Mouse Model – 408

Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation – 365

Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum – 357

Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – 373

High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain – 409

Modeling Phenotypes of Tuberosclerosis in the Mouse – 310

Program Project on the Pathogenesis and Treatment of Parkinson's Disease – 334

Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399

## **MICROBIOLOGY**

A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414

Cloning and Characterization of SLC26A7 and SLC26A9 Anion Exchangers – 68

## **MICROCLIMATOLOGY**

Skin Temperature Feedback Optimizes Microclimate Cooling – 272

## **MICROCOMPUTERS**

Automatic Author Profiling of Online Chat Logs – 503

## **MICROCRACKS**

Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – 119

## **MICROELECTROMECHANICAL SYSTEMS**

A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 113

Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – 133

Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems – 204

Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope – 140

Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – 591

MEMS Shear Stress Sensors: Promise and Progress – 190

Microconnectors and Non-Powered Microassembly Therewith – 202

Micromechanical Resonator Device Having a Desired Mode Shape – 201

Microsystems Research in Japan – 191

## **MICROELECTRONICS**

10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 191

Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 604

Microconnectors and Non-Powered Microassembly Therewith – 202

## **MICROFLUIDIC DEVICES**

Electrospray Emitter for Microfluidic Channel – 206

## **MICROGRAVITY**

Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 417

Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

## **MICROINSTRUMENTATION**

Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186

## **MICROMACHINING**

Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – 134

Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186

## **MICROMECHANICS**

Finite Element Solution: Nonlinear Flapping Beams for Use with Micro Air Vehicle Design – 3

Micromechanical Resonator Device Having a Desired Mode Shape – 201

## **MICROMETEOROLOGY**

Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – 273

## **MICROMETERS**

High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133

## **MICROORGANISMS**

A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414

Antimicrobial Polymeric Surfaces – 79

Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – 675

Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335

Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – 386

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 113

Microbial Dynamics during Barley Tempeh Fermentation – 104

Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385

Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

Tools for Ultraspecific Probe/Primer Design – 327

## **MICROPROCESSORS**

Parallel Simulation of Chip-Multiprocessor Architectures – 447

Potential Thermal Security Risks – 441

## **MICROSCOPES**

Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121

## **MICROSCOPY**

Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – 591

Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale – 188

Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392

## **MICROSTRUCTURE**

Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 84

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99

Micro and Nano-structure Development and Multiscale Physics at Sliding Metal Interfaces. Final Report May 2006 – 78

Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion – 116

Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint) – 92

Numerical Investigation for the Microstructural Effects on the Crack Growth Behavior of Particulate Composite Materials – 79

Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99

## **MICROWAVE EQUIPMENT**

Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – 48

## **MICROWAVES**

Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – 196

High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments – 554

## **MIDDLE EAST**

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 262

## **MIE SCATTERING**

Feasibility of Measuring <sup>3</sup>He Bubble Diameter Populations in Deuterium-Tritium Ice Layers Using Mie Scattering – 573

## **MIGRATION**

Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor – 281

Integration of Soluble and Adhesive Gradient Signals in Directed Cell Migration – 310

Technical Work Plan for: Near-Field Environment: Engineered Barrier System: Radionuclide Transport Abstraction Model Report – 253

Victim Migration: Dynamically Adapting Between Private and Shared CMP Caches – 442

## **MILITARY AIR FACILITIES**

Final Environmental Assessment for Construction of an Addition to Support the Joint Strike Fighter Reprogramming Facility, Building 614, on Eglin Air Force Base, Florida – 251

## **MILITARY AIRCRAFT**

Navy-Marine Corps Tactical Air Integration Plan: Background and Issues for Congress – 9

## **MILITARY HELICOPTERS**

Comanche Helicopter Program - A Strategic Failure – 30

Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 21

Military Helicopter Modernization: Background and Issues for Congress – 28

## **MILITARY OPERATIONS**

A Conceptual Operational Model for Command and Control of International Missions in the Canadian Forces – 180

A Model of Tactical Battle Rhythm – 170

A Pragmatic C4ISR Approach From the US Army CECOM Security Assistance Perspective – 614

Agile Coalition Environment (ACE) – 613

AI on the Battlefield: An Experimental Exploration (Preprint) – 501

Airborne Armed Full Motion Video: The Nexus of OPS/INTEL Integration in the Joint/Coalition Environment – 229

An Analysis of Small Navy Tactics Using a Modified Hughes' Salvo Model – 541

Analysis of Metrics Utilized in U.S. Joint Experimentation of Future C2 Concepts – 171

Army and Air Force Transformation - Are They Synchronized? – 157

Army Fire Support Investment Framework – 472

- Bilateral Interoperability through Enterprise Architecture – [493](#)
- Building the Readiness Data Warehouse – [479](#)
- C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security – [629](#)
- C2 Interoperability: Simulation, Architecture and Information Security – [642](#)
- C4ISR Architectural Frameworks in Coalition Environments – [153](#)
- Coalition CINC 21 - Leading-Edge Information Technologies to Support Coalition Operations – [627](#)
- Coalition Interoperability Ontology: Sharing Situational Awareness with Allies and Agents – [619](#)
- Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – [471](#)
- Command and Control in Peace Support Operations Model PAX - Approaching New Challenges in the Modeling of C2 – [148](#)
- Command, Control, Coordination, and Cooperation during Defense Support to Civil Authority Operations – [182](#)
- Concept of C4I Data Fusion Command Center for Urban Operations – [155](#)
- Course of Action Analysis for Coalition Operations – [458](#)
- Defense Transportation. DOD Needs a Comprehensive Approach to Planning for Implementing Its New Personal Property Program – [659](#)
- Dental Considerations in a Unified Medical Command – [402](#)
- Developing an Information Superiority-Command and Control Joint Experimentation Strategy – [648](#)
- Developing and Evolving a Joint Australian Task List – [155](#)
- Different Approaches for the Creation and Exploitation of 3D Urban Models – [159](#)
- Effect of Atmospheric Background Aerosols on Biological Agent Detectors – [222](#)
- Effects of the Global War on Terror on Medical Service Corps Retention Rates – [311](#)
- Emerging Energy Requirements for Future C4ISR – [244](#)
- Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – [460](#)
- Evaluation of Organisational Interoperability in a Network Centric Warfare Environment – [146](#)
- Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – [233](#)
- Evolution of a Mission Plan – [646](#)
- Fine Pointing of Military Spacecraft – [51](#)
- Flexible Precision: Air Force's Answer to Army Transformation and Intratheater Airlift on the 21st Century Battlefield – [14](#)
- Flexible UAV Mission Management Using Emerging Technologies – [23](#)
- History of Operations Research in the USA Army, Volume 1: 1942-1962 – [546](#)
- Hurricane Katrina: Lessons for Army Planning and Operations – [163](#)
- Incorporating New Technology to Create a Comprehensive Realistic Training Environment for the 91W – [343](#)
- Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters – [135](#)
- Interoperability -- An Australian View – [639](#)
- Joint Essential Tasks and a Framework for Evaluation – [136](#)
- Joint Space Forces in Theater: Coordination is No Longer Sufficient – [47](#)
- Joint Synthetic Battlespace: Cornerstone for Predictive Battlespace Awareness – [455](#)
- Link Analysis for Dynamic Planning and Scheduling – [502](#)
- Long-Range Operational Military Forecasts for Afghanistan – [271](#)
- Making the Mix Work: Coalition C2 Interoperability during Recent Operations – [161](#)
- Mapping of WDMET in AIS 2005 and AIS 2005 Military – [644](#)
- Measuring the Value of High Level Fusion – [608](#)
- Medical Risk in the Future Force Unit of Employment. Results of the Army Medical Department Transformation Workshop V – [304](#)
- Military Helicopter Modernization: Background and Issues for Congress – [28](#)
- Multinational Interoperability Requirements -- A Core Competency – [645](#)
- NDIA FORCEnet Study - Overview of the Human Element Group's Findings: Implications for C2 and other Aspects of NCW – [172](#)
- Network Centric Operations Conceptual Framework Air-to-Ground Case Study – [483](#)
- Observation on the Joint Service Military Medical Facility What Does the Future Hold – [398](#)
- Open Architecture in Naval Combat System Computing of the 21st Century: Network-Centric Applications – [442](#)
- Optimising the Design of Land Force C2 Architectures – [152](#)
- Organisational Interoperability: Evaluation and Further Development of the OIM Model – [651](#)
- Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – [225](#)
- Regaining the High Ground: The Challenges of Perception Management in National Strategy and Military Operations – [661](#)
- Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army – [282](#)
- Risk Advised Course of Action (COA) Analysis – [532](#)
- Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations – [640](#)
- Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers – [311](#)
- Strategic Airlift Modernization: Background, Issues and Options – [14](#)
- Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans – [640](#)
- Sustaining Air Force Space Systems: A Model for the Global Positioning System – [26](#)
- Testing and Evaluation of Dynasig Biometric Pen in Support of Tactical Military and Law Enforcement Missions – [422](#)
- The Contribution of Command and Control to Unity of Effort – [157](#)
- The Department of Defense Net-Centric Data Strategy: Implementation Requires a Joint Community of Interest (COI) Working Group and Joint COI Oversight Council – [659](#)
- The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – [164](#)
- The Quest for Effective Interoperability - Issues in Achieving a Naval Coalition Force Virtual Combat System – [645](#)
- Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers – [476](#)
- Towards a Computational Model of Sketching – [450](#)
- Transforming Coalition Warfare with Network Centric Capabilities – [149](#)

## MILITARY PERSONNEL

A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 333

Can a Self-Diagnostic Digitally Controlled Pacemaker/Defibrillator Device be Used for Alerting Military Personnel When a Soldier Health Condition Becomes Compromised Out in the Field – 426

COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care – 368

Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375

EyeKon: Distributed Augmented Reality for Soldier Teams – 655

Federally Sponsored Health Care Research Gulf War Illnesses and Beyond – 400

Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27

Galvanic Skin Response as a Measure of Soldier Stress – 410

Hurricane Katrina: Lessons for Army Planning and Operations – 163

Military Airpower: A Revised Digest of Airpower Opinions and Thoughts – 14

RIDE vs. CLASP Comparison and Evaluation: Models and Parameters – 662

Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers – 311

The Effect of Graduate Education on the Performance of Air Force Officers – 526

Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments – 384

Using the Command and Control Framework to Analyse Command Challenges – 151

Voice Recognition Interface in the Rehabilitation of Combat Amputees – 307

When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141

Workload, Stress, and Situation Awareness of Soldiers Who are Controlling Unmanned Vehicles in Future Urban Operations – 408

## MILITARY SPACECRAFT

Fine Pointing of Military Spacecraft – 51

## MILITARY TECHNOLOGY

Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – 6

AFRL/IF Technology Transition to the Warfighter via the CAOC-X – 464

Automating Behavioral Health Screening - Addressing Risk Communication Electronically – 306

C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security – 629

Communication and Decision Making in C4ISR Sustained Operations: An Experimental Approach – 409

Defense Nanotechnology Research and Development Program – 212

Effective Mobile Routing Through Dynamic Addressing – 182

Enhancing Information Systems Security through Biometrics – 472

Establishment of a Center for Defense Robotics – 508

Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631

History of U.S. Military Contributions to the Study of Diarrheal Diseases – 408

Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters – 135

Integration of Information Operations into Effects-Based Operations: Some Observations – 648

Metrics for Command in an NEC Era: Operational Analysis of Way of Command in the Era of Network Enabled Capability – 170

Military Nutrition Research: Four Tasks to Address Personnel Readiness and Warfighter Performance – 366

Nanoscience and Technology at the Air Force Research Laboratory (AFRL) – 54

Operator Influence of Unexploded Ordnance Sensor Technologies – 227

Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army – 282

S&T Implications for Net Centric Operations – 611

Taiwan - AFOSR Nanoscience Initiative Status – 198

USAF Command Doctrine of Centralized Control with Decentralized Execution: Never Divide the Fleet – 170

When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141

When Do Organizations Need to Change (Part II)? Incongruence in Action – 140

## MILITARY VEHICLES

Battle Command on the Move – 145

Joint Light Tactical Vehicle Power Requirements – 250

M1114 -- Golden HMMWV Power: Electrical Systems Used in Theater – 192

## MINE DETECTORS

Background Modeling and Algorithm Fusion for Airborne Landmine Detection – 517

## MINES (ORDNANCE)

Background Modeling and Algorithm Fusion for Airborne Landmine Detection – 517

## MINING

New Metrics for Blog Mining – 622

Pager Phones: Circuit Protection – 168

Pager Phones: Installation – 167

Technology Review of Smart Sensors with Wireless Networks for Applications in Hazardous Work Environments – 168

## MINORITIES

Cord Blood Stem Cell Procurement in Minority Donors – 302

Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362

## MISALIGNMENT

Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint) – 118

## MISSILE CONTROL

Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems – 2

## MISSILE DEFENSE

Challenges for Vertical Collaboration Among Warfighters for Missile Defense C2 – 444

## MISSILE SYSTEMS

Integrated Sensing and Processing (ISP) Phase 2: Demonstration and Evaluation for Distributed Sensor Networks and Missile Seeker Systems – 515

## MISSILES

China: Possible Missile Technology Transfers from U.S. Satellite Export Policy - Actions and Chronology – 637

## MISSION PLANNING

Using Templates to Support Crisis Action Mission Planning – 455

## MITOCHONDRIA

Mechanisms of Alpha-synuclein Aggregation and Toxicity – 330

## MITOSIS

Centrosome-Based Mechanisms, Prognostics and Therapeutics in Prostate Cancer – 346

## MIXING LAYERS (FLUIDS)

Application of Morse Theory to Analysis of Rayleigh Taylor Topology – 569

## MIXTURES

Kapillaerelektrofores i Tva Dimensioner. Slutrapport Fran Innovationsprojekt 14215 (Two-Dimensional Capillary Electrophoresis Final Report of the Innovative Project 14215) – 68

## MOBILITY

Characterization Of Commonly Encountered Explosives Using Highfield Asymmetric Waveform Ion Mobility Spectrometry Coupled With Mass Spectrometry – 594

Human Factors Evaluation of the High Mobility Artillery Rocket System (HIMARS) in the Combined HIMARS-Guided Multiple Launch Rocket System (GMLRS) Initial Operational Test – 423

Human Factors Evaluation of the XM30 Guided Multiple Launch Rocket System (GMLRS) in the Combined High Mobility Artillery Rocket System (HIMARS)-GMLRS Initial Operational Test – 423

Route Optimization for Mobile IPV6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis – 489

Sizing Mobility Readiness Spares Packages for Today's Warfighting Units – 21

Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597

## MODELS

A Conceptual Operational Model for Command and Control of International Missions in the Canadian Forces – 180

A High Order WENO Scheme for a Hierarchical Size-Structured Model – 549

A Model of Command and Control Processes for JWARS: Test Results from Controlled Experiments and Simulation Runs – 151

A Strong Zero-One Law for Connectivity in One-Dimensional Geometric Random Graphs With Non-Vanishing Densities – 527

A Systematic Approach to Optimize Organizations Operating in Uncertain Environments: Design Methodology and Applications – 169

A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model – 508

Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 537

An Examination of a Structural Modeling Risk Probe Technique – 544

An Integrated Approach to Conversion, Verification, Validation and Integrity of AFRL Generic Engine Model and Simulation (Postprint) – 6

Collective Choice with Uncertain Domain Models – 535

Comparison of Isoconversional and Model Fitting Approaches to Kinetic Parameter Estimation and Application Predictions – 108

Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model – 514

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Text – 117

Feasibility Study of Variance Reduction in the Logistics Composite Model – 522

Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551

Methods and Program Products for Optimizing Problem Clustering – 435

Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 580

Modeling the U.S. Military Intelligence Process – 448

Modelling a Network of Decision Makers – 610

Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193

Organisational Interoperability: Evaluation and Further Development of the OIM Model – 651

Probabilistic Analysis for the Mechanical Properties of Cross-Ply Fiber-Reinforced Composite Laminate (Postprint) – 115

Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability – 33

Stochastic Lanchester Air-To-Air Campaign Model: Methods Used to Generate Model Outputs and a User's Guide: 2007 – 527

The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – 625

The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515

The Role of Continuity in Residual-Based Variational Multiscale Modeling of Turbulence – 514

Transforming Intra- and Interagency Processes through Advanced Models and Simulations: An Information Assurance Model – 487

Using a Combination of UML, C2RM, XML, and Metadata Registries to Support Long-Term Development/Engineering – 452

## MODULATION

Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – 324

Radiation-Induced Immune Modulation in Prostate Cancer – 325

## MODULATORS

Coreless Approaches for On/Off Marx Type Modulators – 579

Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441

Topology of On/Off Marx Modulator with Protection of Load and Solid State Switches – 579

## MODULES

Development of an Assistive Technology and Environmental Assessment Instrument for National Surveys: Final Report. Part One: Recommended Modules and Instrument Development Process – 440

Unattended Ground Sensor Assembly – 436

## MODULUS OF ELASTICITY

Atomistic Calculation of Elastic Moduli in Strained Silicon – 187

## MOISTURE CONTENT

Skin Temperature Feedback Optimizes Microclimate Cooling – 272

## MOISTURE RESISTANCE

A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125

## MOISTURE

Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – 74

System for the Evaluation of Moisture Damage Using Fundamental Material Properties – 74

## MOLECULAR BIOLOGY

Role of Merlin in the Growth and Transformation of Arachnoidal Cells – 370

Single-Cell Level Investigation of Cytoskeletal/Cellular Response to External Stimuli – 107

## MOLECULAR DYNAMICS

Applications of Molecular and Materials Modeling – 94

Atomistic Calculation of Elastic Moduli in Strained Silicon – 187

Firefighting Agent Research, Phase I – 10

Structure-Based Approach for Discovery of Small Molecule Inhibitors Targeted at AKT – 296

## MOLECULAR INTERACTIONS

Novel Molecular Interactions and Biological Functions of the Neurofibromatosis 2 Tumor Suppressor Protein, Merlin – 328



## MOLECULAR IONS

Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorencarbonyl Methano[60]Fullerene Pentaads – 88

## MOLECULAR ORBITALS

Perylene N-Type Semiconductors and Related Devices – 205

## MOLECULAR STRUCTURE

Assessment of Detection and Refinement Strategies for de novo Protein Structures using Force Field and Statistical Potentials – 353

Molecular Structure Analysis of Aminophenyl Silsesquioxane (Preprint) – 97

## MOLECULAR WEIGHT

Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103

Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89

## MOLECULES

High Throughput Screening of Potential Displacer Molecules – 73

Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103

Molecular Random Access Memory Cell – 441

Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds – 90

The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway through High-Throughput Cell-Based Screens – 329

## MOMENTUM TRANSFER

W + Jet Production at CDF – 585

## MONITORS

ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual – 469

## MONKEYS

Cross-Serotype Neutralization of Dengue Virus in *Aotus nancymae* Monkeys – 387

Establishment of a Non-human Primate *Campylobacter* Disease Model for the Pre-clinical Evaluation of *Campylobacter* Vaccine Formulations – 396

The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402

## MONOCYTES

Intracellular Survival of *Campylobacter jejuni* in Human Monocytic Cells and Induction of Apoptotic Death by Cytolethal Distending Toxin – 394

## MONOMERS

An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 331

Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – 100

## MONTE CARLO METHOD

An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems – 60

Applications of Molecular and Materials Modeling – 94

Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454

Effects-Based Design of Robust Organizations – 520

Grid-Search Techniques for Seismic Event Location and Phase Association – 261

Particle Splitting for Monte-Carlo Simulation of the National Ignition Facility – 561

## MOON

Progress Report of the IAU Working Group on Precession and the Ecliptic – 665

## MORPHOLOGY

Automating the Shadow Method for Aerosol Optical Depth Retrieval – 462

Tubular Carbon Nano/micro Structures and Method of Making Same – 74

Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – 668

## MORTALITY

The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314

## MOAISCS

Mosaic Structure of a Multiple-Drug-Resistant, Conjugative Plasmid from *Campylobacter jejuni* – 407

## MOTION PICTURES

A Study of Communicating Science and Engineering – 142

## MOTION SICKNESS

Preliminary Assessment of Stroboscopic Shutter Glasses on Motion Sickness in Helicopter Passengers – 30

## MOTION SIMULATORS

Experiences Linking Vehicle Motion Simulators to Distributed Simulation Experiments – 443

## MOTION

Experiences Linking Vehicle Motion Simulators to Distributed Simulation Experiments – 443

## MOTIVATION

Searching for new Physics at CDF – 560

Yet Another Role for Team Building and Work Motivation -Enabler of Knowledge Creation and Knowledge Sharing – 457

## MOTOR VEHICLES

The Supreme Court's Climate Change Decision: Massachusetts v. EPA – 263

## MOUNTAINS

Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305

Gravity-Wave Dynamics in the Atmosphere – 264

Literature Review of Biodegradation in Soil of Selected Rocky Mountain Arsenal Contaminants: Isodrin, Dieldrin, Diisopropylmethyl-Phosphonate, 1,2-Dibromo-3-Chloropropane, and p-Chloro-Phenylmethylsulfonoxide – 61

## MOVING TARGET INDICATORS

Alternatives for Military Space Radar – 223

Space-Time Adaptive Processing: Fundamentals – 177

## MULTICHANNEL COMMUNICATION

Channel Hopping Multiple Access with Packet Trains for Ad Hoc Networks – 161

## MULTIDISCIPLINARY RESEARCH

MURI Center for Materials Chemistry in the Space Environment – 112

## MULTIMEDIA

Concepts Associated with Transferring Temporal and Spatial Boundary Conditions Between Modules in the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) – 431

Evaluating an Interactive, Multimedia Education and Decision Program for Early-Stage Prostate Cancer Patients in a Randomized Controlled Trial – 342

Using Formal Methods to Reason about Architectural Standards – 472

## MULTIPATH TRANSMISSION

Eigenvector Analysis for Multipath – 549

## MULTIPLE ACCESS

A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – 190

Channel Hopping Multiple Access with Packet Trains for Ad Hoc Networks – 161

## MULTIPLICATION

Reconfigurable Matrix Multiplier Architecture and Extended Borrow Parallel Counter and Small-Multiplier Circuits – 209

## MULTIPLIERS

Reconfigurable Matrix Multiplier Architecture and Extended Borrow Parallel Counter and Small-Multiplier Circuits – 209

## MULTIPOLES

Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454

## MULTIPROCESSING (COMPUTERS)

Parallel Simulation of Chip-Multiprocessor Architectures – 447

Victim Migration: Dynamically Adapting Between Private and Shared CMP Caches – 442

## MULTISENSOR APPLICATIONS

A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration – 511

## MULTISENSOR FUSION

A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration – 511

Advanced Target Tracking Techniques – 175

Army Intelligence Analysis and Interpretation: Assessing the Utility and Limitations of Computational Diagnostic Reasoning – 652

Concept of C4I Data Fusion Command Center for Urban Operations – 155

Counter-Trafficking Integrated Display System (CIDS): A GIS-Based Command & Control Environment for Coalition Nations – 470

Data Fusion 'Cube': A Multi-Dimensional Perspective – 628

Focused Knowledge to the Warfighter – 617

HUMINT Communication Information Systems for Complex Warfare – 642

Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – 637

Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – 631

Measuring the Value of High Level Fusion – 608

Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion – 622

Multi-Sensor Information Fusion Technology Applied to the Development of Smart Aircraft – 8

Prognostic Fusion for Uncertainty Reduction – 35

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective – 621

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective – 623

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective – 623

The Interactive DataWall – 209

Tracking and Data Fusion Applications – 177

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

## MULTISPECTRAL RADAR

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 224

## MULTISTATIC RADAR

Bi- and Multistatic Radar – 176

## MULTIVARIATE STATISTICAL ANALYSIS

A Multivariate Magnitude Robust Control Chart for Mean Shift Detection and Change Point Estimation – 510

Outlier Detection in Hyperspectral Imaging Using Closest Distance to Center with Ellipsoidal Multivariate Trimming – 223

## MUONS

Neutron Production by Muon Spallation I: Theory – 571

Studies of a Gas-Filled Helical Muon Beam Cooling Channel – 565

## MUSCLES

Leg Muscle Usage Effects on Tibial Elasticity during Running – 296

Modeling Phenotypes of Tuberoscleriosis in the Mouse – 310

## MUSCULOSKELETAL SYSTEM

A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 333

Behavioral Health Program Element – 417

Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386

Skeletal Complications in Neurofibromatosis Type 1: The Role of Neurofibromin Haploinsufficiency in Defective Skeletal Remodeling and Bone Healing in NF1 – 377

## MUTATIONS

Microarray Analysis of Transposon Insertion Mutants in *Bacillus Anthracis*: Global Identification of Genes Required for Sporulation and Germination – 335

Restoration of Wild-Type Activity to Mutant p53 in Prostate Cancer: A Novel Therapeutic Approach – 365

Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3 – 358

## NACELLES

A Review of the History of Fire Suppression on U.S. DoD Aircraft – 34

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 226

Experimental Characterization of Turbulent Flow Around Cylinder Arrays – 219

## NAMING

An Enterprise Identifier Strategy for Global Naming Across Arbitrary C4I Systems – 459

## NANOCOMPOSITES

Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 17

Charge Transfer Nanocomposites: The Effects of Scale-Hierarchy – 111

Development of Nanocomposite Reinforced Polymeric Materials to be Used for Racks for Retorting Polymeric Trays – 123

New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210

Novel Continuous Carbon Nanofibers for the Next Generation Lightweight Structural Nanocomposites – 112

Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83

## NANOCRYSTALS

Collaborations in Nuclear Reactors – 559

Final Report LDRD 04-ERD-021 – 67

Structural Investigations of Surface and Orientation-Specific Phenomena in Nanocrystals and Their Assemblies – 203

## NANOINDENTATION

Final Report LDRD 04-ERD-021 – 68

## NANOPARTICLES

Control of DNA Dehybridization via Nanoparticle Antennas for Antisense Gene Therapy – 383

## NANORODS

Fabrications and Characterizations of ZnO/Zn<sub>1-x</sub>Mg<sub>x</sub>O Nanorod Quantum Structures – 186

Structural Investigations of Surface and Orientation-Specific Phenomena in Nanocrystals and Their Assemblies – 203

Synthesis of One-dimensional Nanosized Defects in High T<sub>c</sub> Superconductor – 552

## NANOSTRUCTURE (CHARACTERISTICS)

Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties – 189

Designing of Bulk Nano-Structures With Enhanced Thermoelectric Properties – 553

Micro and Nano-structure Development and Multiscale Physics at Sliding Metal Interfaces. Final Report May 2006 – 78

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

## **NANOSTRUCTURE GROWTH**

Novel Synthesis of Branched Carbon Nanotubes – 207

## **NANOSTRUCTURES (DEVICES)**

Advanced Materials Deposition for Semiconductor Nanostructures Using Supercritical Fluids – 185

Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 16

Designing of Bulk Nano-Structures With Enhanced Thermoelectric Properties – 553

Fabrications and Characterizations of ZnO/Zn1-xMgxO Nanorod Quantum Structures – 186

Nanomaniipulation: Buckling, Transport and Rolling at the Nanoscale – 188

Non-Equilibrium Quantum Dots: Transport – 185

Novel Continuous Carbon Nanofibers for the Next Generation Lightweight Structural Nanocomposites – 112

Semiconductor Quantum Dot Resonant Tunnelling Spectroscopy – 185

Spin Electronics – 189

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

## **NANOTECHNOLOGY**

A Hybrid Nano-Imprinting Lithography Method for Nano-Patterning Based on Infrared Pulsed Laser Heating – 233

Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 16

Compliant, Nanoscale Free-Standing Multilayer Films – 66

Defense Nanotechnology Research and Development Program – 212

Detonation Nanodiamonds and Related Materials. Bibliography Index, Issue 1 – 102

Fabrication of Nanoscaled Systems – 229

Fabrications and Characterizations of ZnO/Zn1-xMgxO Nanorod Quantum Structures – 186

Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92

Nanoscience and Technology at the Air Force Research Laboratory (AFRL) – 54

Non-Equilibrium Quantum Dots: Transport – 185

Novel Organic Field Effect Transistors via Nano-Modification – 197

Semiconductor Quantum Dot Resonant Tunnelling Spectroscopy – 185

Strategic Partnership for Research in Nanotechnology – 210

Taiwan - AFOSR Nanoscience Initiative Status – 198

The Basic Research Manager for the Air Force – 211

The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193

## **NANOWIRES**

Surface-Templated Assembly for Mass-Production of ZnO Nanowire-Based Integrated Devices – 90

## **NAPHTHALENE**

Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – 100

## **NARROWBAND**

Distributed Computing and Collaboration Framework (DCCF) – 466

## **NASA PROGRAMS**

Johnson Space Center Flight Medicine Clinic Experience – 413

## **NATURAL GAS**

Conversion of Hydrogen Sulfide in Coal Gases to Liquid Elemental Sulfur with Monolithic Catalysts. (Annual Report, October 1, 2005-September 30, 2006) – 107

European Security in the Wider Black Sea Area – 242

Improving the Resiliency of the Natural Gas Supply and Distribution Network – 129

Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 237

Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237

## **NATURAL LANGUAGE (COMPUTERS)**

A Survey of Statistical Machine Translation – 510

Automated Run-Time Mission and Dialog Generation – 632

New Metrics for Blog Mining – 622

## **NAVIGATION SATELLITES**

Mission Support for the Communications/Navigation Outage Forecast Satellite – 49

## **NAVIGATION**

Advanced Target Tracking Techniques – 175

Methods and Computer-Readable Medium for Navigating between a Plurality of Discrete Images – 432

Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – 523

Tracking and Data Fusion Applications – 177

Velocity Estimation Using Forward Looking Sonar – 463

## **NAVY**

A Possible Solution for the U.S. Navy's Addiction to Petroleum: A Business Case Analysis for Transitioning the U.S. Navy From Petroleum to Synthetic Fuel Resources – 63

Air Force-Navy Team Achieves Important Flight Test Milestone for Responsive Space Lift – 50

An Analysis of Small Navy Tactics Using a Modified Hughes' Salvo Model – 541

Distributed Simulation Run Automation Capability for the Navy PRA Testbed – 453

Evolution of a Mission Plan – 646

'How Much is a Pound of C4ISR Worth?' An Assessment methodology to Evolve Network Centric Measures and Metrics for Application to FORCENet – 173

Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 460

Modeling and Simulation in Support of Network Centric Warfare Analysis – 143

Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress – 593

Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244

Navy-Marine Corps Tactical Air Integration Plan: Background and Issues for Congress – 9

New Navy Solutions: Developing Simulation Based C4I Applications – 445

Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers – 311

The Potential Impact of an Auction Based Retention Bonus and Other Factors on Continuation Rates of General Dentists Completing Their Initial Obligation – 525

## NEAR FIELDS

Technical Work Plan for: Near-Field Environment: Engineered Barrier System: Radionuclide Transport Abstraction Model Report – 253

## NEAR INFRARED RADIATION

Three-Dimensional near Infrared Imaging of Pathophysiological Changes within the Breast – 363

## NEBULAE

An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 666

## NEGATIVE IONS

Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103

## NEGATIVE RESISTANCE CIRCUITS

Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions – 187

## NEOPLASMS

Characterization of Neurofibromas of the Skin and Spinal Roots in a Mouse Model – 408

HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate – 290

The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway through High-Throughput Cell-Based Screens – 333

The Opposing Roles of Nucleophosmin and the ARF Tumor Suppressor in Breast Cancer – 283

## NERVES

Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – 110

Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374

Effects of Sarin on the Operant Behavior of Guinea Pigs – 382

In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents – 77

## NERVOUS SYSTEM

Ethanol and Mesolimbic Serotonin/Dopamine Interactions via 5HT-1B Receptors – 346

Genetic and Molecular Analysis of the Mechanisms by Which TSC Regulates Neuronal Differentiation – 321

Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – 373

Midkine Promoter-Driven Adenovirus as Potential Therapy for NF1 – 341

Molecular Analysis of Neurotoxin-Induced Apoptosis – 323

Neurofibromatosis and the Painful Neuroma – 315

Program Project on the Pathogenesis and Treatment of Parkinson's Disease – 334

## NETS

An Approximation Technique for Belief Revision in Timed Influence Nets – 521

## NETWORK ANALYSIS

A Multiservice Switch for Advanced Avionics Data Networks – 43

Analysis of Origin Destination Flows (Raw Data) – 521

Defending Electrical Power Grids – 243

Examining Clandestine Social Networks for the Presence of Non-Random Structure – 523

Hacking Social Networks: Examining the Viability of Using Computer Network Attack Against Social Networks – 491

Methods for Effective Virtual Screening and Scaffold-Hopping in Chemical Compounds – 653

Modeling and Simulation in Support of Network Centric Warfare Analysis – 143

Operational Agility: Composing and Orchestrating Mission Capability Packages Through Business Process Execution Language (BPEL) – 444

Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans – 640

Workforce Configuration of a Canadian Forces Gematics Division – 539

## NETWORK CONTROL

Human Systems Integration Assessment of Network Centric Command and Control – 421

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

## NETWORKS

A Review of Recent Algorithms and a New and Improved Cooperative Control Design for Generating a Phantom Track (Preprint) – 26

Adaptive Sampling for Network Management – 485

Advancing Software Security - The Software Protection Initiative – 626

Application of NCO Conceptual Framework to US/UK Coalition Combat Operations during Operation Iraqi Freedom – 494

Autonomous Virtual Mobile Nodes – 535

Effective Mobile Routing Through Dynamic Addressing – 182

Examining Clandestine Social Networks for the Presence of Non-Random Structure – 523

Extending Simple Network Management Protocol (SNMP) Beyond Network Management: A MIB Architecture for Network-Centric Services – 490

Integrated Sensing and Processing (ISP) Phase 2: Demonstration and Evaluation for Distributed Sensor Networks and Missile Seeker Systems – 514

Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node – 641

Key Establishment in Heterogeneous Self-Organized Networks – 484

Simultaneous Localization and Tracking in Wireless Ad-hoc Sensor Networks – 188

The Effects of Social Network Centrality on Group Satisfaction – 477

## NEURAL NETS

Inclusive high-p(T)b anti-b Cross Section Measurement at s \*\* (1/2) Equals 1.96 TeV – 560

## NEUROLOGY

Cell-surface Alpha-glucan in Campylobacter jejuni 81-176 – 402

Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350

PCBs Alter Dopamine Mediated Function in Aging Workers – 294

Toward Neural Control of Prosthetic Devices – 209

## NEUROPHYSIOLOGY

Genetic and Molecular Analysis of the Mechanisms by Which TSC Regulates Neuronal Differentiation – 321

## NEUROSES

Post Traumatic Stress Disorder: The Facts – 369

## NEUROTRANSMITTERS

Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – 352

## NEUTRALIZERS

Characterization of VSW Environment for UUV-N Operations – 214

## NEUTRINOS

Combined muon-neutrino and electron-neutrino Oscillation Search at Mini-BooNE – 558

Long Baseline Neutrino Physics in the U.S – 578

Proposal to Upgrade the MIPP Experiment – 563

## NEUTRON CROSS SECTIONS

Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106

## NEUTRON RADIOGRAPHY

High-Energy Neutron Imaging Development at LLNL – 567

## NEUTRON SPECTROMETERS

Superconducting High Resolution Fast-Neutron Spectrometers – 565

## NEUTRON STARS

FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere' – 672

## NEUTRONS

Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570

Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 130

Correcting the Response of an Albedo Neutron Dosimeter for Energy – 219

High-Energy Neutron Imaging Development at LLNL – 567

Neutron Generators Developed at LBNL for Homeland Security and Imaging Applications – 566

Neutron Production by Muon Spallation I: Theory – 571

Progress on the Europium Neutron-Capture Study Using DANCE – 673

Superconducting High Resolution Fast-Neutron Spectrometers – 564

Systematic Procedure for Assigning Uncertainties to Data Evaluations – 567

Theory of (3He alpha) Surrogate Reactions for Deformed Uranium Nuclei – 582

## NEVADA

Annual Transportation Report for Radioactive Waste Shipments to and from the Nevada Test Site. (Fiscal Year 2006) – 131

Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – 273

Southern Nevada Air Quality Study – 236

## NEW YORK CITY (NY)

Terrorism Information Management Within the New York City Fire Department: Past, Present and Future – 635

## NEW ZEALAND

A Review of Australian and New Zealand Investigations on Aeronautical Fatigue During the Period April 2005 to March 2007 – 3

## NEWS MEDIA

Foreign Policy Effects on Strategic Communications and the Ability to Influence – 181

## NICKEL ALLOYS

Recrystallization and Grain-Growth Behavior of a Nickel-Base Superalloy During Multi-Hit Deformation (Preprint) – 118

The Effect of As-Large-As (ALA) Grains on the High-Temperature Fatigue Life of Waspaloy – 117

## NICKEL

Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint) – 118

Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92

Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106

Recrystallization and Grain-Growth Behavior of a Nickel-Base Superalloy During Multi-Hit Deformation (Preprint) – 118

## NICOTINE

Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333

## NIGHT VISION

Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – 225

## NIOBIUM

Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558

Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565

## NITRATES

Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture – 93

## NITRIDES

Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 070) – 207

Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 378) – 206

Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196

Two Bit/Four Bit SONOS Flash Memory Cell – 200

## NITROGEN COMPOUNDS

Insensitive High-Performance Replacements for RDX in Explosive and Propellant Formulations – 60

## NITROGEN OXIDES

Guidance for Estimating VOC and NOx Emission Changes from MACT Rules – 257

Impedance Analysis of Electrochemical NOx Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247

## NITROGUANIDINE

Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture – 93

## NITROUS OXIDES

Guidance for Estimating VOC and NOx Emission Changes from MACT Rules – 257

## NOISE INTENSITY

Research Plan for Measuring Noise Levels in Highway Pavements in Texas – 259

## NOISE MEASUREMENT

Development and Implementation of Noise Analysis Standards for ACSA Airports – 255

## NOISE REDUCTION

Chamber Core Structures for Fairing Acoustic Mitigation – 50

Development and Implementation of Noise Analysis Standards for ACSA Airports – 255

High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction – 35

## NOISE (SOUND)

NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252

Preliminary Findings from Noise Testing on PFC Pavements in Texas – 260

## NONCONDENSABLE GASES

Feasibility Study of H(sub2)S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California – 259

## NONDESTRUCTIVE TESTS

A Test Method to Assess the Foldability of Flexible Structural Materials – 125

Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint) – 80

Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 81

Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193

Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers – 34

## NONEQUILIBRIUM FLOW

Comparison of Thermodynamic Equilibrium and Non-Equilibrium Representation of Materials – 219

Quantifying Non-Equilibrium in Hypersonic Flows Using Entropy Generation – 219

## NONINTRUSIVE MEASUREMENT

On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – 551

## NONLINEAR OPTICS

New Materials, Techniques and Device Concepts for Organic NLO Chromophore-based Electrooptic Devices. Part 1 – 291

## NONLINEAR SYSTEMS

Experimental Methods to Characterize Nonlinear Vibration of Flapping Wing Micro Air Vehicles – 32

F-15B QuietSpike(TradeMark) Aeroservoelastic Flight Test Data Analysis – 35

## NONLINEARITY

Computational Nonlinear Optics: Femtosecond Atmospheric Light String Applications – 266

Experimental Methods to Characterize Nonlinear Vibration of Flapping Wing Micro Air Vehicles – 32

Finite Element Solution: Nonlinear Flapping Beams for Use with Micro Air Vehicle Design – 3

Implicit Solvers for Large Scale Nonlinear Problems – 433

Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorenocarbonyl Methano[60]Fullerene Pentaads – 87

Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – 21

## NONPARAMETRIC STATISTICS

An Analysis of Robust Workforce Scheduling Models for a Nurse Rostering Problem – 300

## NOZZLE FLOW

IHPRT Improvements to the Solid Performance Program (SPP) – 542

## N-TYPE SEMICONDUCTORS

Perylene N-Type Semiconductors and Related Devices – 205

## NUCLEAR EXPLOSIONS

Detection of Atmospheric Explosions at IMS Monitoring Stations using Infrared Sound Techniques – 265

Screening Doses for Induction of Cancers Calculated With the Interactive Radio Epidemiological Program (IREP) – 306

## NUCLEAR FUELS

Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 131

Iran's Nuclear Program: Recent Developments – 594

## NUCLEAR MAGNETIC RESONANCE

Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306

New Structural Approaches to Understanding the Disease Related Forms of the Prion Protein – 352

NMR Analysis of Thiodiglycol Oxidation by Mammalian Alcohol Dehydrogenases – 371

Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – 384

## NUCLEAR PHYSICS

Nuclear Photo-Science and Applications with T-Rex Sources – 563

Test Suite for Nuclear Data I. Deterministic Calculations for Critical Assemblies and Replacement Coefficients – 574

## NUCLEAR POWER PLANTS

Hot Leg Piping Materials Issues (U) – 596

India's Nuclear Separation Plan: Issues and Views – 595

## NUCLEAR POWERED SHIPS

Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress – 593

## NUCLEAR PROPULSION

Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244

## NUCLEAR RADIATION

A Rationale for Establishing Survivability Requirements for Objective Force Unmanned Army Platforms and Systems – 191

Fundamentals of Aerospace Medicine: Cosmic Radiation – 412

## NUCLEAR REACTIONS

LDRD Final Report: Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057) – 563

Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106

## NUCLEAR REACTORS

Collaborations in Nuclear Reactors – 559

Emerging Energy Requirements for Future C4ISR – 244

Iran's Nuclear Program: Recent Developments – 595

## NUCLEAR TRANSFORMATIONS

AFCI Storage and Disposal FY-06 Progress Report – 106

## NUCLEAR WEAPONS

Iran's Nuclear Program: Recent Developments – 594

## NUCLEIC ACIDS

Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 405

## NUCLEONS

Proposal to Upgrade the MIPP Experiment – 564

## NUCLEOTIDES

Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394

## NUMBER THEORY

Parallel Eigensolver for H (curl) Problems using H1 Auxiliary Space AMG Preconditioning – 434

## NUMERICAL ANALYSIS

Broken Symmetries and Magnetic Dynamics – 220

Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 603

Fundamental Study on Quantum Nanojets – 548

National Software Infrastructure for Lattice Quantum Chromodynamics – 581

Numerical Analysis of Chamber Wall Heat Transfer in a GH2/GO2 Sub-Scale Combustor – 98

Receptive Field Structures for Recognition – 190

## NUMERICAL APERTURE

Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool – 600

## NUMERICAL CONTROL

A Security Risk Measurement for the RAdAC Model – 490

Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478

Transforming Intra- and Interagency Processes through Advanced Models and Simulations: An Information Assurance Model – 487

## NUTRITION

Military Nutrition Research: Four Tasks to Address Personnel Readiness and Warfighter Performance – 367

Platelet Activating Factor: A Growth Factor for Breast Cancer – 341

Selenium and Breast Cancer Chemoprevention – 339

Third Annual Clinical Diabetes Technology Meeting – 647

## OBESITY

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357

Role of Obesity in Prostate Cancer Development – 336

## OBSERVATION

Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – 524

## OBSERVATORIES

Searching for Double Beta Decay with the Enriched Xenon Observatory – 566

## OCEAN MODELS

Study of the Utility of NWP Forecast Guidance and Simple Ocean Modeling as a Tool for Planning During Reactive Situations – 269

## OCEAN SURFACE

A Geometric Investigation of Acoustical Wavefront Scattering and Healing Induced by Ocean Internal Waves – 588

Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress – 593

Ocean Wave Energy Harvesting Devices – 479

## OCEANOGRAPHY

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 589

Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407

## OCEANS

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 589

Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587

BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279

NOAA National Passive Acoustics Workshop, 2006 – 590

North West Shelf Unmanned Aerial System Trial – 18

Ocean Wave Energy Harvesting Devices – 479

Study of the Utility of NWP Forecast Guidance and Simple Ocean Modeling as a Tool for Planning During Reactive Situations – 269

## OFFSHORE PLATFORMS

Studies on Three-Dimensional Slamming on Slender Ships – 221

## OIL SLICKS

No Further Action Decision Under CERCLA, Fort Devens Study Area 58, Buildings 2648 and 2650 Fuel Oil Spills – 128

## OILS

America's Energy Security Policy: Goals for 2025 – 129

Building Alternative-Energy Partnerships with Latin America – 249

China's Energy Security and Its Military Modernization Efforts: How China Plans to Dominate the World – 248

Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250

Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244

Oil Vulnerabilities and USA Strategy – 241

Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report – 109

Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – 253

## OLIGOMERS

Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121

## ONCOGENES

A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358

Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 352

Regulation of Apoptosis by AFG3L2, a Potential Oncogene – 293

The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis – 322

## ON-LINE SYSTEMS

Air Force Information Workflow Automation through Synchronized Air Power Management (SAPM) – 610

## OPERATING SYSTEMS (COMPUTERS)

Recent Physics Results from NSTX – 571

## OPERATIONAL PROBLEMS

'COM as Shooter' Operational Planning using C2 for Confronting and Collaborating – 169

## OPERATIONS RESEARCH

History of Operations Research in the USA Army, Volume 1: 1942-1962 – 546

Preliminary Findings: Design of Experiments University XXI (FY05) Research and Support for the US Army – 621

## OPERATOR PERFORMANCE

Operator Influence of Unexploded Ordnance Sensor Technologies – 228

## OPTICAL COMMUNICATION

Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) – 178

Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153

Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 597

## OPTICAL EQUIPMENT

Chiral Multichromic Single Crystals for Optical Devices – 580

Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers – 272

Introduction to Synthetic Aperture Radar (SAR) – 175

Reversible Electrodeposition Optical Modulation Device with Conducting Polymer Counter Electrode – 213

Visible and Infrared Optical Design for the ITER Upper Ports – 599

## OPTICAL FIBERS

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

## OPTICAL PROPERTIES

A Verification of Optical Depth Retrievals From High Resolution Satellite Imagery – 225

BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279

Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597

New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210

Polarized Optical Probes – 599

## OPTICAL SWITCHING

Self Assembled Nano-Photonic Devices Derived from Marine DNA for Opto-Electronic Applications – 292

## OPTICAL THICKNESS

A Verification of Optical Depth Retrievals From High Resolution Satellite Imagery – 225

Automating the Shadow Method for Aerosol Optical Depth Retrieval – 462

## OPTICAL WAVEGUIDES

Photonic Device and Method for Making Same – 209

## OPTIMIZATION

A Comparison of Trajectory Determination Approaches for Small UAVs – 11

A Distributed Approach for Multi-Constrained Path Selection and Routing Optimization – 640

A Heuristic Design Information Sharing Framework for Hard Discrete Optimization Problems – 542

A Parallel Particle Swarm Optimizer – 533

A Systematic Approach to Optimize Organizations Operating in Uncertain Environments: Design Methodology and Applications – 169

Decentralized Control Using Global Optimization (DCGO) (Preprint) – 495

Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – 511

Implicit Solvers for Large Scale Nonlinear Problems – 433

Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52

Optimization of Synthetic Jet Actuators – 235

Optimizing the Prioritization of Natural Disaster Recovery Projects – 274

Parallel Global Optimization with the Particle Swarm Algorithm (Preprint) – 533

Prioritizing Satellite Payload Selection via Optimization – 46

Scale-Independent Biomechanical Optimization – 521

Towards Multi Level Optimization. Space Mapping and Manifold Mapping – 433

Value Added Analysis - VAAFY03 – 532

## OPTOELECTRONIC DEVICES

Electronic and Optoelectronic Devices and Methods for Preparing Same – 213

New Materials, Techniques and Device Concepts for Organic NLO Chromophore-based Electrooptic Devices. Part 1 – 291

Perylene N-Type Semiconductors and Related Devices – 205

## ORDER-DISORDER TRANSFORMATIONS

Sinodal Decomposition and Order Disorder Transformation in a Water Quenched U-6wtNb Alloy – 70

## ORDNANCE

Acoustic Identification of Filler Materials in Unexploded Ordnance – 82

Adaptive and Iterative Processing Techniques for Overlapping Signatures – 555

Evaluation of airborne Electromagnetic Systems for Detection and Characterization of unexploded ordnance (uXo) – 12

Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – 637

Non-Thermal, On-Site Decontamination and Destruction of Practice Bombs – 141

Operator Influence of Unexploded Ordnance Sensor Technologies – 227

Signal Event Detection System – 590

Unexploded Ordnance Site Investigation of US Military Ranges in Panama: Empire, Balboa West and Pina Ranges – 135

## ORGANIC CHEMISTRY

Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations – 61

## ORGANIC COMPOUNDS

Novel Technology Evaluation for Volatile Organic Compounds Emission Control – 60

## ORGANIC MATERIALS

Novel Organic Field Effect Transistors via Nano-Modification – 197

Organic Polymers with Magneto-Dielectric Properties – 124

## ORGANIC PHOSPHORUS COMPOUNDS

Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – 372

Atropine and Other Anticholinergic Drugs – 372

In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents – 77

Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – 230

## ORGANIC SEMICONDUCTORS

Perylene N-Type Semiconductors and Related Devices – 205

## ORGANISMS

Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – 675

NOAA National Passive Acoustics Workshop, 2006 – 590

Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems – 354

## ORGANIZATIONS

A CBO Study. The Army's Bandwidth Bottleneck – 154

A Model for Effective Organization and Communication of Homeland Security Activity at the State Level – 157

A Quantum Approach to Multi-Agent Systems (MAS), Organizations, and Control – 534

A Systematic Approach to Optimize Organizations Operating in Uncertain Environments: Design Methodology and Applications – 169

Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – 422

Corporate Entrepreneurship Assessment Instrument (CEAI): Refinement and Validation of a Survey Measure – 136

Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362

Distributed Command and Organizational Situation Awareness – 142

DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – 643

Effective Mobile Routing Through Dynamic Addressing – 182

Effects-Based Design of Robust Organizations – 520

'How Much is a Pound of C4ISR Worth?' An Assessment methodology to Evolve Network Centric Measures and Metrics for Application to FORCENet – 173

Long-Range Operational Military Forecasts for Iraq – 269

Medical Risk in the Future Force Unit of Employment. Results of the Army Medical Department Transformation Workshop V – 304

Modelling Operational Command Structures Using ORGAHEAD – 451

Optimising the Design of Land Force C2 Architectures – 152

Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts) – 537

Sharing the Dragon's Teeth: Terrorist Groups and the Exchange of New Technologies – 643

Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans – 640

System Instantiation Comparison Method: A Technique for Comparing Military Headquarters – 542

Time-Base Tree Graphs for Stabilized Force Structure Representations – 539

When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141

When Do Organizations Need to Change (Part II)? Incongruence in Action – 140

## OSCILLATIONS

A High Order WENO Scheme for a Hierarchical Size-Structured Model – 549

A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model – 508

Combined muon-neutrino and electron-neutrino Oscillation Search at Mini-BooNE – 557

Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – 515

Long Baseline Neutrino Physics in the U.S – 578

SOME Aspects of Hadron Hadron Collisions in High Energy Interactions (B(O)s) Mixing Oscillations in Semileptonic Decay at D0 Experiment) – 557

The Matrix Pencil and its Applications to Speech Processing – 589



## OSTEOBLASTS

Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 412

## OSTEOPOROSIS

Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411

Skeletal Complications in Neurofibromatosis Type 1: The Role of Neurofibromin Haploinsufficiency in Defective Skeletal Remodeling and Bone Healing in NF1 – 377

## OUTLIERS (STATISTICS)

Outlier Detection in Hyperspectral Imaging Using Closest Distance to Center with Ellipsoidal Multivariate Trimming – 223

## OVARIES

Biological Basis for Chemoprevention of Ovarian Cancer – 359

Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum – 357

Mechanisms and Chemoprevention of Ovarian Carcinogenesis – 358

PARK2, a Large Common Fragile Site Gene, is Part of a Stress Response Network in Normal Cells That is Disrupted During the Development of Ovarian Cancer – 359

## OVER-THE-HORIZON RADAR

Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227

## OXIDATION RESISTANCE

A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125

## OXIDATION-REDUCTION REACTIONS

Electronically Induced Redox Barriers for Treatment of Groundwater – 198

## OXIDATION

A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 340

Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44

NMR Analysis of Thiodiglycol Oxidation by Mammalian Alcohol Dehydrogenase – 371

## OXIDES

Effects of Temperature and Environment on Creep Behavior of an Oxide-Oxide Ceramic Matrix Composite – 103

Impedance Analysis of Electrochemical NO<sub>x</sub> Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247

Off-Axis Creep Behavior of Oxide/Oxide Nextel(Trademark)720/AS-0 (Preprint) – 122

Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds – 90

Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures – 96

Vertical Cavity Surface Emitting Laser Having a Gain Guide Aperture Interior to an Oxide Confinement Layer – 599

## OXYGEN ATOMS

Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 53

## OXYGEN PLASMA

Oxygen Plasma Treatment and Deposition of CN<sub>x</sub> on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121

## OXYGENATION

Guidelines for Oxygenated Gasoline Credit Programs under Section 211(m) of the Clean Air Act as Amended – 252

## OXYGEN

A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395

Oxygen Transport Ceramic Membranes. Quarterly Report from October 2006 through December 2006 – 126

## OXYNITRIDES

Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – 91

Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127

## OZONE

Achievements in Stratospheric Ozone Protection – 278

Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 255

Guidance for Estimating VOC and NO<sub>x</sub> Emission Changes from MACT Rules – 257

Review of the Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper – 256

Smog: Who Does it Hurt. What You Need to Know about Ozone and Your Health – 259

## OZONOSPHERE

Achievements in Stratospheric Ozone Protection – 278

## PACIFIC OCEAN

Downstream Impacts Due to the Extratropical Transition of Tropical Cyclones Over the Western North Pacific – 267

## PACKAGING

Improving Thermal Performance of Radioactive Material Drum Type Packages by Using Heat Pipes – 131

Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – 59

Type B Radioactive Material Package Failure Modes and Contents Compliance – 238

## PACKET SWITCHING

Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448

## PACKING DENSITY

On the Importance of Atomic Packing in Determining Dielectric Permittivities – 553

## PAIN

A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 333

Neurofibromatosis and the Painful Neuroma – 315

## PAINTS

Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities – 64

## PANCREAS

Artificial Pancreas for Control of BG and Insulin Levels in Hospitalized Patients with Diabetes and Stress Hyperglycemia – 328

## PARABOLIC DIFFERENTIAL EQUATIONS

Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model – 514

## PARACHUTES

Low Cost Parachute – 2

## PARALLEL PROCESSING (COMPUTERS)

A Distributed Parallel Embedded System for Autonomous Sonar Arrays – 450

A Distributed Parallel Processing System for Command and Control Imagery – 466

A High-Performance Communication Service for Parallel Computing on Distributed DSP Systems – 449

A Parallel Particle Swarm Optimizer – 533

Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – 448

Exploiting Data-Flow for Fault-Tolerance in a Wide-Area Parallel System – 447

Fault-Tolerant Parallel Algorithms for Adaptive Matched-Field Processing on Distributed Array Systems – 509

HPC-Colony: Services and Interfaces to Support Systems with Very Large Numbers of Processors. (2006 Annual Report, January-December 2006) – 431

Parallel Simulation of Chip-Multiprocessor Architectures – 447

Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448

Purple Computational Environment with Mappings to Ace Requirements for the General Availability User Environment Capabilities. Version 2.0 – 433

Report to the Institutional Computing Executive Group (ICEG) August 14, 2006 – 433

#### PARALLEL PROGRAMMING

PCA RAW FABRIC: Architectural Prototyping, Demonstration and Evaluation – 462

#### PARALYSIS

Autologous Marrow-Derived Stem Cell-Seeded Gene-Supplemented Collagen Scaffolds for Spinal Cord Regeneration as a Treatment for Paralysis – 299

#### PARAMETER IDENTIFICATION

Comparison of Isoconversional and Model Fitting Approaches to Kinetic Parameter Estimation and Application Predictions – 108

Fundamentals of Signal Processing for Phased Array Radar – 176

#### PARAMETERIZATION

Regression Strategies for Parameter Space Exploration. A Case Study in Semicoarsening Multigrid and R – 435

Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 597

#### PARASITES

A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389

Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations – 284

Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402

Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386

Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398

Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392

The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401

Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404

#### PARASITIC DISEASES

A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389

Behavioral Responses to DDT and Pyrethroids Between Anopheles Minimus Species A and C Malaria Vectors in Thailand – 393

Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402

Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium falciparum Malaria in Peru – 380

HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400

Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392

The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401

White Blood Cell Counts and Malaria – 400

#### PARTIAL DIFFERENTIAL EQUATIONS

Parameter Space: The Final Frontier. Certified Reduced Basis Methods for Real-Time Reliable Solution of Parameterized Partial Differential Equations – 512

#### PARTICLE ACCELERATORS

8 GeV Beam Line Optics Optimization for the Rapid Antiproton Transfers at Fermilab – 557

AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605

Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558

Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565

High-Energy Neutron Imaging Development at LLNL – 567

Implementation of the Polarized HD Target at the Thomas Jefferson National Accelerator. Reporting Period for January 1, 2002 to December 31, 2006 – 583

Inclusive high-p(T)b anti-b Cross Section Measurement at  $s^{**}(1/2)$  Equals 1.96 TeV – 560

Injector Test Facility for the LCLS. Executive Summary – 566

Massive Metrology: Development and Implementation of a 3D Reference Frame for the Realignment of Fermilab's Tevatron – 606

Overview of Theory and Simulations in the Heavy Ion Fusion Science Virtual National Laboratory – 559

Performance Measurement of the Upgraded D0 Central Track Trigger – 558

Preliminary Study of Using 'Pipetron'-Type Magnets for a Pre-Accelerator for the LHC – 566

Quantitative Experiments with Electrons in a Positively Charged Beam – 606

Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab – 564

Resonant Second Generation Slepton Production at the Tevatron – 586

Results on QCD Physics from the CDF-II Experiment – 559

Search for Chargino and Neutralino at Run II of the Tevatron Collider – 576

Searching for new Physics at CDF – 560

Some Searches for New Physics with the D0 Detector – 585

Spectroscopy and Decay of B Hadrons at the Tevatron – 576

Survey and Alignment of the Fermilab Electron Cooling System – 585

SUSY Multilepton Signatures at Tevatron – 576

t-tbar Production at the Tevatron. Event Selection and Cross Section Measurement – 586

Variable Directional Coupler for an Alternate ILC High-Power RF Distribution Scheme – 605

#### PARTICLE COLLISIONS

Measurements of the B Production Cross Section in Proton-Antiproton Collisions at  $s^{**}(1/2) = 1.96$  TeV using Semileptonic Decays of b Hadrons – 586

#### PARTICLE DECAY

B0 to K0K0bar and Other Hadronic b to d Decays – 567

Charmless B Decays – 577

Measurements of the B Production Cross Section in Proton-Antiproton Collisions at  $s^{**}(1/2) = 1.96$  TeV using Semileptonic Decays of b Hadrons – 586

Some Aspects of Hadron Hadron Collisions in High Energy Interactions (B(O)(s) Mixing Oscillations in Semileptonic Decay at D0 Experiment) – 557

## **PARTICLE ENERGY**

Improved Charged Particle Model in CA-LEICF – 569

## **PARTICLE IMAGE VELOCIMETRY**

Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel – 15

## **PARTICLE MOTION**

Particle Splitting for Monte-Carlo Simulation of the National Ignition Facility – 561

## **PARTICLE PRODUCTION**

Search for Higgs at CDF – 564

## **PARTICLES**

pH Triggerable Polymeric Particles – 66

Resuspension Physics of Fine Particles – 260

## **PARTICULATES**

Diesel Particulate Measurement Research, 2007. Phase 3 – 238

Fuel Property Effects on T700 Exhaust Particulates – 132

High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – 125

Modeling the Effects of Crevice Former, Particulates, and the Evolving Surface Profile In Crevice Corrosion – 119

Numerical Investigation for the Microstructural Effects on the Crack Growth Behavior of Particulate Composite Materials – 79

Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – 123

## **PASSENGERS**

Aviation Security: Efforts to Strengthen International Passenger Prescreening are Under Way, but Planning and Implementation Issues Remain – 3

Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10

Preliminary Assessment of Stroboscopic Shutter Glasses on Motion Sickness in Helicopter Passengers – 30

## **PATCH ANTENNAS**

Method for Constructing Antennas from Textile Fabrics and Components – 179

## **PATENT APPLICATIONS**

Antimicrobial Polymeric Surfaces – 79

Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72

Cooled Turbine Airfoil – 42

Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214

Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115

High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 556

Integrated Plasmon and Dielectric Waveguides – 587

Method and System for Interactive Modeling of High-Level Network Performance with Low-Level Link Design – 436

Novel Synthesis of Branched Carbon Nanotubes – 207

Pneumatically Actuated Flexible Coupling and Effectors for Lapping/Polishing – 34

Signal Event Detection System – 590

Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof – 72

System and Method for Field Testing a Tack Coat Layer – 75

Systems and Methods for Altering Vestibular Biology – 506

Thermally Compensated Fiber Bragg Grating Mount – 236

Tubular Carbon Nano/micro Structures and Method of Making Same – 74

## **PATHOGENESIS**

A Biophysico-computational Perspective of Breast Cancer Pathogenesis and Treatment Response – 325

Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333

Program Project on the Pathogenesis and Treatment of Parkinson's Disease – 334

The Role of CRELD1 Isoform 9B in the Pathogenesis of Breast Cancer – 280

## **PATHOGENS**

Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335

Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – 386

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

Tools for Ultraspecific Probe/Primer Design – 327

## **PATHOLOGY**

Integration of Anatomic and Pathogenetic Bases for Early Lung Cancer Diagnosis – 506

## **PATIENTS**

Adjuvant Immunotherapy for Patients at High Risk of Recurrence Following Radiation Therapy for Prostate Cancer – 298

Antagonism of Taxol Cytotoxicity by Pro-lactin: Implications for Patient Resistance to Chemotherapy – 364

Artificial Pancreas for Control of BG and Insulin Levels in Hospitalized Patients with Diabetes and Stress Hyperglycemia – 328

Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy – 286

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

Evaluating an Interactive, Multimedia Education and Decision Program for Early-Stage Prostate Cancer Patients in a Randomized Controlled Trial – 342

Health Information Exchange in Post-Acute and Long-Term Care – 663

Hot Flashes and Quality of Life Among Breast Cancer Patients – 288

IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345

Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385

## **PATTERN RECOGNITION**

Conditional Random People: Tracking Humans with CRFs and Grid Filters – 505

Facial Recognition Evaluation Project Passport Office of Canada - The Methodology and Findings – 228

Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – 637

New Metrics for Blog Mining – 622

Pattern Analysis of Directed Graphs Using DEDICOM: An Application to Enroll Email – 439

Training Coordination Proxy Agents – 616

Ultra-fast Object Recognition from Few Spikes – 501

## **PATTERN REGISTRATION**

Advanced Technologies in Safe and Efficient Operating Rooms – 309

## **PAVEMENTS**

A Value-Focused Thinking Model for the Selection of the Best Rigid Pavement, Partial-Depth Spall Repair Material – 20

Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – 45

Preliminary Findings from Noise Testing on PFC Pavements in Texas – 260

Research Plan for Measuring Noise Levels in Highway Pavements in Texas – 259

Subgrade CBR Values for Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility – 13

System for the Evaluation of Moisture Damage Using Fundamental Material Properties – 74

#### **PAYLOADS**

Payload Isolation System for Launch Vehicles – 54

Prioritizing Satellite Payload Selection via Optimization – 46

Unmanned Aerial Vehicles: Background and Issues for Congress – 30

#### **PEACETIME**

Coalition Information Sharing: Lessons from Kosovo – 183

Command and Control in Peace Support Operations Model PAX - Approaching New Challenges in the Modeling of C2 – 148

#### **PENETRATION**

A Multipurpose Projectile for Penetrating Urban Targets – 519

Analysis of USA' Broadband Policy – 491

Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250

#### **PEPTIDES**

Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – 338

Human Platelets Exhibit Chemotaxis using Functional N-Formyl Peptide Receptors – 386

New Structural Approaches to Understanding the Disease Related Forms of the Prion Protein – 352

Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333

Protein Transduction Based Therapies for Breast Cancer – 315

#### **PERCEPTION**

Assessing Perceptions of Knowledge Management Maturity/Capabilities: A Case Study of SAF/FM – 649

#### **PERCHLORATES**

Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD – 139

Perchlorate Removal, Destruction, and Field Monitoring Demonstration – 101

#### **PERFORMANCE PREDICTION**

A Method to Predict Atomization Performance in Gas-Centered Swirl-Coaxial Injectors – 218

Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors – 216

Flight Attendant Fatigue – 412

Knowledge Tracing and Prediction of Future Trainee Performance – 531

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

Method and System for Interactive Modeling of High-Level Network Performance with Low-Level Link Design – 436

Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts) – 411

Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448

#### **PERFORMANCE TESTS**

Infiniband Performance Comparisons of SDR, DDR and Infinipath – 205

Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – 38

Performance Measurement in C2 Systems – 496

Performance Measurement of the Upgraded D0 Central Track Trigger – 558

#### **PERMEABILITY**

Permeability Prediction of Three-Dimensional Woven Fabrics – 89

Preliminary Findings from Noise Testing on PFC Pavements in Texas – 260

#### **PERMITTIVITY**

On the Importance of Atomic Packing in Determining Dielectric Permittivities – 553

Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds – 90

#### **PERSONAL GULF**

Federally Sponsored Health Care Research Gulf War Illnesses and Beyond – 400

Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350

#### **PERSONAL COMPUTERS**

Assessment of Two Desk-Top Computer Simulations Used to Train Tactical Decision Making (TDM) of Small Unit Infantry Leaders – 482

#### **PERSONNEL DEVELOPMENT**

Experimentation with Evolving C2 Operation Centers - Implications for the Human Element – 137

Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7

#### **PERSONNEL MANAGEMENT**

Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497

#### **PERSONNEL**

Assessment of Two Desk-Top Computer Simulations Used to Train Tactical Decision Making (TDM) of Small Unit Infantry Leaders – 482

Defense Logistics: Army and Marine Corps' Body Armor Requirements, Controls, and Other Issues – 425

DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – 643

Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel – 424

Military Nutrition Research: Four Tasks to Address Personnel Readiness and Warfighter Performance – 366

NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252

PCBs Alter Dopamine Mediated Function in Aging Workers – 294

Platform Camera Aircraft Detection for Approach Evaluation and Training – 29

Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics – 635

Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – 256

Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389

The Effect of Graduate Education on the Performance of Air Force Officers – 526

#### **PERTURBATION**

A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 375

Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53

#### **PERU**

Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – 381

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404

- Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- PESTICIDES**  
Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350  
USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling – 277
- PETROLEUM PRODUCTS**  
A Possible Solution for the U.S. Navy's Addiction to Petroleum: A Business Case Analysis for Transitioning the U.S. Navy From Petroleum to Synthetic Fuel Resources – 63  
No Further Action Decision Under CERCLA Study Area 43E Historic Gas Station Sites Fort Devens, Massachusetts – 62  
No Further Action Decision Under CERCLA, Study Area 43P Historic Gas Station Sites, Fort Devens, Massachusetts – 62
- PHARMACOLOGY**  
A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 375  
Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416  
Pharmacological and Nonpharmacological Methods of Treatment for Fragile – 410  
The Need for an Aerospace Pharmacy Residency – 419
- PHASE CONTRAST**  
High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133
- PHASE SHIFT**  
Non-Multiple Delay Element Values for Phase Shifting – 199  
Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509  
Simulation of Coherent Signals with Forward Error Correction Coding – 540
- PHASED ARRAYS**  
Fundamentals of Signal Processing for Phased Array Radar – 176  
Ultrasound Phased Arrays – 208  
Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 597
- PHENYLS**  
Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306
- PHOSGENE**  
Nuclear Safety: DOE's Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened – 132
- PHOSPHATES**  
Prevention of Prostate Cancer by Inositol Hexaphosphate – 361
- PHOSPHIDES**  
Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP2 – 234
- PHOSPHORUS**  
Analysis of p21-Activated Kinase Function in Neurofibromatosis Type 2 – 315  
DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – 383  
Mechanisms of Disease Persistence in Chronic Myelogenous Leukemia (CML) – 318  
Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemo-Resistance - Potential Mechanism of PIM Action – 282  
Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – 352
- PHOSPHORYLATION**  
cSrc and Her2 Signaling Pathways Cooperate with Estrogen to Promote ER Phosphorylation, Ubiquitination and Proteolysis in ER Negative Breast Cancers – 356  
DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – 383  
Novel Molecular Interactions and Biological Functions of the Neurofibromatosis 2 Tumor Suppressor Protein, Merlin – 327
- PHOTOCHROMISM**  
Self Assembled Nano-Photonic Devices Derived from Marine DNA for Optoelectronic Applications – 292
- PHOTOCONDUCTIVITY**  
New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210
- PHOTOGRAPHS**  
A Distributed Parallel Processing System for Command and Control Imagery – 466  
An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222
- PHOTOGRAPHY**  
Facial Recognition Evaluation Project Passport Office of Canada - The Methodology and Findings – 228
- PHOTOLUMINESCENCE**  
Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115  
Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – 63
- PHOTOMETERS**  
Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – 119
- PHOTOMETRY**  
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77
- PHOTONICS**  
New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210
- PHOTONS**  
Final Task Report on NRF Measurements of Photon Scattering Resonances in Plutonium at the High Voltage Research Laboratory of MIT – 561  
Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Nonparabolicity and the Urbach Tail – 102  
Novel Two- and Three-Photon Pumped Lasing Dyes: Design, Synthesis, and Characterization – 232
- PHOTOREFRACTIVITY**  
New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210
- PHOTOSYNTHESIS**  
Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204
- PHOTOVOLTAIC CONVERSION**  
Experience Scaling-Up Manufacturing and Emerging Photovoltaic Technologies – 245
- PH**  
pH Triggerable Polymeric Particles – 66
- PHTHALOCYANIN**  
Electrochemical Investigations of the Interface at Li/Li+ Ion Conducting Channel – 90
- PHYSICAL EXAMINATIONS**  
High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 351

## PHYSICAL EXERCISE

Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water – 410

Short-Term Exercise and Prostate Cancer Prevention in African American Men – 359

The Effect of Increasing Mass on Locomotion – 413

## PHYSICIANS

Immunology, Systems Biology, and Immunotherapy of Breast Cancer – 360

## PHYSIOLOGICAL EFFECTS

Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321

Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416

Flight Attendant Fatigue – 412

Galvanic Skin Response as a Measure of Soldier Stress – 410

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – 415

## PHYSIOLOGICAL RESPONSES

Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 400

Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – 415

Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332

## PHYSIOLOGY

Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps – 7

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 418

Physiological Stress Reactivity and Breast Cancer – 391

## PICKLING (METALLURGY)

Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – 109

## PIEZOELECTRIC CRYSTALS

Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187

## PIEZOELECTRIC TRANSDUCERS

Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers – 35

## PIEZOELECTRICITY

Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187

Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551

Optimization of Synthetic Jet Actuators – 235

Proceedings of the Symposium on Ferroelectricity and Piezoelectricity (IMRC 2005) – 76

Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – 211

## PILOTLESS AIRCRAFT

A Comparison of Trajectory Determination Approaches for Small UAVs – 11

Autonomous Unmanned Aerial Vehicle Rendezvous for Automated Aerial Refueling – 11

Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – 38

Persistent Monitoring Platforms – 36

Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26

RF Design for Tactical Ultra-Light Unmanned Aerial Vehicle Radar System – 27

Unmanned Aerial Vehicles: Background and Issues for Congress – 30

## PILOTS

Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27

Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 32

Platform Camera Aircraft Detection for Approach Evaluation and Training – 29

## PIPES (TUBES)

Development and Manufacture of Cost Effective Composite Drill Pipe. 2006 Annual Technical Progress Report – 84

From Stove-pipe to Network Centric Leveraging Technology to Present a Unified View – 616

Hot Leg Piping Materials Issues (U) – 595

## PISTON ENGINES

Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 238

Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237

## PITCH (INCLINATION)

Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere – 261

## PITUITARY HORMONES

Antagonism of Taxol Cytotoxicity by Pro lactin: Implications for Patient Resistance to Chemotherapy – 364

Role of Growth Hormone in Prostate Cancer – 342

## PIXELS

An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 223

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

Polarimeter in a Pixel – 195

## PLANAR STRUCTURES

Position Analysis of Planar Tensegrity Structures – 583

## PLANET DETECTION

High Contrast Imaging Using Adaptive Optics for Extrasolar Planet Detection – 666

## PLANETARY NEBULAE

An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 666

## PLANETARY QUARANTINE

Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – 398

## PLANNING

A Conceptual Operational Model for Command and Control of International Missions in the Canadian Forces – 180

AI on the Battlefield: An Experimental Exploration (Preprint) – 501

C3X: Correlation, Causation and Controlled Experimentation for C2 – 146

Changing the Cultural Paradigm to Meet Emerging Requirements – 56

Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – 471

Flexible UAV Mission Management Using Emerging Technologies – 23

Link Analysis for Dynamic Planning and Scheduling – 502

Long-Range Operational Military Forecasts for Afghanistan – 271

Multinational Information Sharing and Collaborative Planning Limited Objective Experiments – 655

- Optimising the Design of Land Force C2 Architectures – [152](#)
- Risk Advised Course of Action (COA) Analysis – [532](#)
- Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans – [640](#)
- Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – [19](#)
- Towards a Computational Model of Sketching – [450](#)
- ‘COM as Shooter’ Operational Planning using C2 for Confronting and Collaborating – [169](#)
- PLASMA CONTROL**
- Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma – [574](#)
- Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – [518](#)
- PLASMA ENGINES**
- Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites – [124](#)
- PLASMA HEATING**
- The Status and Future of the ICRF – [665](#)
- PLASMA PHYSICS**
- Energy Efficient Transient: Plasma Ignition: Physics and Technology – [111](#)
- PLASMA RADIATION**
- Development of Technologies to Utilize Laser Plasma Radiations Sources for Radiation Effects Sciences – [600](#)
- PLASMA SHEATHS**
- On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – [551](#)
- PLASMAS (PHYSICS)**
- Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma – [574](#)
- Interaction of Intense Electron Beams with Plasma – [582](#)
- Laser Plasma Interactions in High Energy Density Plasmas – [602](#)
- Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry – [603](#)
- Tip Clearance Control Using Plasma Actuators – [16](#)
- PLASMIDS**
- Mosaic Structure of a Multiple-Drug-Resistant, Conjugative Plasmid from *Campylobacter jejuni* – [407](#)
- Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – [399](#)
- PLASMONS**
- Electro-Optic Array Interface – [213](#)
- Integrated Plasmon and Dielectric Waveguides – [587](#)
- PLASTIC DEFORMATION**
- The Effect of Inhomogeneous Plastic Deformation on the Ductility and Fracture Behavior of Age Hardenable Aluminum Alloys – [116](#)
- PLASTICS**
- A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – [125](#)
- PLATELETS**
- Human Platelets Exhibit Chemotaxis using Functional N-Formyl Peptide Receptors – [386](#)
- Integration of Soluble and Adhesive Gradient Signals in Directed Cell Migration – [310](#)
- Platelet Activating Factor: A Growth Factor for Breast Cancer – [341](#)
- PLOTTING**
- Near-Relativistic Electron c/v Onset Plots – [668](#)
- PLUG NOZZLES**
- Technologies for Propelled Hypersonic Flight, Volume 1 - Subgroup 1: Plug Nozzles – [40](#)
- Technologies for Propelled Hypersonic Flight – [40](#)
- PLUGS**
- Quick-Turn Finite Element Analysis for Plug-and-Play Satellite Structures – [520](#)
- PLUMES**
- Minimization of Thruster Plume Effects on Spacecraft Surfaces – [52](#)
- Southern Nevada Air Quality Study – [236](#)
- PLUTONIUM**
- Changes in Delta-Plutonium Due to Self-Irradiation Aging Observed by Continuous In-Situ X-ray Scattering – [120](#)
- Final Task Report on NRF Measurements of Photon Scattering Resonances in Plutonium at the High Voltage Research Laboratory of MIT – [561](#)
- Iran’s Nuclear Program: Recent Developments – [594](#)
- Radiation Damage Effects on the Magnetic Properties of  $Pu(1-x)Am(x)$  ( $x=0.224$ ) – [562](#)
- PLY ORIENTATION**
- Probabilistic Analysis for the Mechanical Properties of Cross-Ply Fiber-Reinforced Composite Laminate (Postprint) – [115](#)
- PNEUMATICS**
- Pneumatically Actuated Flexible Coupling end Effectors for Lapping/Polishing – [34](#)
- POINT DEFECTS**
- Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – [187](#)
- POISONS**
- Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – [297](#)
- Semi-Synthesis and In-vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism – [401](#)
- POLAR CAPS**
- Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica – [241](#)
- POLAR ORBITS**
- Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – [48](#)
- POLARIMETERS**
- Polarimeter in a Pixel – [195](#)
- POLARIMETRY**
- Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – [632](#)
- Polarimetric Thermal Imaging – [540](#)
- POLARIZERS**
- Polarized Optical Probes – [599](#)
- POLICIES**
- Analysis of USA’ Broadband Policy – [491](#)
- Appraising Policies to Reduce Freight Transport Time and Its Variability-A New Method – [430](#)
- Army Fuels: Policies, Regulations, and Executive Orders – [129](#)
- Building a Deterrence Policy Against Strategic Information Warfare – [654](#)
- China: Possible Missile Technology Transfers from U.S. Satellite Export Policy - Actions and Chronology – [637](#)
- Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – [10](#)
- Further Evidence of the Effects of Wind Turbine Farms on AD Radar – [532](#)
- Future Applications in Using Biometrics to Enhance Security Level of Coalition Information Sharing Networks – [477](#)
- Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues – [618](#)
- Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – [497](#)
- Review of the Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper – [256](#)

- Security Classification Policy and Procedure: E.O. 12958, as Amended – 650
- Security Classified and Controlled Information: History, Status, and Emerging Management Issues – 658
- Static Reachability Analysis and Validation Regarding Security Policies Implemented via Packet Filters – 489
- The Demise of Russian Health Capital: The Continuity of Ineffective Government Policy – 323
- ‘Sensitive But Unclassified’ Information and Other Controls: Policy and Options for Scientific and Technical Information – 635
- POLISHING**
- Pneumatically Actuated Flexible Coupling end Effectors for Lapping/Polishing – 34
- POLLUTION CONTROL**
- Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities – 64
- Electronically Induced Redox Barriers for Treatment of Groundwater – 198
- Feasibility Study of H(sub2)S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California – 259
- Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254
- Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – 256
- Reduced Exhaust Emissions Gas Turbine Engine Combustor – 39
- Removal of Elemental Mercury from a Gas Stream Facilitated by a Non-Thermal Plasma Device. Final Report – 258
- Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – 252
- POLLUTION MONITORING**
- LLNL 10(a)(1)(A) Annual Report (TE-053672-2)-2006 – 254
- Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274
- POLYCHLORINATED BIPHENYLS**
- PCBs Alter Dopamine Mediated Function in Aging Workers – 295
- POLYCYCLIC AROMATIC HYDROCARBONS**
- Degradation of Polycyclic Aromatic Hydrocarbons by Actinomycetes – 104
- Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78
- POLYETHYLENES**
- Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89
- POLYIMIDES**
- Characterization of the Structure-Processing-Performance Relations of Phenylethynyl Phthalic Anhydride Crosslinked Fluorinated Polyimides (AFR-PEPA-N) and Their Carbon Fiber Composites – 85
- Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- POLYMER MATRIX COMPOSITES**
- Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 17
- Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint) – 80
- Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 81
- Oxygen Plasma Treatment and Deposition of CN<sub>x</sub> on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121
- POLYMERIC FILMS**
- MURI Center for Materials Chemistry in the Space Environment – 112
- Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79
- Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89
- POLYMERIZATION**
- A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395
- Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385
- Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- POLYMERS**
- Antimicrobial Polymeric Surfaces – 79
- Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72
- Hyperbranched Polymers for Resin Transfer Molding – 126
- Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – 67
- Organic Polymers with Magneto-Dielectric Properties – 124
- pH Triggerable Polymeric Particles – 66
- Polymers for Orientation and Stability of Liquid Crystals – 75
- Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites – 123
- Post-Coupling Synthetic Approach for Polymeric Antioxidants – 65
- Short Report: Detection of Orienta Tsutsumushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385
- Targeted Therapies for Myeloma and Metastatic Bone Cancers – 328
- Telechelic Alkadiene Polymers with Crosslinkable End Groups and Methods for Making the Same – 73
- POLYMERISM**
- Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340
- Prostate Cancer Gene Discovery Using ROMA – 371
- POLYNOMIALS**
- Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 598
- POLYNUCLEOTIDES**
- Bioreactive Allosteric Polynucleotides – 69
- POLYPEPTIDES**
- Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – 65
- POLYPROPYLENE**
- Development of Nanocomposite Reinforced Polymeric Materials to be Used for Racks for Retorting Polymeric Trays – 123
- POLYSTYRENE**
- Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81
- POLYURETHANE RESINS**
- Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof – 72
- POPULATIONS**
- A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 333
- Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285



- Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 352
- Signal Population in the License-Exempt Wireless-Radio Bands at the MOUT Site – 152
- Using DISTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – 253
- POROSITY**  
Permeability Prediction of Three-Dimensional Woven Fabrics – 89
- PORPHYRINS**  
A New Synthesis of Porphyrins with Extended Conjugation and their Photophysics – 62
- PORTABLE EQUIPMENT**  
Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249
- Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331
- Handheld Broadband Electromagnetic UXO Sensor – 198
- POSITION (LOCATION)**  
Client Location in 802.11 Networks – 639
- Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261
- Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153
- Grid-Search Techniques for Seismic Event Location and Phase Association – 261
- Impact Location for a Multilayer Transversely Isotropic Plate – 604
- Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node – 641
- Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 352
- Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457
- Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – 262
- Self-Stabilizing Mobile Node Location Management and Message – 511
- Signal Event Detection System – 590
- Simultaneous Localization and Tracking in Wireless Ad-hoc Sensor Networks – 188
- Simultaneous Localization, Calibration, and Tracking in an ad Hoc Sensor Network – 536
- POSITIONING**  
Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy – 287
- POSITRONS**  
Beam Dynamics in a Spectrometer for the Polarized Positron Production Experiment – 584
- POTABLE WATER**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
- POTENTIAL ENERGY**  
Position Analysis of Planar Tensegrity Structures – 583
- POWDER METALLURGY**  
Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint) – 92
- POWDERED ALUMINUM**  
Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83
- PRECESSION**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – 665
- PRECIPITATION HARDENING**  
The Effect of Inhomogeneous Plastic Deformation on the Ductility and Fracture Behavior of Age Hardenable Aluminum Alloys – 116
- PRECIPITATION (METEOROLOGY)**  
1958-2006 Precipitation Climatology for Lawrence Livermore National Laboratory, Livermore Site and Site 300 – 275
- PREDICTION ANALYSIS TECHNIQUES**  
Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31
- USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling – 277
- PREDICTIONS**  
Advances in Modeling and Simulation Capabilities for Predicting Store Trajectories - Past Success and Future Challenges – 5
- Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions – 603
- fRMSDPred: Predicting Local RMSD Between Structural Fragments Using Sequence Information – 369
- Joint Synthetic Battlespace: Cornerstone for Predictive Battlespace Awareness – 455
- Predicting the Cosmological Constant from the Causal Entropic Principle – 671
- Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184
- PREPROCESSING**  
Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 33
- PRESIDENTIAL REPORTS**  
VXX Presidential Helicopter: Background and Issues for Congress – 29
- PRESSURE SENSORS**  
Reconfigurable Linear Sensor Arrays for Reduced Channel Count – 208
- PRESSURIZING**  
Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – 97
- PRESTRESSING**  
Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – 240
- PREVENTION**  
Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 337
- Can GWOT Primary Prevention Strategy More Effectively Impede Religious Extremism? – 390
- Defect Prevention and Detection in Software for Automated Test Equipment – 430
- Efficacy of Calcium and Vitamin D Supplementation for the Prevention of Stress Fractures in Female Naval Recruits – 288
- Intelligence Reform and Terrorism Prevention Act of 2004: 'Lone Wolf' Amendment to the Foreign Intelligence Surveillance Act – 664
- NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252
- Prevention of Prostate Cancer by Inositol Hexaphosphate – 361
- Short-Term Exercise and Prostate Cancer Prevention in African American Men – 359
- PRIMATES**  
Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 397
- HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397

Monitoring and Counteracting Functional Deterioration in Parkinson's Disease: A Multilevel Integrative Approach in a Prime Model System – 319

#### PRINCIPAL COMPONENTS ANALYSIS

Hyperspectral Imagery Target Detection Using Principal Component Analysis – 522

#### PRINTED CIRCUITS

Assured Reference Technology Research (ARTHUR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – 596

#### PRIORITIES

Army Intelligence Analysis and Interpretation: Assessing the Utility and Limitations of Computational Diagnostic Reasoning – 652

Optimizing the Prioritization of Natural Disaster Recovery Projects – 274

Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – 256

#### PRIVACY

Challenges and Potential Research Areas in Biometrics – 476

DigitalPersona - Case Study: Department of Defense – 475

Electronic Vehicle Identification: Industry Standards, Performance, and Privacy Issues – 178

Human Factors and Privacy – 476

Privacy and Biometrics: The Human Factors – 477

#### PROBABILITY DISTRIBUTION FUNCTIONS

An Inverse of the Circular Coverage Function – 525

An Inverse of the Elliptic Coverage Function – 525

An Inverse of the Generalized Circular Error Function – 525

#### PROBABILITY THEORY

An Approximation Technique for Belief Revision in Timed Influence Nets – 521

An Inverse of the Circular Coverage Function – 525

An Inverse of the Elliptic Coverage Function – 525

An Inverse of the Generalized Circular Error Function – 525

Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – 453

IEIST Technologies Enabling TCT Prosecution – 538

Probabilistic Modeling of Space Shuttle Debris Impact – 58

Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26

Risk Assessment: Evidence Base – 529

Survey of Probabilistic Models for Relational Data – 435

Techniques for the Statistical Analysis of Observer Data – 524

#### PROBES

Polarized Optical Probes – 599

#### PROBLEM SOLVING

A Qualitative Approach to Rigid Body Mechanics – 501

A Quantum Approach to Multi-Agent Systems (MAS), Organizations, and Control – 534

Cooperative Solutions in Multi-Person Quadratic Decision Problems: Finite-Horizon and State-Feedback Cost-Cumulant Control Paradigm – 516

Implicit Solvers for Large Scale Nonlinear Problems – 433

Multi-Agent Systems in Mobile Ad hoc Networks – 626

Parallel Eigensolver for H (curl) Problems using H1 Auxiliary Space AMG Preconditioning – 434

Problem representation and variation in the forecasts of 'political experts' – 543

Some Experience with a H1 Based Auxiliary Space AMG for H (curl) Problems – 437

The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367

The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618

Using Templates to Support Crisis Action Mission Planning – 455

#### PROCEDURES

Best Practice in Adhesive-Bonded Structures and Repairs – 67

Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of Travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan – 375

Supporting Effects-Based Operations with Information Technology Tools: Examining Underlying Assumptions of EBO Tool Development Practices – 536

System-of-Systems Governance: New Patterns of Thought – 465

#### PROCUREMENT

Conditions for Achieving Network-Centric Operations in Systems of Systems – 465

Cord Blood Stem Cell Procurement in Minority Donors – 302

Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461

Report to the Institutional Computing Executive Group (ICEG) August 14, 2006 – 433

Topics in Interoperability: Structural Grammaticals in a System of Systems – 465

Unmanned Aerial Vehicles: Background and Issues for Congress – 30

#### PRODUCTIVITY

The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities – 481

#### PROGNOSIS

Prognostic Significance of Telomere Attrition in Ductal Carcinoma in Situ of the Breast – 391

#### PROGRAM VERIFICATION (COMPUTERS)

Enhancing Information Systems Security through Biometrics – 472

#### PROGRAMMING LANGUAGES

Hao Spectral Diagnostic Package for Emitted Radiation (Haos-Diper) Reference Guide. Version 1.0 – 558

Operational Agility: Composing and Orchestrating Mission Capability Packages Through Business Process Execution Language (BPEL) – 444

PCA RAW FABRIC: Architectural Prototyping, Demonstration and Evaluation – 462

#### PROJECT MANAGEMENT

Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 489

Concept of C4I Data Fusion Command Center for Urban Operations – 155

Framework for Information Age Assessment Metrics – 171

Information Age Architectures Must Be Enterprise Architecture – 171

#### PROJECT PLANNING

NOAA National Passive Acoustics Workshop, 2006 – 590

#### PROJECTILES

A Multipurpose Projectile for Penetrating Urban Targets – 519

Design of Experiments Study of the Initial Extended Area Protection and Survivability (EAPS) Projectile System – 527

Stochastic Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile – 427

Structural Design and Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile Configurations – 216

#### PROPELLANT TANKS

Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – 97

#### PROPELLANTS

Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – 130

Insensitive High-Performance Replacements for RDX in Explosive and Propellant Formulations – 59

Investigation of Advanced Propellants to Enable Single Stage to Orbit Launch Vehicles – 51

## PROPELLERS

Technologies for Propelled Hypersonic Flight, Volume 2 - Subgroup 2: Scram Propulsion – 41

Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight – 41

## PROPHYLAXIS

A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – 406

Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 336

Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340

## PROPORTIONAL NAVIGATION

Proportional Navigation With Adaptive Terminal Guidance For Aircraft Rendezvous (Preprint) – 7

## PROPOSALS

UH-USA Agreement - A Telemedicine Research Proposal – 624

## PROPULSION SYSTEM CONFIGURATIONS

Confined Detonations and Pulse Detonation Engines – 42

## PROPULSION

Investigation of Advanced Propellants to Enable Single Stage to Orbit Launch Vehicles – 52

Technologies for Propelled Hypersonic Flight – 40

## PROSTATE GLAND

A Phase II Immunotherapeutic Trial: Combination Androgen Ablative Therapy and CTLA-4 Blockade as a Treatment for Advanced Prostate Cancer – 298

Activation and Protection of Dendritic Cells in the Prostate Cancer Environment – 312

Adjuvant Immunotherapy for Patients at High Risk of Recurrence Following Radiation Therapy for Prostate Cancer – 298

Anti-Angiogenic Action of Neutral Endopeptidase – 285

Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 336

Apoptosis and Tumor Progression in Prostate Cancer – 338

Apoptosis-Dependent and Apoptosis-Independent Functions of Bim in Prostate Cancer Cells – 307

ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer – 344

Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy – 286

Biological Impact of Senescence Induction in Prostate Cancer Therapy – 293

Cadmium, Zinc, and Selenium Levels in Carcinoma of the Human Prostate – 356

Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer – 320

Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells – 303

Centrosome-Based Mechanisms, Prognostics and Therapeutics in Prostate Cancer – 345

Decipher the Transcriptional Program in Prostate Cancer Cells – 305

Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362

Developing Models to Facilitate the Appropriate Selection and Effective Targeting of Candidate Antigens for Specific Cellular Immunotherapy of Prostate Cancer – 349

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Development of a Novel, Non-Invasive Diagnostic Test for Prostate Cancer – 284

Development of Antigen Presenting Cells for Adoptive Immunotherapy in Prostate Cancer – 286

Development of Methodology to Maintain Primary Cultures of Normal and Malignant Human Prostatic Epithelial Cells in Vivo – 342

Development of Novel Bifunctional Compounds that Induce Apoptosis in Prostate Cancer Cells – 365

Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340

Differential Mechanisms of Androgen Resistance – 313

DRF3 as a Cholesterol-Dependent Regulator of Src in Prostate Cancer – 315

Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381

Early Detection of Prostate Cancer – 323

Effect of COX-2 (PGE2) and IL-6 on Prostate Cancer Bone Mets – 294

Effects of Modifications in the Laminin-10 Basal Laminina on Prostate Cancer Invasion – 376

Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor – 281

Evaluating an Interactive, Multimedia Education and Decision Program for Early-Stage Prostate Cancer Patients in a Randomized Controlled Trial – 342

Evaluation of Genomic Instability in the Abnormal Prostate – 405

FGFR4 Downregulation of Cell Adhesion in Prostate Cancer – 376

Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes – 341

Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – 329

GKLF as a Novel Target in Selenium Chemoprevention of Prostate Cancer – 361

Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis – 344

High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350

HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate – 290

Humanin: A Novel Therapeutic Target in Prostate Cancer – 319

Identification of a Protein for Prostate-Specific Infection – 301

Identification of Sonic Hedgehog-Induced Stromal Factors That Stimulate Prostate Tumor Growth – 295

Identifying Molecular Factors in Androgen Receptor Nuclear Export – 282

IDO Inhibitors for Combination Therapy of Prostate Cancer – 317

Imaging Primary Prostate Cancer and Bone Metastasis – 325

Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging – 355

Interactions between Dietary Factors and Inflammation in Prostate Carcinogenesis – 349

Intra-Prostate Cancer Vaccine Inducer – 316

Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344

Involvement and Regulation of Heparanase in Prostate Cancer Progression – 318

Knockout AR in Prostate – 280

Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 352

Long-Term Outcomes of Alternative Brachytherapy Techniques for Early Prostate Cancer – 294

Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351

Mechanism of Tumor Metastasis Suppression by the KA11 Gene – 318

Methylselenium and Prostate Cancer Apoptosis – 339

Molecular Effects of 13C/DIM in Prostate Cancer – 406

MR Imaging Based Treatment Planning for Radiotherapy of Prostate Cancer – 349

Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy – 363

Origin and Properties of Prostatic Stem Cells – 299

p63 in Development and Maintenance of the Prostate Epithelium – 355

Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313

Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemo-Resistance - Potential Mechanism of PIM Action – 282

Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer – 302

Prevention of Prostate Cancer by Inositol Hexaphosphate – 361

Proof of Concept for Systematic Collection of Optimal Molecular Quality Anatomically Oriented Normal Prostate from Diverse Age and Race Transplant Donors – 326

Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – 352

Prostate Cancer Gene Discovery Using ROMA – 371

PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – 302

Radiation-Induced Immune Modulation in Prostate Cancer – 325

Radio-sensitizing Effects of Novel Histone De-Acetylase Inhibitors in Prostate Cancer – 283

Restoration of Wild-Type Activity to Mutant p53 in Prostate Cancer: A Novel Therapeutic Approach – 365

Role of Caveolin-1 in Prostate Cancer Angiogenesis – 286

Role of Growth Hormone in Prostate Cancer – 342

Role of Obesity in Prostate Cancer Development – 336

Role of Reactive Stroma in Prostate Cancer Progression – 317

Selective Androgen Receptor Downregulators (SARDs): A New Prostate Cancer Therapy – 303

Short-Term Exercise and Prostate Cancer Prevention in African American Men – 359

Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy – 316

Studies of Prostate Tumor Development Via CRE/LOXP Technology – 309

The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway through High-Throughput Cell-Based Screens – 329

The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis – 322

The Significance of Focal Basal Cell Layer Disruption-Induced Immuno-Cell Infiltration in Prostate Cancer Invasion – 364

Unique Approaches to Androgen Effects on Prostate Cancer – 334

Validation of Quantitative Multimodality Analysis of Telomerase Activity in Urine Cells as a Noninvasive Diagnostic and Prognostic Tool for Prostate Cancer – 366

Vasculature-Specific Adenovirus Vectors for Gene Therapy of Prostate Cancer – 352

## PROSTHETIC DEVICES

Toward Neural Control of Prosthetic Devices – 210

## PROTECTION

Achievements in Stratospheric Ozone Protection – 278

Activation and Protection of Dendritic Cells in the Prostate Cancer Environment – 312

Advancing Software Security - The Software Protection Initiative – 626

Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331

Defending Electrical Power Grids – 243

Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426

Design of Experiments Study of the Initial Extended Area Protection and Survivability (EAPS) Projectile System – 527

Digital C4I Interoperability: The EM Protection Issue – 163

FCS Technology Insertion and Transition – 508

Homeland Security -- Reducing the Vulnerability of Public and Private Information Infrastructures to Terrorism: An Overview – 493

Homeland Security: Protecting Airspace in the National Capital Region – 25

Issues and Requirements for Cybersecurity in Network Centric Warfare – 446

Novel Collective Protection Filters for Emerging TIC Requirements: Axial and Radial-Flow Filter Designs – 55

Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

Protection of Software-based Survivability Mechanisms – 447

Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – 369

Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379

Stochastic Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile – 427

Structural Design and Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile Configurations – 216

Technical and Non-Technical Problems in Biometric Physical Access Control Systems – 473

Topology of On/Off Marx Modulator with Protection of Load and Solid State Switches – 579

## PROTECTIVE COATINGS

First Principles and Multi-Scale Modeling of the Roles of Impurities and Dopants on Thermal Barrier Coating Failure – 88

Nanoengineered Additives for Active Coatings – 61

Oxygen Plasma Treatment and Deposition of CNx on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121

Releaseable Corrosion Inhibitor Compositions – 108

## PROTECTORS

Skin Temperature Feedback Optimizes Microclimate Cooling – 272

Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments – 205

## PROTEINS

An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 331

Assessment of Detection and Refinement Strategies for de novo Protein Structures using Force Field and Statistical Potentials – 353

Association between Microtubule Associated Protein -2 and the EGRF Signaling in Breast Cancer – 296

Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – 338

Deciphering the Molecular Mechanisms of Breast Cancer – 324

DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – 383

DRF3 as a Cholesterol-Dependent Regulator of Src in Prostate Cancer – 315

Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor – 281

Feasibility of Biomonitoring of Exposure to Permethrin Through Analysis of Long-Lived (Metabolite) Adducts to Proteins – 320

fRMSDPred: Predicting Local RMSD Between Structural Fragments Using Sequence Information – 369

HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397

Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388

Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389

Identification of a Protein for Prostate-Specific Infection – 301

Kapillaerelektrofores i Tva Dimensioner. Slutrapport Fran Innovationsprojekt 14215 (Two-Dimensional Capillary Electrophoresis Final Report of the Innovative Project 14215) – 68

Mechanisms of Alpha-synuclein Aggregation and Toxicity – 330

Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – 65

New Structural Approaches to Understanding the Disease Related Forms of the Prion Protein – 348

Novel Molecular Interactions and Biological Functions of the Neurofibromatosis 2 Tumor Suppressor Protein, Merlin – 327

Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemoresistance - Potential Mechanism of PIM Action – 282

Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398

Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – 352

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

Protein Transduction Based Therapies for Breast Cancer – 315

Selective Androgen Receptor Downregulators (SARDs): A New Prostate Cancer Therapy – 303

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway through High-Throughput Cell-Based Screens – 329

The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis – 322

The Role of RB in the Therapeutic Response of Breast Cancer – 301

The Role of TSC Proteins in Regulating Cell Adhesion and Motility – 281

## PROTEOME

A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389

Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335

Proteomic Analysis of Rickettsia prowazekii – 395

Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers – 322

## PROTOCOL (COMPUTERS)

A Distributed Approach for Multi-Constrained Path Selection and Routing Optimization – 640

A Multi-Ring Framework for Survivable Group Communications – 440

A Test Method to Assess the Foldability of Flexible Structural Materials – 125

An Evaluation Methodology for Protocol Analysis Systems – 490

C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security – 629

Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459

Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – 448

Decentralized Control Using Global Optimization (DCGO) (Preprint) – 495

Extending Simple Network Management Protocol (SNMP) Beyond Network Management: A MIB Architecture for Network-Centric Services – 490

Guidance Material for Mode S-Specific Protocol Application Avionics – 37

Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node – 641

Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – 38

Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448

Static Reachability Analysis and Validation Regarding Security Policies Implemented via Packet Filters – 489

Testing for Compliance to NTCIP Standards – 428

## PROTON BEAMS

Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – 584

## PROTON-ANTI-PROTON INTERACTIONS

Measurements of the B Production Cross Section in Proton-Antiproton Collisions at  $s^{1/2} = 1.96$  TeV using Semileptonic Decays of b Hadrons – 586

SUSY Multilepton Signatures at Tevatron – 576

## PROTONS

Potential Applications of Microtesla Resonance Imaging Detected Using a Superconducting Quantum Interference Device – 560

## PROTOTYPES

Case Study of a Prototype Set of Behaviorally Anchored Rating Scales (BARS) for C2 Assessment – 135

Evolution of a Mission Plan – 646

IEIST Technologies Enabling TCT Prosecution – 538

IMMR Phase 1 Prototyping Plan Inputs – 663

PCA RAW FABRIC: Architectural Prototyping, Demonstration and Evaluation – 462

Systems Engineering for Rapid Prototyping: Friendly Marking Device – 227

The Challenge of New and Emerging Information Operations – 649

- The Outlook Y-JBI: An E-Mail Based Approach to Prototyping the Joint Battlespace Infosphere – 152
- Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – 59
- PROTOZOA**
- A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptional, and Proteomic Analyses – 389
- The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites – 404
- PROVING**
- Challenges for Biometrics Systems: Performance and Fake Resistance – 475
- Code Verification Results of an LLNL ASC Code on Some Tri-Lab Verification Test Suite Problems – 562
- Constraints on Meta-Stable de Sitter Flux Vacua – 579
- Demonstratore Foer Stoerskydd av GNSS-Mottagare (Demonstrator for Anti-Jamming of GNSS Receivers) – 204
- Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – 450
- Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers – 476
- PSYCHOLOGICAL TESTS**
- Quantitative Analysis of Situational Awareness (QUASA): Applying Signal Detection Theory to True/False Probes and Self-Ratings – 133
- PSYCHOLOGY**
- Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350
- PSYCHOMOTOR PERFORMANCE**
- Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water – 410
- PSYCHOPHARMACOLOGY**
- Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – 419
- PSYCHOTHERAPY**
- Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments – 384
- PSYCHOTROPIC DRUGS**
- Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – 419
- PUBLIC HEALTH**
- Building Collaborative Capacity for Biosecurity at the Georgia Seaports – 638
- Health Effects Support Document for Terbacil – 73
- Integrating Local Public Health Agencies into the Homeland Security Community – 311
- Mandatory Vaccinations: Precedent and Current Laws – 393
- Nuclear Safety: DOE's Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened – 131
- Public Health Assessment for Galena Airport (A.K.A. USAF Galena Air Force Station), Galena, Yukon-Koyukuk County, Alaska, May 21, 2007. EPA Facility ID: AK9570028655 – 257
- Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers – 312
- The Demise of Russian Health Capital: The Continuity of Ineffective Government Policy – 323
- What's in a Name. Examination of Light and Intermittent Smokers. Helping to Set the Tobacco Control Research Agenda. – 257
- PUBLIC LAW**
- Access to Government Information in the USA – 650
- PUERTO RICO**
- Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan ASSF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI – 87
- PULMONARY FUNCTIONS**
- Pulmonary Toxicity of Cholinesterase Inhibitors – 382
- PULSE COMMUNICATION**
- Can a Self-Diagnostic Digitally Controlled Pacemaker/Defibrillator Device be Used for Alerting Military Personnel When a Soldier Health Condition Becomes Compromised Out in the Field – 426
- PULSE DETONATION ENGINES**
- Confined Detonations and Pulse Detonation Engines – 42
- PULSE POSITION MODULATION**
- Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) – 178
- PULSED LASER DEPOSITION**
- Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127
- PULSED LASERS**
- A Hybrid Nano-Imprinting Lithography Method for Nano-Patterning Based on Infrared Pulsed Laser Heating – 233
- Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127
- PULSEJET ENGINES**
- Energy Efficient Transient: Plasma Ignition: Physics and Technology – 111
- PURIFICATION**
- Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – 65
- Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – 123
- PURITY**
- Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint) – 118
- Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion – 116
- PURSUIT TRACKING**
- A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37
- Vector Pursuit Path Tracking for Autonomous Ground Vehicles – 507
- PURSUIT-EVASION GAMES**
- Multi-Cumulant and Non-Inferior Strategies for Multi-Player Pursuit-Evasion (PREPRINT) – 544
- PYROELECTRICITY**
- Pyroelectric AlGaIn/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 97
- QUADRANTS**
- Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) – 178
- QUADRATIC EQUATIONS**
- Cooperative Solutions in Multi-Person Quadratic Decision Problems: Finite-Horizon and State-Feedback Cost-Cumulant Control Paradigm – 517
- QUADRATIC PROGRAMMING**
- A Method for Including Control Effector Interactions in the Control Allocation Problem (Preprint) – 461
- QUADRATURES**
- Receptive Field Structures for Recognition – 190
- QUALITATIVE ANALYSIS**
- Dynamic Across-Time Measurement Interpretation: Maintaining Qualitative Understandings of Physical System Behavior – 501
- Qualitative Kinematics of Linkages – 500
- Qualitative Reasoning about Fluids and Mechanics – 446
- The Logic of Occurrence – 500
- QUALITY CONTROL**
- Change-Point Methods for Overdispersed Count Data – 522
- Final Site Safety and Health Plan for Phase II RCRA Facility Investigation Fort Benjamin Harrison Marion County, Indiana – 308

The Synergic Integrated Concepts of C2S – 174

U.S. Army Toxic and Hazardous Materials Agency Quality Assurance Program – 93

#### QUANTITATIVE ANALYSIS

Analysis of Network-Enabled ASW Concepts of Operation – 529

Quantitative Analysis of Situational Awareness (QUASA): Applying Signal Detection Theory to True/False Probes and Self-Ratings – 132

Use of Modeling and Simulation (M&S) in Support of the Quantitative Assessment of FORCEnet Systems and Concepts – 456

Validation of Quantitative Multimodality Analysis of Telomerase Activity in Urine Cells as a Noninvasive Diagnostic and Prognostic Tool for Prostate Cancer – 366

#### QUANTUM CHEMISTRY

Applications of Molecular and Materials Modeling – 94

Pentazole-Based Energetic Ionic Liquids: A Computational Study (Preprint) – 97

#### QUANTUM CHROMODYNAMICS

AdS/CFT and QCD – 572

BlueGene/L Supercomputer and Quantum ChromoDynamics – 560

Conformal Template and New Perspectives for Quantum Chromodynamics – 574

First Observation of Bottom Baryon Sigma(b) States at CDF – 586

National Software Infrastructure for Lattice Quantum Chromodynamics – 581

Results on QCD Physics from the CDF-II Experiment – 559

W + Jet Production at CDF – 585

#### QUANTUM COMPUTATION

Proceedings of the Quantum Computation for Physical Modeling Workshop 2004. Held in North Falmouth, MA on 12-15 September 2004 – 592

Proceedings of the Quantum Computation for Physical Modeling Workshop Held in North Falmouth, Massachusetts on October 18-19, 2000 – 519

#### QUANTUM DOTS

Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties – 189

Dynamics of Epitaxy on the Nano-sized Semiconductor Surfaces – 188

Method of Forming Quantum Dots at Predetermined Positions on a Substrate – 201

New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210

Non-Equilibrium Quantum Dots: Transport – 185

Semiconductor Quantum Dot Resonant Tunnelling Spectroscopy – 185

Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196

#### QUANTUM ELECTRONICS

Method of Forming Quantum Dots at Predetermined Positions on a Substrate – 201

#### QUANTUM THEORY

A Quantum Approach to Multi-Agent Systems (MAS), Organizations, and Control – 535

Fabrications and Characterizations of ZnO/Zn<sub>1-x</sub>Mg<sub>x</sub>O Nanorod Quantum Structures – 186

Fundamental Study on Quantum Nanojets – 548

Physical Renormalization of Quantum Field Theories – 556

Proceedings of the Quantum Computation for Physical Modeling Workshop 2004. Held in North Falmouth, MA on 12-15 September 2004 – 592

Proceedings of the Quantum Computation for Physical Modeling Workshop Held in North Falmouth, Massachusetts on October 18-19, 2000 – 519

Scalability, Complexity and Reliability in Quantum Information Processing – 591

#### QUANTUM WELLS

Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186

#### QUARKS

Measurements of Top Quark Properties at CDF – 564

National Software Infrastructure for Lattice Quantum Chromodynamics – 581

t-bar Production at the Tevatron. Event Selection and Cross Section Measurement – 586

#### QUEBEC

Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 353

#### QUERY LANGUAGES

Semantic Graph Query Language – 434

#### QUEUEING THEORY

The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – 625

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

Workforce Configuration of a Canadian Forces Gematics Division – 539

#### RACES (ANTHROPOLOGY)

Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340

#### RADAR BEAMS

Space-Time Adaptive Processing: Fundamentals – 177

#### RADAR DATA

Bi- and Multistatic Radar – 176

Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere – 260

Software to Generate 3-Dimensional Displays of Inverse Synthetic aperture Radar Data – 455

#### RADAR DETECTION

Advanced Radar Signal and Data Processing – 175

Fundamentals of Signal Processing for Phased Array Radar – 176

Space-Time Adaptive Processing: Fundamentals – 177

#### RADAR EQUIPMENT

RF Design for Tactical Ultra-Light Unmanned Aerial Vehicle Radar System – 27

#### RADAR IMAGERY

Alternatives for Military Space Radar – 223

Development and Assessment of a Complete ATR Algorithm Based on ISAR Euler Imagery – 468

Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – 631

Software to Generate 3-Dimensional Displays of Inverse Synthetic aperture Radar Data – 455

#### RADAR RANGE

Bi- and Multistatic Radar – 176

#### RADAR SIGNATURES

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 224

#### RADAR TARGETS

Advanced Target Tracking Techniques – 175

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 223

Space-Time Adaptive Processing: Algorithms – 177

Tracking and Data Fusion Applications – 177

#### RADAR TRACKING

A Centripetal Acceleration Statistic for Tracking Maneuvering Targets with Radar – 225

Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227

#### **RADAR**

A Review of Recent Algorithms and a New and Improved Cooperative Control Design for Generating a Phantom Track (Preprint) – 26

Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere – 260

Pilot Study: Parasitic and Passive Radar – 179

The Effects of Wind Turbine Farms on Air Defence Radars – 22

#### **RADIAL FLOW**

Novel Collective Protection Filters for Emerging TIC Requirements: Axial and Radial-Flow Filter Designs – 55

#### **RADIANCE**

Observation of Tidal Effects on LWIR Radiance Above the Mesopause – 262

Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared – 271

#### **RADIANT COOLING**

Nonequilibrium Stagnation-Line Radiative Heating for Fire II – 221

#### **RADIATION DAMAGE**

Radiation Damage Effects on the Magnetic Properties of Pu(1-x)Am(x) (x=0.224) – 562

#### **RADIATION DOSAGE**

Correcting the Response of an Albedo Neutron Dosimeter for Energy – 220

Long-Term Outcomes of Alternative Brachytherapy Techniques for Early Prostate Cancer – 294

Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676

Multiple Aperture Radiation Therapy (MART) for Breast Cancer – 292

#### **RADIATION EFFECTS**

Development of Technologies to Utilize Laser Plasma Radiations Sources for Radiation Effects Sciences – 600

Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676

Radiation-Induced Immune Modulation in Prostate Cancer – 325

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

Utility of DF-1 for Radioprotection in Lymphocytes – 420

#### **RADIATION HAZARDS**

Consequence Assessment Methods for Incidents Involving Releases From Liquefied Natural Gas Carriers – 607

Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676

#### **RADIATION PROTECTION**

A Rationale for Establishing Survivability Requirements for Objective Force Unmanned Army Platforms and Systems – 191

Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676

Nuclear Safety: DOE's Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened – 131

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

Utility of DF-1 for Radioprotection in Lymphocytes – 420

#### **RADIATION SHIELDING**

Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676

Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab – 564

#### **RADIATION SPECTRA**

Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597

#### **RADIATION THERAPY**

Adjuvant Immunotherapy for Patients at High Risk of Recurrence Following Radiation Therapy for Prostate Cancer – 298

ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer – 344

Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy – 286

MR Imaging Based Treatment Planning for Radiotherapy of Prostate Cancer – 349

Multiple Aperture Radiation Therapy (MART) for Breast Cancer – 292

#### **RADIATION TOLERANCE**

Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381

#### **RADIATION TRANSPORT**

Summary of LLNL Russian Projects – 573

#### **RADIATIVE TRANSFER**

Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – 48

Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System – 271

Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared – 271

#### **RADICALS**

Health Effects Support Document for Terbacil – 73

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 113

#### **RADIO ASTRONOMY**

GISMO – 231

#### **RADIO BURSTS**

Near-Relativistic Electron c/v Onset Plots – 668

#### **RADIO FREQUENCIES**

Assured Reference Technology Research (ARTHR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – 596

Development of a Charged-particle Accumulator Using an RF Confinement Method II – 591

Development of a Charged-Particle Accumulator Using an RF Confinement Method – 593

Model Based Statistical Estimation of Sandia RF Ohmic Switch Dynamic Operation from Stroboscopic X-ray Imaging – 207

Neutron Generators Developed at LBNL for Homeland Security and Imaging Applications – 566

Non-Electronic Radio Front-End (NERF) – 211

Optical and Radio Frequency Refractivity Fluctuations from High Resolution Point Sensors: Sea Breezes and Other Observations – 554

Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192

Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab – 564

RF Design for Tactical Ultra-Light Unmanned Aerial Vehicle Radar System – 27

Signal Population in the License-Exempt Wireless-Radio Bands at the MOUT Site – 152

Theory for the RF Surface Field for Various Metals at the Destructive Breakdown Limit – 73



- Variable Directional Coupler for an Alternate ILC High-Power RF Distribution Scheme – [605](#)
- RADIO FREQUENCY HEATING**  
The Status and Future of the ICRF – [665](#)
- RADIO FREQUENCY INTERFERENCE**  
Assured Reference Technology Research (ARTHUR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – [596](#)  
Client Location in 802.11 Networks – [639](#)
- RADIO RECEIVERS**  
The Mitigation of Radio Noise from External Sources at Receiving Sites – [163](#)
- RADIO SIGNALS**  
Near-Relativistic Electron c/v Onset Plots – [668](#)
- RADIO TELESCOPES**  
Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – [669](#)
- RADIO TRANSMISSION**  
Simulation of Radiowave Propagation in a Dense Urban Environment – [554](#)
- RADIO TRANSMITTERS**  
Pilot Study: Parasitic and Passive Radar – [179](#)
- RADIO WAVES**  
Simulation of Radiowave Propagation in a Dense Urban Environment – [554](#)
- RADIOACTIVE DECAY**  
Searching for Double Beta Decay with the Enriched Xenon Observatory – [566](#)
- RADIOACTIVE ISOTOPES**  
Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – [373](#)  
Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface – [102](#)  
Technical Work Plan for: Near-Field Environment: Engineered Barrier System: Radionuclide Transport Abstraction Model Report – [253](#)
- RADIOACTIVE MATERIALS**  
Improving Thermal Performance of Radioactive Material Drum Type Packages by Using Heat Pipes – [131](#)  
Terrorist 'Dirty Bombs': A Brief Primer – [250](#)  
Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – [59](#)  
Type B Radioactive Material Package Failure Modes and Contents Compliance – [238](#)
- RADIOACTIVE WASTES**  
AFCI Storage and Disposal FY-06 Progress Report – [106](#)
- Annual Transportation Report for Radioactive Waste Shipments to and from the Nevada Test Site. (Fiscal Year 2006) – [131](#)
- Technical Work Plan for: Near-Field Environment: Engineered Barrier System: Radionuclide Transport Abstraction Model Report – [253](#)
- RADIOCHEMISTRY**  
Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – [106](#)
- RADIOGRAPHY**  
Flash X-ray (FXR) Linear Induction Accelerator(LIA) Optimization Upgrade of the OTR Emittance Diagnostic – [576](#)  
X-Ray Dose in Microfocus Radiographic Inspections – [137](#)
- RADIOLOGY**  
Bisphosphonate-Based Contrast Agents for Radiological Imaging of Microcalcifications – [362](#)  
Building Collaborative Capacity for Biosecurity at the Georgia Seaports – [638](#)  
High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – [133](#)  
Integration of Anatomic and Pathogenetic Bases for Early Lung Cancer Diagnosis – [506](#)  
Screening Doses for Induction of Cancers Calculated With the Interactive Radio Epidemiological Program (IREP) – [306](#)  
Terrorist 'Dirty Bombs': A Brief Primer – [250](#)
- RADIOMETERS**  
On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – [263](#)
- RADIOTELEPHONES**  
Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – [38](#)  
Software Communications Architecture (SCA) Compliant Software Defined Radio Design for Interim Standard 95B (IS-95B) Transceiver – [463](#)
- RADON ISOTOPES**  
Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface – [102](#)
- RADON**  
Radon Screening of Buildings at the Umatilla Depot Activity, Hermiston, Oregon – [94](#)  
Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface – [102](#)
- RAIL TRANSPORTATION**  
Human Error Investigation Software Tool (HEIST) – [428](#)  
In-Track Demonstration of Laser-Treated Rail to Reduce Friction and Wear – [74](#)
- RAILGUN ACCELERATORS**  
Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns – [96](#)  
Solid State Capacitor Discharge Pulsed Power Supply Design for Railguns – [193](#)
- RAILS**  
In-Track Demonstration of Laser-Treated Rail to Reduce Friction and Wear – [74](#)
- RAIN**  
Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – [276](#)
- RANDOM ACCESS MEMORY**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – [54](#)  
Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – [438](#)  
Molecular Random Access Memory Cell – [441](#)
- RANDOM ACCESS**  
Molecular Random Access Memory Cell – [441](#)  
Two Bit/Four Bit SONOS Flash Memory Cell – [200](#)
- RANDOM NOISE**  
Simulation of Coherent Signals with Forward Error Correction Coding – [540](#)
- RANGE ERRORS**  
Application of the Unscented Transformation to Obtain Target Range, Bearing, Elevation, Range Rate, Speed and Course Estimates and Errors From Tracks Given in Cartesian Coordinates – [517](#)
- RANGEFINDING**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – [588](#)  
Hypothermia Induction and Recovery in Free-Ranging Rats – [409](#)
- RAPID PROTOTYPING**  
AFRL/IF Technology Transition to the Warfighter via the CAOC-X – [465](#)  
Methodology for Rapid Development of C2 Planning Systems – [173](#)
- RATINGS**  
Case Study of a Prototype Set of Behaviorally Anchored Rating Scales (BARS) for C2 Assessment – [135](#)  
Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – [240](#)  
Quantitative Analysis of Situational Awareness (QUASA): Applying Signal Detection Theory to True/False Probes and Self-Ratings – [132](#)  
Relationship of Complexity Factor Ratings With Operational Errors – [513](#)

RIDE vs. CLASP Comparison and Evaluation: Models and Parameters – 662

## RATIONS

Development of Nanocomposite Reinforced Polymeric Materials to be Used for Racks for Retorting Polymeric Trays – 123

Retort Racks for Polymeric Trays in 1400 Style Spray Retorts – 518

## RATS

A Rat Model for Human Ductal Carcinoma In Situ – 392

Hypothermia Induction and Recovery in Free-Ranging Rats – 409

Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335

## RAYLEIGH SCATTERING

Filtered Rayleigh Scattering Measurements in a Buoyant Flowfield – 544

## RAYLEIGH WAVES

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265

Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – 262

## RDX

Insensitive High-Performance Replacements for RDX in Explosive and Propellant Formulations – 60

## REACTION KINETICS

The Effect of Increasing Mass on Locomotion – 414

## REACTION WHEELS

Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667

## REACTIVITY

Crosslinked Compounds and Methods of Making and Using Thereof – 72

Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – 417

Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope – 140

Physiological Stress Reactivity and Breast Cancer – 391

Role of Reactive Stroma in Prostate Cancer Progression – 317

Study of the Utility of NWP Forecast Guidance and Simple Ocean Modeling as a Tool for Planning During Reactive Situations – 269

Utility of DF-1 for Radioprotection in Lymphocytes – 420

## REACTOR SAFETY

Emerging Energy Requirements for Future C4ISR – 244

## REACTOR TECHNOLOGY

Iran's Nuclear Program: Recent Developments – 594

## READERS

Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers – 476

## REAL TIME OPERATION

A High-Performance Communication Service for Parallel Computing on Distributed DSP Systems – 449

Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – 448

Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers – 272

Experiments with the Sun Java Real-Time System -- Part 2 – 466

Grid Computing for High Performance Computing (HPC) Data Centers – 451

High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133

Independent Testing of Iris Recognition Technology (ITIRT) – 475

Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – 118

Parameter Space: The Final Frontier. Certified Reduced Basis Methods for Real-Time Reliable Solution of Parametrized Partial Differential Equations – 512

QoS Negotiation in Real-Time Systems and its Application to Automated Flight Control – 43

Real-Time Communication and Coordination in Embedded Sensor Networks – 533

Real-Time Sonar Beamforming on High-Performance Distributed Computers – 596

Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385

Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – 39

Using Dynamic Adjustment of Serialization Order for Real-Time Database Systems – 613

## RECEIVERS

Demonstratore Foer Stoerskydd av GNSS-Mottagare (Demonstrator for Anti-Jamming of GNSS Receivers) – 204

Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) – 177

## RECLAMATION

Work Plan and Field Sampling Plan Site Investigations Fort Devens, Massachusetts – 251

## RECONFIGURABLE HARDWARE

Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer – 513

## RECONNAISSANCE

A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620

Alternatives for Military Space Radar – 223

An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144

Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective – 621

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective – 623

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective – 623

The Coalition Aerial Surveillance and Reconnaissance (CAESAR) Approach to Enhancing the Interoperability of Coalition Ground Surveillance Systems – 224

The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164

## RECRYSTALLIZATION

Recrystallization and Grain-Growth Behavior of a Nickel-Base Superalloy During Multi-Hit Deformation (Preprint) – 118

## REDUNDANCY

Homeland Security -- Reducing the Vulnerability of Public and Private Information Infrastructures to Terrorism: An Overview – 493

## REFINING

Corporate Entrepreneurship Assessment Instrument (CEAI): Refinement and Validation of a Survey Measure – 136

## REFLECTANCE

Coherence Solution for Bidirectional Reflectance of Surfaces with Wavelength-Scale Statistics (Postprint) – 529

## REFLECTION

High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations – 527

## REFRACTIVITY

Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597

Optical and Radio Frequency Refractivity Fluctuations from High Resolution Point Sensors: Sea Breezes and Other Observations – 554

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

## REFRACTORIES

Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – 330

Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer – 302

## REFRIGERANTS

Motor Frame Cooling with Hot Liquid Refrigerant and Internal Liquid – 76

## REFUELING

Automated Aerial Refueling Presentation to 2007 ARSAG Conference (Preprint) – 15

Autonomous Unmanned Aerial Vehicle Rendezvous for Automated Aerial Refueling – 11

Proportional Navigation With Adaptive Terminal Guidance For Aircraft Rendezvous (Preprint) – 7

Simulation of the Dynamically Coupled KC-135 Tanker and Refueling Boom – 11

## REGENERATORS

Storage, Generation, and Use of Hydrogen – 69

## REGRESSION ANALYSIS

fRMSDPred: Predicting Local RMSD Between Structural Fragments Using Sequence Information – 369

The Effect of Graduate Education on the Performance of Air Force Officers – 526

The Potential Impact of an Auction Based Retention Bonus and Other Factors on Continuation Rates of General Dentists Completing Their Initial Obligation – 525

## REGULATIONS

Army Fuels: Policies, Regulations, and Executive Orders – 129

DigitalPersona - Case Study: Department of Defense – 475

The Supreme Court's Climate Change Decision: Massachusetts v. EPA – 263

## REGULATORS

DRF3 as a Cholesterol-Dependent Regulator of Src in Prostate Cancer – 316

## REINFORCING FIBERS

Symposium on Nano- and Micro-Scale Mechanics of Engineering Materials – 660

## RELATIONAL DATA BASES

Survey of Probabilistic Models for Relational Data – 435

## RELATIVISTIC EFFECTS

Evolution of Time Scales – 666

## RELIABILITY ANALYSIS

Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – 448

Multicast Performance Analysis for High-Speed Torus Networks – 484

Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III – 650

## RELIABILITY

Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438

Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192

Scalability, Complexity and Reliability in Quantum Information Processing – 591

Usability and Acceptability of Biometric Security Systems – 473

## REMOTE CONTROL

Design and Implementation of an Intelligent Primitive Driver – 550

## REMOTE SENSING

Automating the Shadow Method for Aerosol Optical Depth Retrieval – 462

BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279

System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory – 50

## REMOTELY PILOTED VEHICLES

Pictorial Display Design to Enhance Spatial Awareness of Operators in Unmanned Aviation – 28

Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26

## RENDEZVOUS GUIDANCE

Proportional Navigation With Adaptive Terminal Guidance For Aircraft Rendezvous (Preprint) – 7

## REPLACING

Test Suite for Nuclear Data I. Deterministic Calculations for Critical Assemblies and Replacement Coefficients – 575

## REPLICAS

An Adaptive Quality of Service Aware Middleware for Replicated Services – 521

## REPTILES

Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250

## REQUIREMENTS

An Empirical Assessment of the Impact of Requirements Uncertainty on Development Quality Performance – 446

Defense Logistics: Army and Marine Corps' Body Armor Requirements, Controls, and Other Issues – 425

Industrial Base Model Data Requirements (IBMDR) – 650

Multinational Interoperability Requirements -- A Core Competency – 645

## RESEARCH AND DEVELOPMENT

AFRL/IF Technology Transition to the Warfighter via the CAOC-X – 465

Challenges and Potential Research Areas in Biometrics – 476

Communication and Decision Making in C4ISR Sustained Operations: An Experimental Approach – 409

Defense Nanotechnology Research and Development Program – 212

Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 21

Establishment of a Center for Defense Robotics – 508

Hydrogen Technology Research at the Savannah River National Laboratory. Center for Hydrogen Research and the Hydrogen Technology Research Laboratory – 109

Military Nutrition Research: Four Tasks to Address Personnel Readiness and Warfighter Performance – 366

Nanoscience and Technology at the Air Force Research Laboratory (AFRL) – 54

Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army – 282

Taiwan - AFOSR Nanoscience Initiative Status – 198

The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities – 480

## RESEARCH FACILITIES

Design, Construction, and Validation of the AFIT Small Scale Combustion Facility and Sectional Model of the Ultra-Compact Combustor – 139

## RESEARCH MANAGEMENT

Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 489

Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362

Report to Congress on the Activities of the DoD Office of Technology Transition – 651

The Basic Research Manager for the Air Force – 211

## RESEARCH

The Basic Research Manager for the Air Force – 211

## RESERVES

Critical Review of the U.S. Marine Corps' Space Cadre Strategy – 674

Medical Reserve Corps Volunteers' Ability and Willingness to Report to Work for the Department of Health During Catastrophic Disasters – 312

## RESERVOIRS

Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378

## RESIDUAL STRESS

Investigation of Lattice and Thermal Stress in GaN/AlGaIn Field-Effect Transistors – 194

## RESIN TRANSFER MOLDING

Hyperbranched Polymers for Resin Transfer Molding – 127

Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121

Tension-Compression Fatigue Behavior of a Carbon Fiber/Epoxy (IM7/EPON 862) Composite Fabricated Using Vacuum Assisted Resin Transfer Molding Process – 85

## RESINS

A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125

Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121

## RESONANT TUNNELING

Non-Equilibrium Quantum Dots: Transport – 185

Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186

Semiconductor Quantum Dot Resonant Tunneling Spectroscopy – 185

## RESONATORS

Chamber Core Structures for Fairing Acoustic Mitigation – 50

Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems – 204

Micromechanical Resonator Device Having a Desired Mode Shape – 201

Non-Electronic Radio Front-End (NERF) – 211

## RESOURCES MANAGEMENT

Analyzing the Interdiction of Sea-Borne Threats Using Simulation Optimization – 451

Bringing Climate Change Into Natural Resource Management. Proceedings of a Workshop – 273

Capability Based Resourcing for DPEM – 9

Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459

Sensor Management in Command & Control – 632

The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8

User-Level QoS-Adaptive Resource Management in Server End-Systems – 485

## RESPIRATION

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Injuries – 297

## RESPIRATORY DISEASES

Scavenger Receptors and Resistance to Inhaled Allergens – 328

## RESPONSES

Emergency Preparedness and the Year 2000 Challenge – 443

Hurricane Katrina: Lessons for Army Planning and Operations – 163

Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91

## RESTORATION

Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305

Novel Technology Evaluation for Volatile Organic Compounds Emission Control – 60

Restoration of Wild-Type Activity to Mutant p53 in Prostate Cancer: A Novel Therapeutic Approach – 365

Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – 252

## RESUSCITATION

A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395

Far Forward Treatment of Hemorrhagic Shock – 378

The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314

## RETAINING

Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions – 265

## RETICLES

EUV Inspection of Reticle Defect Repair Sites – 600

## REUSABLE HEAT SHIELDING

Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging – 355

## REUSABLE LAUNCH VEHICLES

Determining Logistics Ground Support Manpower Requirements for a Reusable Military Launch Vehicle – 58

Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48

## REUSE

Re-Use of Integrated Dictionary Components for C4ISR Architectures – 148

## REVERBERATION CHAMBERS

Radiated Susceptibility Test in Reverberation Chamber – 202

## REVERSE ENGINEERING

Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts) – 537

## REYNOLDS NUMBER

Filtered Rayleigh Scattering Measurements in a Buoyant Flowfield – 544

## RHEOLOGY

Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81

## RIBONUCLEIC ACIDS

A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389

A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358

An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330

HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate – 290

Intra-Prostate Cancer Vaccine Inducer – 316

Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287

p63 in Development and Maintenance of the Prostate Epithelium – 355

Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313

Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330

## **RIGID STRUCTURES**

A Qualitative Approach to Rigid Body Mechanics – 501

FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures – 29

## **RISK**

A Correlation Between Quality Management Metrics and Technical Performance Measurement – 637

A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – 478

A Security Risk Measurement for the RAdAC Model – 490

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357

Adjuvant Immunotherapy for Patients at High Risk of Recurrence Following Radiation Therapy for Prostate Cancer – 298

An Examination of a Structural Modeling Risk Probe Technique – 544

Automating Behavioral Health Screening - Addressing Risk Communication Electronically – 306

Biometric Security Issues – 474

Building Collaborative Capacity for Biosecurity at the Georgia Seaports – 638

Challenges for Biometrics Systems: Performance and Fake Resistance – 475

COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care – 368

Concepts Associated with Transferring Temporal and Spatial Boundary Conditions Between Modules in the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) – 431

Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340

DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – 643

Executive Overview of SEI MOSAIC: Managing for Success Using a Risk-Based Approach – 545

Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631

Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD – 139

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – 138

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – 138

Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – 97

Learning from Past Experiences – 56

Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497

Medical Risk in the Future Force Unit of Employment. Results of the Army Medical Department Transformation Workshop V – 304

Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289

Potential Thermal Security Risks – 441

Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393

Privacy and Biometrics: The Human Factors – 477

PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – 302

Risk Advised Course of Action (COA) Analysis – 532

Risk Assessment: Evidence Base – 529

Risk Bounds for Regularized Least-Squares Algorithm with Operator-Value Kernels – 524

Risk of Cyberterrorism to Naval Ships Inport Naval Station Everett: A Model Based Project Utilizing SIAM – 491

Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – 251

Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389

The Independent Readiness Team (IRRT) of SMC – 49

Tsunami Risk Reduction for the USA: A Framework for Action – 264

Updating Optimal Decisions Using Game Theory and Exploring Risk Behavior Through Response Surface Methodology – 534

## **RIVERS**

A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California – 222

## **ROADS**

Impacts of Traveler Information on Transportation Network Operations and Potential Deployment Technologies – 178

## **ROBOTICS**

Development of a Geospatial Data-Sharing Method for Unmanned Vehicles Based on the Joint Architecture for Unmanned Systems (JAUS) – 662

Establishment of a Center for Defense Robotics – 508

FCS Technology Insertion and Transition – 508

Focused Knowledge to the Warfighter – 617

Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – 505

Information Fusion for Hypothesis Generation under Uncertain and Partial Information Access Situation – 499

On-Orbit Identification of Inertia Properties of Spacecraft using Robotics Technology – 49

## **ROBOTS**

A Study of Autonomous Micro-Robots and Their Application to Complex Environments, Volume 1 – 543

An Intelligent Interface-Agent Framework for Supervisory Command and Control – 498

Compliant Formation Control of an Autonomous Multiple Vehicle System – 507

Design and Implementation of a Modular Manipulator Architecture – 546

Lethality and Autonomous Robots: An Ethical Stance – 504

Simultaneous Planning and Control for Autonomous Ground Vehicles – 507

Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – 523

## **ROCKET LAUNCHERS**

Human Factors Evaluation of the XM30 Guided Multiple Launch Rocket System (GMLRS) in the Combined High Mobility Artillery Rocket System (HIMARS)-GMLRS Initial Operational Test – 423

## ROCKY MOUNTAINS (NORTH AMERICA)

Biodegradation of DIMP, Dieldrin, Iso-drin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305

## RODENTS

Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379

Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens – 405

Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – 394

Origin and Properties of Prostatic Stem Cells – 299

## ROOFS

A Decision Model for Selecting Energy Efficient Technologies for Low-Sloping Roof Tops Using Value-Focused Thinking – 243

## ROOM TEMPERATURE

Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions – 187

## ROOMS

Advanced Technologies in Safe and Efficient Operating Rooms – 309

## ROTARY WING AIRCRAFT

High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction – 35

## ROTATING ENVIRONMENTS

Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 412

## ROTATING GENERATORS

Broken Symmetries and Magnetic Dynamics – 220

## ROTATION

AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605

## ROUTES

A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 375

Automatic Generation of Best Emergency Routes and Procedures on a Brazilian Frigate – 467

Impacts of Traveler Information on Transportation Network Operations and Potential Deployment Technologies – 178

Route Optimization for Mobile IPv6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis – 489

## RUBBER

Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 114

Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140

## RUNWAY INCURSIONS

Enhanced Aircraft Conspicuity to Reduce Runway Incursions – 13

## RUNWAYS

Decks for Rapid Runway Mat Application (Postprint) – 46

Rapid Runway Repair (RRR): An Optimization for Minimum Operating Strip (MOS) Selection – 45

## RUSSIAN FEDERATION

Russian and Chinese Information Warfare: Theory and Practice – 628

The Demise of Russian Health Capital: The Continuity of Ineffective Government Policy – 323

## S WAVES

Acoustic Proximity Ranging in the Presence of Secondary Echoes – 588

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265

## SABOTAGE

Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497

## SAFETY FACTORS

A System of Systems Interface Hazard Analysis Technique – 541

## SAFETY MANAGEMENT

Learning from Past Experiences – 56

## SAFETY

Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 131

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233

Final Site Safety and Health Plan for Phase II RCRA Facility Investigation Fort Benjamin Harrison Marion County, Indiana – 308

High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction – 35

Human Error Investigation Software Tool (HEIST) – 427

Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety and Regulation – 129

Next Generation Systems Languages – 455

NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252

Nuclear Safety: DOE's Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened – 131

Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387

Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments – 205

Technology Review of Smart Sensors with Wireless Networks for Applications in Hazardous Work Environments – 168

Truck Driver Occupational Safety and Health. 2003 Conference Report and Selective Literature Review – 238

## SALIVA

Galvanic Skin Response as a Measure of Soldier Stress – 410

## SAMPLED DATA SYSTEMS

Systematic Procedure for Assigning Uncertainties to Data Evaluations – 568

## SAMPLERS

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

## SAMPLING

A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 113

Adaptive Sampling for Network Management – 485

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261

Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394

Quarterly Groundwater Monitoring First Quarter Sampling Results Fort Dix, New Jersey – 61

Work Plan and Field Sampling Plan Site Investigations Fort Devens, Massachusetts – 251

## SAN FRANCISCO (CA)

Asbestos Survey for Fort Point US Coast Guard Station. Presidio of San Francisco. Volume 2 – 241

## SANDWICH STRUCTURES

Decks for Rapid Runway Mat Application (Postprint) – 46

## SATELLITE COMMUNICATION

Global Broadcast Service Security Classification/Declassification Guide (SCG) – 160

## SATELLITE CONTROL

System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory – 50

## SATELLITE IMAGERY

A Verification of Optical Depth Retrievals From High Resolution Satellite Imagery – 225

Automating the Shadow Method for Aerosol Optical Depth Retrieval – 462

## SATELLITE NETWORKS

T/R Module for Satellite TT&C Ground Link – 200

## SCALARS

Gravi-Leptogenesis: Leptogenesis from Gravity Waves in Pseudo-Scalar Driven Inflation Models – 673

Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Postprint) – 534

## SCANNERS

Wide Area Search and Engagement Simulation Validation – 32

## SCANNING ELECTRON MICROSCOPY

Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121

Strategic Partnership for Research in Nanotechnology – 210

## SCANNING

Wide Area Search and Engagement Simulation Validation – 32

## SCATTERING

Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597

Final Task Report on NRF Measurements of Photon Scattering Resonances in Plutonium at the High Voltage Research Laboratory of MIT – 561

Point Spread Function Characterization of a Radially Displaced Scatterer Using Circular Synthetic Aperture Radar – 230

Terrorist 'Dirty Bombs': A Brief Primer – 250

## SCHEDULING

A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – 190

An Analysis of Robust Workforce Scheduling Models for a Nurse Rostering Problem – 300

Link Analysis for Dynamic Planning and Scheduling – 502

Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 32

Optimal UAV Task Assignment and Scheduling (Preprint) – 24

UAV Scheduling via the Vehicle Routing Problem with Time Windows (Preprint) – 20

## SCHOOLS

Chemical Management Resource Guide for School Administrators – 75

IAQ Tools for Schools. Managing Asthma in the School Environment – 259

## SCHOTTKY DIODES

Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode – 212

Pyroelectric AlGaIn/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 96

## SCIENCE

Science & Technology Review January/February 2007 – 575

## SCIENTISTS

Support for the Resident Research Associateship Program with the U.S. Army Medical Research and Materiel Command – 338

## SCORING

Mapping of WDMET in AIS 2005 and AIS 2005 Military – 645

## SEA BREEZE

Optical and Radio Frequency Refractivity Fluctuations from High Resolution Point Sensors: Sea Breezes and Other Observations – 554

## SEA WATER

A Detailed Study of Advection Sea Fog Formation to Reduce the Operational Impacts Along the Northern Gulf of Mexico – 268

Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe<sub>48</sub>Mo<sub>14</sub>Cr<sub>15</sub>Y<sub>2</sub>C<sub>15</sub>B<sub>6</sub> and W-Containing Variants – 69

Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe<sub>48</sub>Mo<sub>14</sub>Cr<sub>15</sub>Y<sub>2</sub>C<sub>15</sub>B<sub>6</sub> and Variants – 107

Emerging Energy Requirements for Future C4ISR – 244

## SEALING

Microsystem Enclosure and Method of Hermetic Sealing – 71

## SEARCH PROFILES

Grid-Search Techniques for Seismic Event Location and Phase Association – 261

## SEARCH RADAR

Further Evidence of the Effects of Wind Turbine Farms on AD Radar – 532

The Effects of Wind Turbine Farms on ATC Radar – 134

## SEAS

A Detailed Study of Advection Sea Fog Formation to Reduce the Operational Impacts Along the Northern Gulf of Mexico – 268

Analyzing the Interdiction of Sea-Borne Threats Using Simulation Optimization – 451

Interim Heavy Airlift: Sea Base Logistics Glider Concept – 14

## SEATS

Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10

## SECONDARY FLOW

Improving COIL Efficiency By Iodine Pre-Dissociation Via Corona Discharge In The Transonic Section Of The Secondary Flow – 234

## SECURITY

A Model for Effective Organization and Communication of Homeland Security Activity at the State Level – 157

A Model of Trust for Developing Trustworthy Systems From Untrustworthy Actors – 660

A Pragmatic C4ISR Approach From the US Army CECOM Security Assistance Perspective – 614

A Security Risk Measurement for the RAdAC Model – 490

Advancing Software Security - The Software Protection Initiative – 626

America's Energy Security Policy: Goals for 2025 – 129

An Agent-Based Dynamic Information Security Model in Information Warfare – 643

Analyzing the Interdiction of Sea-Borne Threats Using Simulation Optimization – 451

Army Facility Energy Demand and the Impact on National Security – 243

Aviation Security: Foreign Airport Assessments and Air Carrier Inspections Help Enhance Security, but Oversight of These Efforts Can Be Strengthened – 12

Biometric Security Issues – 474

Bridging the Gap in Port Security; Network Centric Theory Applied to Public/Private Collaboration – 492

Building Collaborative Capacity for Biosecurity at the Georgia Seaports – 638

C2 Interoperability: A Force Multiplier for Joint/Combined Operations and Homeland Security – 629

C2 Interoperability: Simulation, Architecture and Information Security – 642

C4ISR Architectural Frameworks in Coalition Environments – 153

Capacity Building and Sustainment: Focusing on the End-State for Homeland Security – 503

Center for Coastline Security Technology, Year-2 – 228

Challenges for Biometrics Systems: Performance and Fake Resistance – 475

Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488

China's Energy Security and Its Military Modernization Efforts: How China Plans to Dominate the World – 248

Communications Architecture Recommendations to Enable Joint Vision 2020 – 488

Critical Infrastructure: Control Systems and the Terrorist Threat – 496

Critical Infrastructure Information Disclosure and Homeland Security – 656

Data Mining and Homeland Security: An Overview – 647

DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – 643

European Security in the Wider Black Sea Area – 242

Future Applications in Using Biometrics to Enhance Security Level of Coalition Information Sharing Networks – 477

Global Broadcast Service Security Classification/Declassification Guide (SCG) – 160

Global Climate Change: National Security Implications – 266

Homeland Security -- Reducing the Vulnerability of Public and Private Information Infrastructures to Terrorism: An Overview – 493

Homeland Security Act of 2002: Critical Infrastructure Information Act – 639

Homeland Security: Protecting Airspace in the National Capital Region – 25

Impact of Information Technology-For Strategic Leaders – 181

Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues – 618

Integrating Local Public Health Agencies into the Homeland Security Community – 311

Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – 497

Issues and Requirements for Cybersecurity in Network Centric Warfare – 446

National Security and the Threat of Climate Change – 279

National Security Letters in Foreign Intelligence Investigations: A Glimpse of the Legal Background and Recent Amendments – 633

National Security Letters in Foreign Intelligence Investigations: Legal Background and Recent Amendments – 634

Network Centric Warfare for Coalition Integrated Defense Against Terrorism – 165

Neutron Generators Developed at LBNL for Homeland Security and Imaging Applications – 566

Potential Thermal Security Risks – 441

Proceedings of the 1st Army Installation Energy Security and Independence Conference – 245

Real Time Identification – 475

Realistic and Affordable Cyberware Opponents for the Information Warfare Battlespace – 537

Recommendations for Network- and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457

Route Optimization for Mobile IPV6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis – 489

Secure Enterprise Access Control (SEAC) Role Based Access Control (RBAC) – 483

Security Classification Policy and Procedure: E.O. 12958, as Amended – 650

Security Classified and Controlled Information: History, Status, and Emerging Management Issues – 658

Security Strategy for a Biometrics Deployment – 474

Signals Intelligence Support to the Cockpit – 504

Static Reachability Analysis and Validation Regarding Security Policies Implemented via Packet Filters – 489

Tag Device, Luggage Tag, and Method of Manufacturing a Tag Device – 200

Technical and Non-Technical Problems in Biometric Physical Access Control Systems – 473

Terrorism Information Management Within the New York City Fire Department: Past, Present and Future – 634

Terrorist 'Dirty Bombs': A Brief Primer – 250

The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193

Towards the Development of a Defensive Cyber Damage and Mission Impact Methodology – 641

Transformational Medical Technologies Initiative (TMTI) – 310

Usability and Acceptability of Biometric Security Systems – 473

Vulnerabilities in Biometric Encryption Systems – 473

'Sensitive But Unclassified' Information and Other Controls: Policy and Options for Scientific and Technical Information – 635

## SEDIMENTS

Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78

## SEEDS

Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel – 15

## SEISMIC WAVES

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265

Grid-Search Techniques for Seismic Event Location and Phase Association – 261

Review of the Stability Analysis for the LANL BSL-3 Building Foundation – 264

## SEISMOLOGY

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 262

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265

Grid-Search Techniques for Seismic Event Location and Phase Association – 261

Review of the Stability Analysis for the LANL BSL-3 Building Foundation – 264

## SELECTION

Collective Choice with Uncertain Domain Models – 535

## SELENIUM

Cadmium, Zinc, and Selenium Levels in Carcinoma of the Human Prostate – 356

GKLF as a Novel Target in Selenium Chemoprevention of Prostate Cancer – 361

Nano-Dots Enhanced White Organic Light-Emitting Diodes – 90



- Selenium and Breast Cancer Chemoprevention – 339
- SELF ASSEMBLY**  
Meso-Scale Self-Assembly Pilot Study – 199
- SELF ORGANIZING SYSTEMS**  
Self-Organized Air Tasking: Examining a Non-Hierarchical Model for Joint Air Operations – 500
- SEMANTICS**  
Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS) – 625  
Information Engineering in Support of Multilateral Joint Operational Interoperability – 611  
Semantic Graph Query Language – 434  
The Benefit of Ontologies for Interoperability of CCIS. (Easy, Quick and Cheap Solutions are Impossible, if Semantics of CCIS are Affected.) – 620
- SEMICONDUCTING FILMS**  
Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196
- SEMICONDUCTOR DEVICES**  
Damascene Process for Use in Fabricating Semiconductor Structures Having Micro/Nano Gaps – 213  
Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184  
Spin Electronics – 189
- SEMICONDUCTOR LASERS**  
Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230
- SEMICONDUCTORS (MATERIALS)**  
Advanced Materials Deposition for Semiconductor Nanostructures Using Super-critical Fluids – 185  
Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204  
Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties – 189  
Dynamics of Epitaxy on the Nano-sized Semiconductor Surfaces – 188  
Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 070) – 206  
Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 378) – 206
- Non-Equilibrium Quantum Dots: Transport – 185  
Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186  
Self-Aligned Body Tie for a Partially Depletion SOI Device Structure – 201  
Semiconductor Quantum Dot Resonant Tunnelling Spectroscopy – 185  
Structural Investigations of Surface and Orientation-Specific Phenomena in Nanocrystals and Their Assemblies – 203  
Two Bit/Four Bit SONOS Flash Memory Cell – 200  
Venturing Through the Forbidden Band – 194
- SENSE ORGANS**  
Ethanol and Mesolimbic Serotonin/Dopamine Interactions via 5HT-1B Receptors – 346
- SENSITIVITY**  
A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620  
Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells – 303  
Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer – 364  
Measuring ‘Impossible’ Intermolecular Cross-Peaks to Improve Selectivity and Sensitivity in Breast MRI – 396  
Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287  
Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy – 363  
Role of Thermochemical Decomposition in Energetic Material Initiation Sensitivity and Explosive Performance – 101  
Shot-Peening Sensitivity of Aerospace Materials – 5  
Stab Sensitivity of Energetic Nanolaminates – 84  
The Tactile Modality: A Review of Tactile Sensitivity and Human Tactile Interfaces – 423  
‘Sensitive But Unclassified’ Information and Other Controls: Policy and Options for Scientific and Technical Information – 635
- SENSITIZING**  
Radio-sensitizing Effects of Novel Histone De-Acetylase Inhibitors in Prostate Cancer – 283
- SENSORS**  
Fusion of Imaging and Inertial Sensors for Navigation – 228  
Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – 230
- Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186  
Object Detection in Electro-Optic Sensor Images – 208
- SEPARATED FLOW**  
Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4
- SEPARATORS**  
Heat Generation during Overcharge in Sealed Cells – 248
- SEQUENCING**  
Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles – 381
- SEROTONIN**  
Ethanol and Mesolimbic Serotonin/Dopamine Interactions via 5HT-1B Receptors – 346
- SERUMS**  
Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 309  
Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – 338  
Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374  
Human Spotted Fever Rickettsial Infections – 386  
IDO Inhibitors for Combination Therapy of Prostate Cancer – 317  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389  
Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379
- SERVICE ORIENTED ARCHITECTURE**  
Service Oriented Architecture for Coast Guard Command and Control – 633
- SEX**  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389  
Studies of Prostate Tumor Development Via CRE/LOXP Technology – 309  
Unique Approaches to Androgen Effects on Prostate Cancer – 334
- SHALLOW WATER**  
Characterization of VSW Environment for UUV-N Operations – 214
- SHAPE MEMORY ALLOYS**  
High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor – 119
- SHAPES**  
A Multipurpose Projectile for Penetrating Urban Targets – 519

- High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor – 119
- SHEAR STRESS**  
 Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – 134  
 Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear – 80  
 MEMS Shear Stress Sensors: Promise and Progress – 190
- SHEATHS**  
 On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – 551
- SHELTERS**  
 NIOSH Health Hazard Evaluation Report: HETA No. 2007-0068-3042, Noise Exposures and Hearing Loss Assessments among Animal Shelter Workers, Louisiana Society for the Prevention of Cruelty to Animals, Algiers, Louisiana, May 2007 – 252
- SHIELDING**  
 Analysis of the Thermal Shielding Properties of Camouflage Materials Brief – 192
- SHIPS**  
 A Pareto Approach to Lossy Matching – 203  
 Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – 453  
 Distributed Simulation Run Automation Capability for the Navy PRA Testbed – 453  
 Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244  
 Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227
- SHOCK (PHYSIOLOGY)**  
 A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395  
 Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385  
 Far Forward Treatment of Hemorrhagic Shock – 378  
 The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314
- SHOCK WAVES**  
 Comparison of Thermodynamic Equilibrium and Non-Equilibrium Representation of Materials – 219
- SHORELINES**  
 Center for Coastline Security Technology, Year-2 – 229
- SHOT PEENING**  
 Shot-Peening Sensitivity of Aerospace Materials – 5
- SICKNESSES**  
 Cell-surface Alpha-glucan in Campylobacter jejuni 81-176 – 402  
 Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375  
 Federally Sponsored Health Care Research Gulf War Illnesses and Beyond – 400  
 History of U.S. Military Contributions to the Study of Diarrheal Diseases – 408  
 Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396
- SIDELOBES**  
 Principles of Adaptive Array Processing – 176
- SIGNAL DETECTION**  
 Quantitative Analysis of Situational Awareness (QUASA): Applying Signal Detection Theory to True/False Probes and Self-Ratings – 133  
 Signal Event Detection System – 590
- SIGNAL DETECTORS**  
 Early Detection of Prostate Cancer – 323  
 Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509
- SIGNAL PROCESSING**  
 A High-Performance Communication Service for Parallel Computing on Distributed DSP Systems – 449  
 Dataflow Integration and Simulation Techniques for DSP System Design Tools – 467  
 Fundamentals of Signal Processing for Phased Array Radar – 176  
 Introduction to Synthetic Aperture Radar (SAR) – 175  
 Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193  
 Real-Time Sonar Beamforming on High-Performance Distributed Computers – 596  
 Signals Intelligence Support to the Cockpit – 504
- SIGNAL TO NOISE RATIOS**  
 An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234
- Spread Spectrum Signal Characteristic Estimation Using Exponential Averaging and an AD-HOC Chip rate Estimator – 195
- SIGNATURES**  
 Adaptive and Iterative Processing Techniques for Overlapping Signatures – 556  
 Hyperspectral Imagery Target Detection Using Improved Anomaly Detection and Signature Matching Methods – 592  
 SUSY Multilepton Signatures at Tevatron – 576
- SIGNS AND SYMPTOMS**  
 Can GWOT Primary Prevention Strategy More Effectively Impede Religious Extremism? – 390  
 Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375  
 Digital Watermarking Using Syndrome Codes – 516  
 Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – 380  
 Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378  
 Long-Term Outcomes of Alternative Brachytherapy Techniques for Early Prostate Cancer – 294  
 Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – 324  
 Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350  
 Pharmacological and Nonpharmacological Methods of Treatment for Fragile – 410  
 Prevalence and Outcomes of Restless Legs Syndrome Among Veterans – 346
- SILICATES**  
 Infrared Spectroscopy and Stable Isotope Geochemistry of Hydrated Silicate Glasses – 254  
 Processing of Multifunctional Epoxy Resins Modified with Silicon Based Nanomaterials (POSTPRINT) – 124
- SILICON CARBIDES**  
 A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184  
 Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 83  
 Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear – 80

Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode – 212

Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192

Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184

Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91

## SILICON DIOXIDE

Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54

Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186

## SILICON OXIDES

Two Bit/Four Bit SONOS Flash Memory Cell – 201

## SILICON

10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 191

A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125

Atomistic Calculation of Elastic Moduli in Strained Silicon – 187

Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – 133

Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 604

Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186

Processing of Multifunctional Epoxy Resins Modified with Silicon Based Nanomaterials (POSTPRINT) – 124

Self-Aligned Body Tie for a Partially Depletion SOI Device Structure – 201

Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures – 96

## SIMULATION

A Model of Command and Control Processes for JWARS: Test Results from Controlled Experiments and Simulation Runs – 152

A Multipurpose Projectile for Penetrating Urban Targets – 519

A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 374

Advances in Modeling and Simulation Capabilities for Predicting Store Trajectories - Past Success and Future Challenges – 5

Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 537

An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234

An Integrated Approach to Conversion, Verification, Validation and Integrity of AFRL Generic Engine Model and Simulation (Postprint) – 6

Analyzing the Interdiction of Sea-Borne Threats Using Simulation Optimization – 451

Automated Run-Time Mission and Dialog Generation – 632

C2 Interoperability: Simulation, Architecture and Information Security – 642

C4I Tactical Applications Utilizing Embedded Simulations – 150

C4I-Simulation Interoperability Using the DII COE and HLA – 468

Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 226

Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 603

CLMT2 User's Guide: A Coupled Model for Simulation of Hydraulic Processes from Canopy to Aquifer – 276

Data Alignment between Army C4I Databases and Army Simulations – 653

Dataflow Integration and Simulation Techniques for DSP System Design Tools – 467

Direct Numerical Simulation and Experimental Validation of Hypersonic Boundary-Layer Receptivity and Instability – 512

Distributed Simulation Run Automation Capability for the Navy PRA Testbed – 453

Experiences Linking Vehicle Motion Simulators to Distributed Simulation Experiments – 443

F-15B QuietSpike(TradeMark) Aeroservoelastic Flight Test Data Analysis – 35

Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144

Helmet-Mounted Displays for Use in Air Force Training and Simulation – 6

Introducing Actions into Qualitative Simulation – 499

Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling – 220

Mobile Sensor Networks: A Discrete Event Simulation of WMD Threat Detection in Urban Traffic Schemes – 156

Modeling and Simulation in Support of Network Centric Warfare Analysis – 143

Modeling and Simulation Links with Command & Control (C2) Systems: Considerations in Architecture Designs – 162

Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 580

Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461

Modeling Command and Control in Multi-Agent Systems – 452

Modeling the Structure and Effectiveness of Intelligence Organizations: Dynamic Information Flow Simulation – 626

Modeling the U.S. Military Intelligence Process – 448

Multinational C2 Experiments Supported by C2 Systems and Modeling and Simulations Addressing Army Transformation of Collaborative Planning and Interoperable Execution in a Coalition Environment – 615

New Navy Solutions: Developing Simulation Based C4I Applications – 445

On-Orbit Identification of Inertia Properties of Spacecraft using Robotics Technology – 49

Optimizing Parallel Execution of Detailed Wireless Network Simulation – 624

Overview of Theory and Simulations in the Heavy Ion Fusion Science Virtual National Laboratory – 559

Parallel Simulation of Chip-Multiprocessor Architectures – 447

Particle Filter Based Tracking in a Detection Sparse Discrete Event Simulation Environment – 541

Purple Computational Environment with Mappings to Ace Requirements for the General Availability User Environment Capabilities. Version 2.0 – 433

Rayleigh Taylor Instability induced Mixing. Initial Conditions Modeling, Three Dimensional Simulations and Comparisons with Experiment – 570

Research Institute for Autonomous Precision Guided Systems – 31

Risk Advised Course of Action (COA) Analysis – 532

Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations – 640

Self-Consistent Simulations of High-Intensity Beams and E-Coulsds with WARP POSINST – 568

Self-Organized Air Tasking: Examining a Non-Hierarchical Model for Joint Air Operations – 499

Simulated Performance of a Second Generation Compact Compton Imaging Detector – 569

Simulating Candidate Missions for a Novel Glider Unmanned Underwater Vehicle – 464

Simulation and Analysis of Dart Dispense Events with Collisions – 235

Simulation of Coherent Signals with Forward Error Correction Coding – 540

Simulation of Radiowave Propagation in a Dense Urban Environment – 554

Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – 430

Simulation of the Dynamically Coupled KC-135 Tanker and Refueling Boom – 11

Simulation-Based Learning: Workshops for Researchers and Educators in the Western USA, and the Pacific Rim – 619

The GeoGraph 3D Computational Laboratory – 538

Transforming Intra- and Interagency Processes through Advanced Models and Simulations: An Information Assurance Model – 487

Use of Modeling and Simulation (M&S) in Support of the Quantitative Assessment of FORCEnet Systems and Concepts – 456

Use of Statistical Tools to Improve Modeling and Simulation of Store Separation – 4

Visual Simulation S&T: Summary of Accomplishments – 7

Web Enabling HLA Compliant Simulations to Support Network Centric Applications – 444

Wide Area Search and Engagement Simulation Validation – 32

## **SIMULATORS**

An Integrated Approach to Conversion, Verification, Validation and Integrity of AFRL Generic Engine Model and Simulation (Postprint) – 6

Experiences Linking Vehicle Motion Simulators to Distributed Simulation Experiments – 443

Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415

The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8

The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367

The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618

## **SINGLE CRYSTALS**

Chiral Multichromic Single Crystals for Optical Devices – 580

Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP2 – 233

## **SITES**

1958-2006 Precipitation Climatology for Lawrence Livermore National Laboratory, Livermore Site and Site 300 – 275

## **SITUATIONAL AWARENESS**

Analysis of Network-Enabled ASW Concepts of Operation – 529

Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – 422

Coalition Interoperability Ontology: Sharing Situational Awareness with Allies and Agents – 619

Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627

Constructible Assessment for Situation Awareness in a Distributed C2 Environment – 148

Data Fusion 'Cube': A Multi-Dimensional Perspective – 628

Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps – 6

Distributed Command and Organizational Situation Awareness – 142

From the Battlefield to the Homeland: Building the Case for Network-Centric Response – 636

HUMINT Communication Information Systems for Complex Warfare – 642

Measuring the Value of High Level Fusion – 608

Models of Jointness: Infrastructure Issues for Inter-Organisational Working – 642

Monitoring the Command and Control Weapon System. A Master Caution Panel for C2 System Monitoring – 154

Pictorial Display Design to Enhance Spatial Awareness of Operators in Unmanned Aviation – 28

Quantitative Analysis of Situational Awareness (QUASA): Applying Signal Detection Theory to True/False Probes and Self-Ratings – 132

Shared Situational Awareness Environment for Tactical Level Humanitarian Emergency Operations – 454

The Interactive DataWall – 209

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

Workload, Stress, and Situation Awareness of Soldiers Who are Controlling Unmanned Vehicles in Future Urban Operations – 408

## **SKEWNESS**

Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – 437

## **SLABS**

Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – 255

## **SLAMMING**

Studies on Three-Dimensional Slamming on Slender Ships – 221

## **SLEDS**

An Evaluation of High Velocity Wear – 142

Parametric Dynamic Load Prediction of a Narrow Gauge Rocket Sled – 135

## **SLEEP DEPRIVATION**

High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain – 409

## **SLEEP**

A Collaborative Study of Sleep, Performance and Health Relationships – 383

High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain – 409

## **SLENDER CONES**

Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4

## **SLIDING**

Final Scientific/Technical Phase I Report on Sliding Mode Pulsed Current Averaging IC Drivers for High-Brightness Light Emitting Diodes – 603

Micro and Nano-structure Development and Multiscale Physics at Sliding Metal Interfaces. Final Report May 2006 – 78

## **SLOPES**

A Decision Model for Selecting Energy Efficient Technologies for Low-Sloping Roof Tops Using Value-Focused Thinking – 243

## **SMALLPOX**

Smallpox Antiviral Drug – 286

## **SMOG**

Smog: Who Does it Hurt. What You Need to Know about Ozone and Your Health – 259

## **SMOKE**

Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption – 337

Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250

## **SOCIAL FACTORS**

The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy – 362

## **SOCIOLOGY**

The Effects of Social Network Centrality on Group Satisfaction – 478

## **SODIUM HYDROXIDES**

Heat of Dilution Calculation for 19 Molar Sodium Hydroxide with Water for Use in 241-S-112 – 103

## **SOFTWARE DEVELOPMENT TOOLS**

A Computer Tool for Modeling C4I Applications – 167

A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division – 20

Field Level Computer Exploitation Package – 464

Infra-Gravity Wave Input Toolbox (IGWT): User's Guide – 470

Military Information Networks as Complex Adaptive Systems – 512

Modelling Operational Command Structures Using ORGAHEAD – 451

Optimizing Parallel Execution of Detailed Wireless Network Simulation – 624

Path Planning Software and Graphics Interface for an Autonomous Vehicle, Accounting for Terrain Features – 480

Simulating Candidate Missions for a Novel Glider Unmanned Underwater Vehicle – 464

Software Communications Architecture (SCA) Compliant Software Defined Radio Design for Interim Standard 95B (IS-95B) Transceiver – 463

## **SOFTWARE ENGINEERING**

A Practical Example of Applying Application-Driven Design (ADD), Version 2.0 – 545

A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – 478

An Empirical Assessment of the Impact of Requirements Uncertainty on Development Quality Performance – 446

Boot Camp for Cognitive Systems: A Model for Preparing Systems with Machine Learning for Deployment – 463

C2 Interoperability: Simulation, Architecture and Information Security – 642

CASE Planning and the Software Process – 481

Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI – 481

Conditions for Achieving Network-Centric Operations in Systems of Systems – 465

Design and Application of the Reconstruction Software for the BaBar Calorimeter – 584

Design and Implementation of a Modular Manipulator Architecture – 546

Distributed Computing and Collaboration Framework (DCCF) – 466

Experiments with the Sun Java Real-Time System -- Part 2 – 466

Firefighting Agent Research, Phase I – 10

Mediators in Infrastructure Survivability Enhancement – 449

Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478

Quality-Attribute-Based Economic Valuation of Architectural Patterns – 479

Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452

System-of-Systems Governance: New Patterns of Thought – 465

Task Adaptable Display of Information for Training, Maintenance, and Emergency Response – 654

The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities – 480

Topics in Interoperability: Structural Programmatics in a System of Systems – 465

Willow System Demonstration – 449

## **SOIL MOISTURE**

Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – 273

## **SOILS**

Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305

Literature Review of Biodegradation in Soil of Selected Rocky Mountain Arsenal Contaminants: Isodrin, Dieldrin, Diisopropylmethyl-Phosphonate, 1,2-Dibromo-3-Chloropropane, and p-Chloro-Phenylmethylsulfonate – 61

Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – 273

Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface – 102

Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture – 93

## **SOLAR ARRAYS**

Deployable Solar Array Assembly – 47

## **SOLAR CELLS**

Deployable Solar Array Assembly – 47

Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 604

Studies of Basic Electronic Properties of CdTe-Based Solar Cells and Their Evolution DURING Processing and Stress. Final Technical Report October 16, 2001-August 31, 2005 – 246

Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59

## **SOLAR COLLECTORS**

Wave Front Sensor for Solar Concentrator Control – 52

## **SOLAR CORPUSCULAR RADIATION**

Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events – 668

Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676

## **SOLAR CYCLES**

Observational Properties of Coronal Mass Ejections – 671

## **SOLAR ENERGY**

Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204

Experience Scaling-Up Manufacturing and Emerging Photovoltaic Technologies – 245

Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244

Report to Congress on Assessment of Potential Impact of Concentrating Solar Power for Electricity Generation (EPACT 2005 - Section 934 (c)) – 247

Wave Front Sensor for Solar Concentrator Control – 52

## **SOLAR FLARES**

Acceleration and Propagation in the Heliosphere – 670

Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events – 668

## **SOLAR GENERATORS**

Report to Congress on Assessment of Potential Impact of Concentrating Solar Power for Electricity Generation (EPACT 2005 - Section 934 (c)) – 247

## **SOLAR HEATING**

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

## **SOLAR INSTRUMENTS**

Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59

## **SOLAR POWERED AIRCRAFT**

Persistent Monitoring Platforms – 36

## **SOLAR RADIATION**

MURI Center for Materials Chemistry in the Space Environment – 112

National Solar Radiation Data Base 1991-2005 Update: User's Manual – 245

## **SOLAR RADIO BURSTS**

Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – 669

## **SOLAR STORMS**

Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events – 668

## **SOLAR SYSTEM**

Fundamentals of Aerospace Medicine: Cosmic Radiation – 413

## **SOLAR WIND**

Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – 669

## **SOLENOIDS**

Summary Report--FY2006 ITER Work Accomplished – 575

## **SOL-GEL PROCESSES**

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

## **SOLID PROPELLANT ROCKET ENGINES**

IHPRT Improvements to the Solid Performance Program (SPP) – 542

Lessons Learned in Solid Rocket Combustion Instability – 93

## **SOLID ROCKET PROPELLANTS**

Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – 130

## **SOLID STATE**

Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306

Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187

Solid State Capacitor Discharge Pulsed Power Supply Design for Railguns – 193

Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapotic Self-complementary Tecton Tailored to Halogen Bonding – 98

Topology of On/Off Marx Modulator with Protection of Load and Solid State Switches – 579

## **SOLIDS**

Ultrafast, In Situ Probing of Shocked Solids at the Mesoscale and Beyond: a New Paradigm for Materials Dynamics – 573

## **SOLUBILITY**

Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor – 281

## **SOLUTES**

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – 138

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – 138

## **SOLVENTS**

Nano-Dots Enhanced White Organic Light-Emitting Diodes – 90

Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report – 109

## **SONAR**

A Distributed Parallel Embedded System for Autonomous Sonar Arrays – 450

Center for Coastline Security Technology, Year-2 – 228

Real-Time Sonar Beamforming on High-Performance Distributed Computers – 596

Velocity Estimation Using Forward Looking Sonar – 463

## **SONIC BOOMS**

Sonic Boom Assessment for the Crew Exploration Vehicle – 56

## **SORBENTS**

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

## **SOUND FIELDS**

A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT) – 218

Dark Core Analysis of Coaxial Injectors at Sub-, Near-, and Supercritical Conditions in a Transverse Acoustic Field – 589

## **SOUND GENERATORS**

Chamber Core Structures for Fairing Acoustic Mitigation – 50

## **SOUND TRANSMISSION**

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 589

Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587

Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153

## **SOUTH AMERICA**

Building Alternative-Energy Partnerships with Latin America – 249

Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393

## **SPACE BASES**

Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – 584

## **SPACE COOLING (BUILDINGS)**

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

## **SPACE EXPLORATION**

Exploration Medical Capability (ExMC) Program – 417

Regression Strategies for Parameter Space Exploration. A Case Study in Semicoarsening Multigrid and R – 435

Translational Research in Space Exploration – 413

## **SPACE FLIGHT**

Integrated Crew Health Care System for Space Flight – 412

## **SPACE HEATING (BUILDINGS)**

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

## **SPACE LOGISTICS**

Changing the Cultural Paradigm to Meet Emerging Requirements – 56

## **SPACE MISSIONS**

Joint Space Forces in Theater: Coordination is No Longer Sufficient – 47

## **SPACE PROGRAMS**

Learning from Past Experiences – 56

## **SPACE PSYCHOLOGY**

Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – 416

## **SPACE SHUTTLE MISSIONS**

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

## **SPACE SHUTTLE ORBITERS**

Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58

## **SPACE SHUTTLES**

Probabilistic Modeling of Space Shuttle Debris Impact – 58

Shuttle Entry Imaging Using Infrared Thermography – 57

## **SPACE STATIONS**

Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54

## SPACE SUITS

Anthropometric Accommodation in Space Suit Design – 424

Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83

## SPACE TRANSPORTATION

Changing the Cultural Paradigm to Meet Emerging Requirements – 56

Developing Metrics in Systems Integration (ISS Program COTS Integration Model) – 608

## SPACEBORNE ASTRONOMY

Exploring the High Energy Universe: GLAST Mission and Science – 667

## SPACEBORNE TELESCOPES

Exploring the High Energy Universe: GLAST Mission and Science – 667

Fine Pointing of Military Spacecraft – 51

## SPACECRAFT CONSTRUCTION MATERIALS

Shot-Peening Sensitivity of Aerospace Materials – 5

## SPACECRAFT DESIGN

Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59

## SPACECRAFT ENVIRONMENTS

A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414

Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425

Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – 415

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

## SPACECRAFT TRACKING

Conditional Random People: Tracking Humans with CRFs and Grid Filters – 505

## SPACECREWS

Behavioral Health Program Element – 417

Exploration Medical Capability (ExMC) Program – 417

Integrated Crew Health Care System for Space Flight – 412

Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425

## SPACE-TIME ADAPTIVE PROCESSING

Space-Time Adaptive Processing: Algorithms – 177

Space-Time Adaptive Processing: Fundamentals – 177

## SPACING

Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214

## SPALLATION

Neutron Production by Muon Spallation I: Theory – 571

## SPARE PARTS

Sizing Mobility Readiness Spares Packages for Today's Warfighting Units – 21

## SPATIAL DISTRIBUTION

The Status and Future of the ICRF – 665

## SPATIAL RESOLUTION

High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 557

## SPECTRAL RESOLUTION

Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592

## SPECTRA

An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 666

Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224

Experimenting with C2 Applications and Federated Infrastructures for Integrated Full-Spectrum Operational Environments in Support of Collaborative Planning and Interoperable Execution – 143

Hao Spectral Diagnostic Package for Emitted Radiation (Haos-Diper) Reference Guide. Version 1.0 – 558

Spread Spectrum Signal Characteristic Estimation Using Exponential Averaging and an AD-HOC Chip rate Estimator – 195

## SPECTROGRAPHS

Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226

Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592

## SPECTROMETERS

Beam Dynamics in a Spectrometer for the Polarized Positron Production Experiment – 584

Characterization Of Commonly Encountered Explosives Using Highfield Asymmetric Waveform Ion Mobility Spectrometry Coupled With Mass Spectrometry – 594

Compact Imaging Spectrometer Utilizing Immersed Gratings – 602

Superconducting High Resolution Fast-Neutron Spectrometers – 564

## SPECTROPHOTOMETRY

Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110

## SPECTROSCOPY

All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets – 674

Final Project Report for Terahertz Spectroscopy of Complex Matter – 106

Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging – 355

Semiconductor Quantum Dot Resonant Tunneling Spectroscopy – 185

Spectroscopy and Decay of B Hadrons at the Tevatron – 576

## SPECTRUM ANALYSIS

A Study of the Attraction Forces of Lunar Dust Simulant – 664

Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – 130

## SPEECH RECOGNITION

A Model for Predicting Intelligibility of Binaurally Perceived Speech – 153

The Accuracy of a Fingerprint/Voice Multimodal Verification System – 473

Voice Recognition Interface in the Rehabilitation of Combat Amputees – 307

## SPENT FUELS

Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 131

## SPILLING

Consequence Assessment Methods for Incidents Involving Releases From Liquefied Natural Gas Carriers – 607

## SPINAL CORD

Autologous Marrow-Derived Stem Cell-Seeded Gene-Supplemented Collagen Scaffolds for Spinal Cord Regeneration as a Treatment for Paralysis – 299

Characterization of Neurofibromas of the Skin and Spinal Roots in a Mouse Model – 407

Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – 373

## SPINDLES

Centrosome-Based Mechanisms, Prognostics and Therapeutics in Prostate Cancer – 346

## SPINE

Characterization of Neurofibromas of the Skin and Spinal Roots in a Mouse Model – 408

## SPORES

Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377

- Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – [394](#)
- Role of Superoxide in the Germination of Bacillus Anthracis Endospores – [380](#)
- SPRAYERS**
- Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – [99](#)
- Retort Racks for Polymeric Trays in 1400 Style Spray Retorts – [518](#)
- SPREAD SPECTRUM TRANSMISSION**
- Spread Spectrum Signal Characteristic Estimation Using Exponential Averaging and an AD-HOC Chip rate Estimator – [195](#)
- SPREADSHEETS**
- Visual Spreadsheets in VisIt – [432](#)
- SPUTTERING**
- Infrared and Electrical Properties of Amorphous Sputtered (LaxA11-x)2O3 films – [63](#)
- SQUID (DETECTORS)**
- Potential Applications of Microtesla Resonance Imaging Detected Using a Superconducting Quantum Interference Device – [560](#)
- STABILITY TESTS**
- L2 Stability Analysis of the Central Discontinuous Galerkin Method and a Comparison between the Central and Regular Discontinuous Galerkin Methods – [523](#)
- Review of the Stability Analysis for the LANL BSL-3 Building Foundation – [264](#)
- STABILITY**
- A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – [551](#)
- Defense Horizons. I-Power: The Information Revolution and Stability Operations. Number 55 – [619](#)
- Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – [4](#)
- Finding Stable Causal Interpretations of Equations – [506](#)
- Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – [353](#)
- L2 Stability Analysis of the Central Discontinuous Galerkin Method and a Comparison between the Central and Regular Discontinuous Galerkin Methods – [523](#)
- Polymers for Orientation and Stability of Liquid Crystals – [75](#)
- Weak Mixing and Rare Decays in the Littlest Higgs Model – [563](#)
- STABILIZATION**
- Autonomous Virtual Mobile Nodes – [535](#)
- Self-Stabilizing Mobile Node Location Management and Message – [511](#)
- STAGNATION POINT**
- Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – [431](#)
- STANDARD MODEL (PARTICLE PHYSICS)**
- Weak Mixing and Rare Decays in the Littlest Higgs Model – [563](#)
- STANDARDIZATION**
- Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – [6](#)
- Cooperative Multi-Agent Systems in Mobile Ad Hoc Networks – [495](#)
- STANDARDS**
- Using Formal Methods to Reason about Architectural Standards – [472](#)
- STAPHYLOCOCCUS**
- Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – [331](#)
- STARBURST GALAXIES**
- Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorene-carbonyl Methano[60]Fullerene Pentaads – [88](#)
- STATE ESTIMATION**
- Conditional Random People: Tracking Humans with CRFs and Grid Filters – [505](#)
- STATE VECTORS**
- Advanced Target Tracking Techniques – [175](#)
- STATIC MODELS**
- Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica – [241](#)
- STATIC TESTS**
- Static Reachability Analysis and Validation Regarding Security Policies Implemented via Packet Filters – [490](#)
- STATIONS**
- No Further Action Decision Under CERCLA Study Area 43E Historic Gas Station Sites Fort Devens, Massachusetts – [63](#)
- STATISTICAL ANALYSIS**
- Model Based Statistical Estimation of Sandia RF Ohmic Switch Dynamic Operation from Stroboscopic X-ray Imaging – [207](#)
- Patterns of War Termination: A Statistical Approach – [528](#)
- Techniques for the Statistical Analysis of Observer Data – [524](#)
- Use of Statistical Tools to Improve Modeling and Simulation of Store Separation – [4](#)
- STATISTICAL DISTRIBUTIONS**
- Advanced Target Tracking Techniques – [175](#)
- STEADY STATE**
- M1114 -- Golden HMMWV Power: Electrical Systems Used in Theater – [192](#)
- Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – [122](#)
- STEAM FLOW**
- Feasibility Study of H(sub2)S Abatement by Incineration of Noncondensable Gases in Vented Steam Flow from Davies-State 5206-1 Geothermal Steam Well, Geysers Geothermal Steam Field, Lake County, California – [259](#)
- STEELS**
- Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – [240](#)
- STELLAR ACTIVITY**
- Eta Carinae: Viewed from Multiple Vantage Points – [674](#)
- STELLAR MASS EJECTION**
- Eta Carinae: Viewed from Multiple Vantage Points – [674](#)
- STELLAR WINDS**
- Eta Carinae: Viewed from Multiple Vantage Points – [674](#)
- STEM CELLS**
- A BCR-ABL Kinase Activity-Independent Signaling Pathway in Chronic Myelogenous Leukemia – [351](#)
- Autologous Marrow-Derived Stem Cell-Seeded Gene-Supplemented Collagen Scaffolds for Spinal Cord Regeneration as a Treatment for Paralysis – [299](#)
- Cord Blood Stem Cell Procurement in Minority Donors – [302](#)
- Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease – [343](#)
- Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – [351](#)
- Origin and Properties of Prostatic Stem Cells – [299](#)
- STEROIDS**
- Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – [324](#)
- Novel and Efficient Synthesis of the Promising Drug Candidate Discodermolide – [355](#)
- Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof – [72](#)
- STIFFENING**
- FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures – [29](#)
- STIFFNESS**
- Estimating Runflat Stiffness – [552](#)



## STIMULATION

Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314

Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287

Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110

## STOCHASTIC PROCESSES

Reducing the 'Gap of Pain': A Strategy for Optimizing Federal Resource Availability in Response to Major Incidents – 526

Scale-Independent Biomechanical Optimization – 521

Stochastic Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile – 427

Stochastic Lanchester Air-To-Air Campaign Model: Methods Used to Generate Model Outputs and a User's Guide: 2007 – 527

Survey of Bayesian Models for Modelling of Stochastic Temporal Processes – 434

## STOICHIOMETRY

Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127

Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures – 96

## STORAGE BATTERIES

Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode – 212

Servicing Hawker Vehicle Batteries with Standard Battery Charging and Test Equipment – 248

## STORAGE RINGS (PARTICLE ACCELERATORS)

Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 581

## STORAGE TANKS

Survey of Underground Storage Tanks and Other Subsurface Structures at the Umatilla Depot Activity, Hermiston, Oregon – 239

## STORAGE

Puzzle-Based Storage Systems – 518

## STORMS

On the Relationship of SAPS to Storm-Enhanced Density – 263

Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – 276

Weathering the Storm. Leading Your Organization Through a Pandemic – 368

## STRAIN RATE

High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – 125

## STRAKES

Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet – 221

## STRANDS

Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558

DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – 383

## STRATEGY

Multi-Cumulant and Non-Inferior Strategies for Multi-Player Pursuit-Evasion (PREPRINT) – 544

Strategic Airlift Modernization: Background, Issues and Options – 14

Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans – 640

U.S. Climate Change Technology Program: Vision and Framework for Strategy and Planning – 258

## STRATOSPHERE RADIATION

Stratospheric Relaxation in IMPACTs Radiation Code – 275

## STRATOSPHERE

Achievements in Stratospheric Ozone Protection – 278

Gravity-Wave Dynamics in the Atmosphere – 264

Stratospheric Relaxation in IMPACTs Radiation Code – 275

## STRESS (BIOLOGY)

Post Traumatic Stress Disorder: The Facts – 369

## STRESS INTENSITY FACTORS

Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31

## STRESS (PHYSIOLOGY)

Workload, Stress, and Situation Awareness of Soldiers Who are Controlling Unmanned Vehicles in Future Urban Operations – 409

## STRESS (PSYCHOLOGY)

Workload, Stress, and Situation Awareness of Soldiers Who are Controlling Unmanned Vehicles in Future Urban Operations – 409

## STRING THEORY

AdS/CFT and QCD – 572

Constraints on Meta-Stable de Sitter Flux Vacua – 579

## STRINGS

Computational Nonlinear Optics: Femtosecond Atmospheric Light String Applications – 266

## STRUCTURAL ANALYSIS

Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – 240

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99

Position Analysis of Planar Tensegrity Structures – 583

Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58

## STRUCTURAL BASINS

Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587

## STRUCTURAL DESIGN

Structural Design and Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile Configurations – 217

## STRUCTURED GRIDS (MATHEMATICS)

Discrete Data Transfer Technique for Fluid-Structure Interaction – 478

Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – 437

## STUDENTS

Baylor College of Medicine Saturday Morning Science Workshop – 608

Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362

Immunology, Systems Biology, and Immunotherapy of Breast Cancer – 360

Knowledge Tracing and Prediction of Future Trainee Performance – 531

## SUBLETHAL DOSAGE

Effects of Sarin on the Operant Behavior of Guinea Pigs – 382

## SUBMERGING

Materials and Fabrication Issues for Large Machined Germanium Immersion Gratings – 575

## SUBROUTINES

An Inverse of the Circular Coverage Function – 525

An Inverse of the Elliptic Coverage Function – 525

An Inverse of the Generalized Circular Error Function – 525

An Inverse of the Incomplete Beta Function (F-(Variance Ratio) Distribution Function) – 467

## SUBSONIC FLOW

High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77

## SUBSTRATES

10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 191

Degradation of Polycyclic Aromatic Hydrocarbons by Actinomycetes – 104

DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – 383

Method of Forming Quantum Dots at Predetermined Positions on a Substrate – 201

On the Correlation Between the Self-Organized Island Pattern and Substrate Elastic Anisotropy – 552

Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures – 96

Superconductors on Iridium Substrates and Buffer Layers – 606

## SULFIDES

Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306

Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379

## SULFUR

Conversion of Hydrogen Sulfide in Coal Gases to Liquid Elemental Sulfur with Monolithic Catalysts. (Annual Report, October 1, 2005-September 30, 2006) – 107

Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383

Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110

Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – 384

## SUMMER

Defense Science Board 2006 Summer Study of Information Management for Net-Centric Operations. Volume 2. Operations Panel Report – 158

Defense Science Board 2006 Summer Study on Information Management for Net-Centric Operations. Volume 1: Main Report – 158

## SUMPS

Gas Turbine Engine Including a Low Pressure Sump Seal Buffer Source and Thermally Isolated Sump – 41

## SUN

Experiments with the Sun Java Real-Time System -- Part 2 – 467

Progress Report of the IAU Working Group on Precession and the Eclipse – 665

Understanding Magnetic Eruptions in the Sun and Their Interplanetary Consequences – 667

## SUPERCOMPUTERS

Advancing Software Security - The Software Protection Initiative – 626

BlueGene/L Supercomputer and Quantum ChromoDynamics – 560

Purple Computational Environment with Mappings to Ace Requirements for the General Availability User Environment Capabilities. Version 2.0 – 433

## SUPERCONDUCTING CAVITY RESONATORS

Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab – 564

## SUPERCONDUCTING MAGNETS

Summary Report--FY2006 ITER Work Accomplished – 575

## SUPERCONDUCTIVITY

New Strategic Plan Takes the ALS into the Future – 577

Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441

Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab – 564

Superconducting High Resolution Fast-Neutron Spectrometers – 564

Synthesis of One-dimensional Nanosized Defects in High T<sub>c</sub> Superconductor – 552

## SUPERCONDUCTORS (MATERIALS)

Superconducting High Resolution Fast-Neutron Spectrometers – 565

Superconductors on Iridium Substrates and Buffer Layers – 606

## SUPERCOOLING

Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270

## SUPERCritical FLOW

A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT) – 218

Advanced Materials Deposition for Semiconductor Nanostructures Using Supercritical Fluids – 184

## SUPERCritical FLUIDS

Advanced Materials Deposition for Semiconductor Nanostructures Using Supercritical Fluids – 185

Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions – 217

## SUPERLATTICES

Superlattice Nanopatterning of Wires and Complex Patterns – 207

## SUPERPLASTICITY

Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion – 117

## SUPERSONIC COMBUSTION RAMJET ENGINES

Technologies for Propelled Hypersonic Flight, Volume 2 - Subgroup 2: Scram Propulsion – 41

## SUPERSONIC COMBUSTION

Technologies for Propelled Hypersonic Flight, Volume 2 - Subgroup 2: Scram Propulsion – 41

## SUPERSONIC FLOW

High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77

## SUPERSONIC WIND TUNNELS

Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel – 15

## SUPERSYMMETRY

Constraints on Meta-Stable de Sitter Flux Vacua – 579

Search for Chargino and Neutralino at Run II of the Tevatron Collider – 576

## SUPPLYING

Final Scientific/Technical Phase I Report on Sliding Mode Pulsed Current Averaging IC Drivers for High-Brightness Light Emitting Diodes – 603

Oil Vulnerabilities and USA Strategy – 241

Proceedings of the 1st Army Installation Energy Security and Independence Conference – 245

Selection Process of a Non-Primary Power Source for a Combat Vehicle – 242

## SUPPORT SYSTEMS

A Model of Tactical Battle Rhythm – 171

Determining Logistics Ground Support Manpower Requirements for a Reusable Military Launch Vehicle – 57

Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States – 439

HPC-Colony: Services and Interfaces to Support Systems with Very Large Numbers of Processors. (2006 Annual Report, January-December 2006) – 431

Using Work-Centered Support System Technology to Enhance Command and Control – 488

## SUPPORTS

Thermally Compensated Fiber Bragg Grating Mount – 236

## SUPPRESSORS

The Opposing Roles of Nucleophosmin and the ARF Tumor Suppressor in Breast Cancer – 283

The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis – 322

The Role of RB in the Therapeutic Response of Breast Cancer – 301

#### **SURFACE DEFECTS**

Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187

#### **SURFACE DIFFUSION**

Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – 431

#### **SURFACE EMITTING LASERS**

Vertical Cavity Surface Emitting Laser Having a Gain Guide Aperture Interior to an Oxide Confinement Layer – 599

#### **SURFACE ENERGY**

Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – 74

Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89

#### **SURFACE PROPERTIES**

Antimicrobial Polymeric Surfaces – 79

Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72

#### **SURFACE REACTIONS**

Controls of Fluid Chemistry on Fracture Growth – 106

Liquid Mixing Reactor for Biochemical Assays – 71

Stab Sensitivity of Energetic Nanolaminates – 84

#### **SURFACE VEHICLES**

Lightweight and Advanced Materials for Defense: Materials for Military Ground Vehicles – 85

#### **SURFACE WAVES**

Infra-Gravity Wave Input Toolbox (IGWT): User's Guide – 470

Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227

#### **SURGERY**

Advanced Technologies in Safe and Efficient Operating Rooms – 309

Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233

#### **SURGES**

M1114 -- Golden HMMWV Power: Electrical Systems Used in Theater – 192

Reducing the 'Gap of Pain': A Strategy for Optimizing Federal Resource Availability in Response to Major Incidents – 526

#### **SURVEILLANCE**

A Bold 21st Century Strategy for U.S. Airborne ISR – 24

A Comparison of Trajectory Determination Approaches for Small UAVs – 11

A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620

Advanced Target Tracking Techniques – 175

COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care – 368

Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178

Digital Convergence Authenticated Video, Voice, & Text – 476

Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144

Guidance Material for Mode S-Specific Protocol Application Avionics – 37

Libraries and the USA PATRIOT Act – 635

Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – 67

Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – 675

Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461

North West Shelf Unmanned Aerial System Trial – 18

Persistent Monitoring Platforms – 36

Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227

Testing the Effectiveness of the North Shore - LIJ Health System's Bioterrorism Response Program to Identified Surveillance Data – 345

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective – 621

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective – 623

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective – 623

The Coalition Aerial Surveillance and Reconnaissance (CAESAR) Approach to Enhancing the Interoperability of Coalition Ground Surveillance Systems – 224

The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164

The USA PATRIOT Act: A Legal Analysis – 638

The USA PATRIOT Act: A Sketch – 633

Tracking and Data Fusion Applications – 177

Very High Resolution SAR and Multi-channel SAR/MTI – 175

#### **SURVEYS**

A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 389

A Survey of Statistical Machine Translation – 509

All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets – 674

Asbestos Survey for Fort Point US Coast Guard Station, Presidio of San Francisco. Volume 2 – 241

Corporate Entrepreneurship Assessment Instrument (CEAI): Refinement and Validation of a Survey Measure – 136

Development of an Assistive Technology and Environmental Assessment Instrument for National Surveys: Final Report. Part One: Recommended Modules and Instrument Development Process – 440

Galvanic Skin Response as a Measure of Soldier Stress – 410

Jefferson Proving Ground, South of the Firing Line, Final Asbestos Survey Summary Report. Volume 3. Buildings 230 through 475 – 241

Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of Travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan – 375

Large Synoptic Survey Telescope and Foundations for Data Exploitation of Petabyte Data Sets – 673

Lethality and Autonomous Robots: An Ethical Stance – 504

Radon Screening of Buildings at the Umatilla Depot Activity, Hermiston, Oregon – 94

Survey and Alignment of the Fermilab Electron Cooling System – 585

Survey of Bayesian Models for Modelling of Stochastic Temporal Processes – 434

Survey of Hurricane Katrina and Hurricane Rita Contracts and Grants. Public Release – 279

Survey of Probabilistic Models for Relational Data – 435

Survey of Underground Storage Tanks and Other Subsurface Structures at the Umatilla Depot Activity, Hermiston, Oregon – 239

## **SURVIVAL**

Environmental Survival, Military Reliance, and Persistence of Burkholderia Pseudomallei – 291

Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – 373

Intracellular Survival of Campylobacter jejuni in Human Monocytic Cells and Induction of Apoptotic Death by Cytolethal Distending Toxin – 394

## **SWINE**

A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395

Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385

The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314

## **SWITCHES**

A Multiservice Switch for Advanced Avionics Data Networks – 43

Model Based Statistical Estimation of Sandia RF Ohmic Switch Dynamic Operation from Stroboscopic X-ray Imaging – 207

Topology of On/Off Marx Modulator with Protection of Load and Solid State Switches – 579

## **SWITCHING CIRCUITS**

Coreless Approaches for On/Off Marx Type Modulators – 579

Model Based Statistical Estimation of Sandia RF Ohmic Switch Dynamic Operation from Stroboscopic X-ray Imaging – 207

## **SWITCHING**

A Multiservice Switch for Advanced Avionics Data Networks – 43

Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438

Configuration Management Support for Long Haul C2 Circuit Switched Services – 154

Final Scientific/Technical Phase I Report on Sliding Mode Pulsed Current Averaging IC Drivers for High-Brightness Light Emitting Diodes – 602

## **SWITZERLAND**

Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 353

## **SYMMETRY**

Control of Spinning Symmetric Airframes – 553

## **SYNCHRONISM**

Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460

Fermi Timing and Synchronization System – 605

New Approaches C4I Data Warehousing for Crisis Action - Synchronization, Replication, Sustainment Design Implications – 645

## **SYNCHROTRONS**

AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605

## **SYNOPTIC METEOROLOGY**

The Forcing of 25-Knot Winds at Hickam and Andersen AFB – 270

## **SYNTHESIS (CHEMISTRY)**

Large Scale Green Synthesis of 1,2,4-Butanetriol – 66

Mesostructured Zeolitic Materials, and Methods of Making and Using the Same – 76

Synthesis, Structure, and Properties of PBO/SWNT Composites – 104

Tubular Carbon Nano/micro Structures and Method of Making Same – 74

## **SYNTHETIC APERTURE RADAR**

Alternatives for Military Space Radar – 223

Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261

Development and Assessment of a Complete ATR Algorithm Based on ISAR Euler Imagery – 468

Introduction to Synthetic Aperture Radar (SAR) – 175

Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – 631

Point Spread Function Characterization of a Radially Displaced Scatterer Using Circular Synthetic Aperture Radar – 230

Software to Generate 3-Dimensional Displays of Inverse Synthetic aperture Radar Data – 455

## **SYNTHETIC FUELS**

A Possible Solution for the U.S. Navy's Addiction to Petroleum: A Business Case Analysis for Transitioning the U.S. Navy From Petroleum to Synthetic Fuel Resources – 63

AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – 254

## **SYSTEM EFFECTIVENESS**

A Methodology for End-to-End Evaluation of Arabic Document Image Processing Software – 469

Airborne Armed Full Motion Video: The Nexus of OPS/INTEL Integration in the Joint/Coalition Environment – 229

Application of NCO Conceptual Framework to US/UK Coalition Combat Operations during Operation Iraqi Freedom – 494

Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – 453

Conditions for Achieving Network-Centric Operations in Systems of Systems – 465

Defense Logistics: Army and Marine Corps' Body Armor Requirements, Controls, and Other Issues – 425

Distributed Simulation Run Automation Capability for the Navy PRA Testbed – 453

Further Evidence of the Effects of Wind Turbine Farms on AD Radar – 532

Joint Essential Tasks and a Framework for Evaluation – 136

Military Helicopter Modernization: Background and Issues for Congress – 28

Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478

Multipurpose Activity Definitions and Interfaces to Support Operational Needs (MADISON) – 542

NAC Off-Vehicle Brake Testing Project – 139

Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227

Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140

## **SYSTEM IDENTIFICATION**

F-15B QuietSpike(TradeMark) Aeroseervoelastic Flight Test Data Analysis – 36

## **SYSTEMS ANALYSIS**

A System of Systems Interface Hazard Analysis Technique – 541

Applying Executable Architectures to Support Dynamic Analysis of C2 Systems – 482

Dynamic Across-Time Measurement Interpretation: Maintaining Qualitative Understandings of Physical System Behavior – 500

Human Systems Integration Assessment of Network Centric Command and Control – 421

System for the Evaluation of Moisture Damage Using Fundamental Material Properties – 74

System Instantiation Comparison Method: A Technique for Comparing Military Headquarters – 542

The Logic of Occurrence – 500

## SYSTEMS ENGINEERING

A System Design Archetype for C4ISR Systems of the 21st Century – 159

A System of Systems Interface Hazard Analysis Technique – 541

Dataflow Integration and Simulation Techniques for DSP System Design Tools – 467

Evolution of C4I Systems – 174

LCLS XTOD Tunnel Vacuum Transport System (XVTS) Final Design Report – 563

Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – 450

NDIA FORCEnet Study - Overview of the Human Element Group's Findings: Implications for C2 and other Aspects of NCW – 172

Solutions Analysis for Helicopter Brownout – 33

Sustaining Air Force Space Systems: A Model for the Global Positioning System – 26

Systems Engineering for Rapid Prototyping: Friendly Marking Device – 227

The DoD Architecture Framework Views as Requirements Vehicles in a Model Driven Architecture Systems Development Process – 496

## SYSTEMS INTEGRATION

A Reference Architecture for Network-Centric Information Systems – 619

A Unifying Strategy for Data Integration for Global Force Management (Briefing Charts) – 147

Conditions for Achieving Network-Centric Operations in Systems of Systems – 465

Counter-Trafficking Integrated Display System (CIDS): A GIS-Based Command & Control Environment for Coalition Nations – 470

Defense Acquisitions. Improved Management and Oversight Needed to Better Control DOD's Acquisition of Services – 492

Developing Metrics in Systems Integration (ISS Program COTS Integration Model) – 608

Human Systems Integration Assessment of Network Centric Command and Control – 421

Integrated Information Management (IIM) – 484

Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273

System-of-Systems Governance: New Patterns of Thought – 465

The Accuracy of a Fingerprint/Voice Multimodal Verification System – 473

The DoD Architecture Framework Views as Requirements Vehicles in a Model Driven Architecture Systems Development Process – 496

## SYSTEMS MANAGEMENT

Systems and Capability Relation Management in Defence Systems-of-System Context – 616

## SYSTEMS STABILITY

New Tools for Hybrid Systems – 518

## TACHYONS

Constraints on Meta-Stable de Sitter Flux Vacua – 579

## TACTICS

An Analysis of Small Navy Tactics Using a Modified Hughes' Salvo Model – 541

## TAIWAN

Taiwan - AFOSR Nanoscience Initiative Status – 199

## TANKER AIRCRAFT

Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability – 33

Simulation of the Dynamically Coupled KC-135 Tanker and Refueling Boom – 11

## TARGET ACQUISITION

Alternatives for Military Space Radar – 223

An Inverse of the Circular Coverage Function – 525

An Inverse of the Elliptic Coverage Function – 525

An Inverse of the Generalized Circular Error Function – 525

Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 223

Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153

Hyperspectral Imagery Target Detection Using Improved Anomaly Detection and Signature Matching Methods – 592

Hyperspectral Imagery Target Detection Using Principal Component Analysis – 522

Integrated Sensing and Processing (ISP) Phase 2: Demonstration and Evaluation for Distributed Sensor Networks and Missile Seeker Systems – 514

Optimizing the Allocation of Sensor Assets for the Unit of Action – 531

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective – 621

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective – 623

The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective – 623

Theory and Applications of Computational Time-Reversal Imaging – 516

## TARGET RECOGNITION

Advanced Radar Signal and Data Processing – 175

Automatic Target Recognition User Interface Tool – 510

Development and Assessment of a Complete ATR Algorithm Based on ISAR Euler Imagery – 468

Point Spread Function Characterization of a Radially Displaced Scatterer Using Circular Synthetic Aperture Radar – 230

Wide Area Search and Engagement Simulation Validation – 32

## TARGETS

A Centripetal Acceleration Statistic for Tracking Maneuvering Targets with Radar – 225

A Multipurpose Projectile for Penetrating Urban Targets – 519

A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620

Adaptive and Iterative Processing Techniques for Overlapping Signatures – 555

Alternatives for Military Space Radar – 223

An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234

Application of the Unscented Transformation to Obtain Target Range, Bearing, Elevation, Range Rate, Speed and Course Estimates and Errors From Tracks Given in Cartesian Coordinates – 517

Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – 584

Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer – 320

Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224

Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions – 603

Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 223

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460

Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast – 319

GKLF as a Novel Target in Selenium Chemoprevention of Prostate Cancer – 361

High Throughput Screening of Crystallization of Materials – 71

Humanin: A Novel Therapeutic Target in Prostate Cancer – 319

IEIST Technologies Enabling TCT Prosecution – 538

IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345

Implementation of the Polarized HD Target at the Thomas Jefferson National Accelerator. Reporting Period for January 1, 2002 to December 31, 2006 – 583

Liquid Mixing Reactor for Biochemical Assays – 71

Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289

Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26

Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601

Simultaneous Localization and Tracking in Wireless Ad-hoc Sensor Networks – 188

Simultaneous Localization, Calibration, and Tracking in an ad Hoc Sensor Network – 536

Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers – 311

Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy – 316

Toward Neural Control of Prosthetic Devices – 209

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

## TASKS

A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37

Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459

Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503

RIDE vs. CLASP Comparison and Evaluation: Models and Parameters – 662

The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367

The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618

## TAXONOMY

A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – 478

A Survey of Statistical Machine Translation – 509

Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion – 622

## TAYLOR INSTABILITY

Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing – 568

Rayleigh Taylor Instability induced Mixing. Initial Conditions Modeling, Three Dimensional Simulations and Comparisons with Experiment – 570

## TEA LASERS

A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 340

## TECHNOLOGIES

Automated STR Analysis for DNA Databases – 429

Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 21

Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – 497

Pilot Study: Parasitic and Passive Radar – 179

Science & Technology Review January/February 2007 – 575

## TECHNOLOGY ASSESSMENT

Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249

Development of an Assistive Technology and Environmental Assessment Instrument for National Surveys: Final Report. Part One: Recommended Modules and Instrument Development Process – 440

Nanoscience and Technology at the Air Force Research Laboratory (AFRL) – 54

Using Work-Centered Support System Technology to Enhance Command and Control – 488

## TECHNOLOGY TRANSFER

AFRL/IF Technology Transition to the Warfighter via the CAOC-X – 465

China: Possible Missile Technology Transfers from U.S. Satellite Export Policy - Actions and Chronology – 637

Report to Congress on the Activities of the DoD Office of Technology Transition – 651

Sharing the Dragon's Teeth: Terrorist Groups and the Exchange of New Technologies – 643

## TECHNOLOGY UTILIZATION

A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 54

ISO/IEC JTC1 SC37 Overview – 474

Technologies for Propelled Hypersonic Flight, Volume 2 - Subgroup 2: Scram Propulsion – 40

Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight – 41

## TELECOMMUNICATION

A Model for Effective Organization and Communication of Homeland Security Activity at the State Level – 157

A Multi-Ring Framework for Survivable Group Communications – 440

An Evaluation Methodology for Protocol Analysis Systems – 490

Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – 422

Automating Behavioral Health Screening - Addressing Risk Communication Electronically – 306

Bone Conduction: Anatomy, Physiology, and Communication – 163

Communication of Context in Multi-Echelon Information Exchange Environments – 656

Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178

Degrees of Shared Awareness – 657

Effective Mobile Routing Through Dynamic Addressing – 182

Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630

HUMINT Communication Information Systems for Complex Warfare – 642

Mission Support for the Communications/Navigation Outage Forecast Satellite – 49

Modeling and Simulation in Support of Network Centric Warfare Analysis – 143

Non-Electronic Radio Front-End (NERF) – 211

Privacy: An Abbreviated Outline of Federal Statutes Governing Wiretapping and Electronic Eavesdropping – 156

The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164

The USA PATRIOT Act: A Legal Analysis – 638

The USA PATRIOT Act: A Sketch – 633

## TELEMEDICINE

Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354

Diabetes Care and Treatment Project: A Joslin Telemedicine Initiative – 373

Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415

Medical Vanguard Diabetes Management – 390

Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360

UH-USA Agreement - A Telemedicine Research Proposal – 624

## TELEPHONES

Analysis of Origin Destination Flows (Raw Data) – 521

Development of an Assistive Technology and Environmental Assessment Instrument for National Surveys: Final Report. Part One: Recommended Modules and Instrument Development Process – 440

Pager Phones: Circuit Protection – 168

Pager Phones: Installation – 167

## TELESCOPES

Adaptive Optics Views of the Hubble Deep Fields Final Report on LLNL LDRD Project 03-ERD-002 – 673

Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226

Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592

Exploiting Adaptive Optics with Deformable Secondary Mirrors – 231

Fine Pointing of Military Spacecraft – 51

Large Synoptic Survey Telescope and Foundations for Data Exploitation of Petabyte Data Sets – 673

Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – 675

## TELOMERES

Prognostic Significance of Telomere Attrition in Ductal Carcinoma in Situ of the Breast – 391

## TEMPERATURE CONTROL

Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint) – 55

Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint) – 55

Potential Thermal Security Risks – 441

## TEMPERATURE DEPENDENCE

Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597

POINT 2007: A Temperature Dependent ENDF/B-VII.0 Data Cross Section Library – 562

## TEMPERATURE DISTRIBUTION

Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59

## TEMPERATURE EFFECTS

Effects of Temperature and Environment on Creep Behavior of an Oxide-Oxide Ceramic Matrix Composite – 103

Improving Thermal Performance of Radioactive Material Drum Type Packages by Using Heat Pipes – 131

Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113

## TEMPERATURE GRADIENTS

Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 604

Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270

## TEMPERATURE MEASUREMENT

Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587

Development of a 3-D Defocusing Liquid Crystal Particle Thermometry and Velocimetry (3DDLCPVT) System – 111

## TEMPERATURE PROFILES

An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234

## TEMPERATURE SENSORS

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

## TEMPLATES

Conformal Template and New Perspectives for Quantum Chromodynamics – 574

Surface-Templated Assembly for Mass-Production of ZnO Nanowire-Based Integrated Devices – 89

Using Templates to Support Crisis Action Mission Planning – 455

## TEMPORAL DISTRIBUTION

Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224

## TENSEGRITY STRUCTURES

Position Analysis of Planar Tensegrity Structures – 583

## TENSILE PROPERTIES

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99

Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99

## TENSILE STRENGTH

Off-Axis Creep Behavior of Oxide/Oxide Nextel(Trademark)720/AS-0 (Preprint) – 123

## TERMINAL GUIDANCE

Proportional Navigation With Adaptive Terminal Guidance For Aircraft Rendezvous (Preprint) – 7

## TERRAIN

Assessing C3I in Support of Dismounted Operations in Complex Terrain – 540

Data Mining Techniques Applied to Urban Terrain Command and Control Experimentation – 615

Evaluation of High Density Surface Observations in Complex Terrain and Their Contribution to the MM5 Model – 268

Path Planning Software and Graphics Interface for an Autonomous Vehicle, Accounting for Terrain Features – 480

The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164

## TERRORISM

Building Collaborative Capacity for Biosecurity at the Georgia Seaports – 638

Can GWOT Primary Prevention Strategy More Effectively Impede Religious Extremism? – 390

Classifying Failing States – 528

Homeland Security: Protecting Airspace in the National Capital Region – 25

Intelligence Reform and Terrorism Prevention Act of 2004: 'Lone Wolf' Amendment to the Foreign Intelligence Surveillance Act – 664

Network Centric Warfare for Coalition Integrated Defense Against Terrorism – 165

Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers – 312

Terrorism Information Management Within the New York City Fire Department: Past, Present and Future – 634

Winning the Battle of Ideas in the War on Terrorism – 181

## TEST CHAMBERS

Radiated Susceptibility Test in Reverberation Chamber – 202

## TEST EQUIPMENT

Development of Subscale Fast Cookoff Test – 135

Servicing Hawker Vehicle Batteries with Standard Battery Charging and Test Equipment – 248

## TEST FACILITIES

Design and Validation of an Aeroacoustic Anechoic Test Facility – 588

Injector Test Facility for the LCLS. Executive Summary – 566

Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab – 564

Subgrade CBR Values for Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility – 13

Technologies for Propelled Hypersonic Flight, Volume 3 - Subgroup 3: CFD Validation for Hypersonic Flight – 41

## TEST STANDS

Network-Centric Applications and Tactical Networks – 173

Route Optimization for Mobile IPV6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis – 489

## TETRAHEDRONS

Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – 431

## TEXTILES

Image Reconstruction Based Modeling of 3D Textile Composite (Postprint) – 128

Method for Constructing Antennas from Textile Fabrics and Components – 179

Thermal Applications for Advanced Metallic Materials (Preprint) – 18

## TEXTS

Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Text – 118

## THAILAND

Behavioral Responses to DDT and Pyrethroids Between Anopheles Minimus Species A and C Malaria Vectors in Thailand – 393

## THEMATIC MAPPING

Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – 632

## THERAPY

A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – 406

A Phase II Immunotherapeutic Trial: Combination Androgen Ablative Therapy and CTLA-4 Blockade as a Treatment for Advanced Prostate Cancer – 297

Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – 110

Biological Impact of Senescence Induction in Prostate Cancer Therapy – 293

Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer – 320

Control of DNA Dehybridization via Nanoparticle Antennas for Antisense Gene Therapy – 383

Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast – 319

Humanin: A Novel Therapeutic Target in Prostate Cancer – 319

IDO Inhibitors for Combination Therapy of Prostate Cancer – 317

IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345

Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351

Midkine Promoter-Driven Adenovirus as Potential Therapy for NF1 – 341

Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289

Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy – 363

Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330

Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer – 302

Protein Transduction Based Therapies for Breast Cancer – 315

Restoration of Wild-Type Activity to Mutant p53 in Prostate Cancer: A Novel Therapeutic Approach – 365

Selective Androgen Receptor Downregulators (SARDs): A New Prostate Cancer Therapy – 303

Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy – 316

Targeted Therapies for Myeloma and Metastatic Bone Cancers – 328

The Role of RB in the Therapeutic Response of Breast Cancer – 301

Ultrasound Phased Arrays – 208

## THERMAL ANALYSIS

Decomposition Kinetic of Greases by Thermal Analysis – 127

Improving Thermal Performance of Radioactive Material Drum Type Packages by Using Heat Pipes – 131

## THERMAL CONDUCTIVITY

Effect of Thermal Conductivity on the Knudsen Layer at Ablative Surfaces – 607

Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81

Thermal Applications for Advanced Metallic Materials (Preprint) – 18

Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83

Thermal Diffusivity and Conductivity Measurements in Diamond Anvil Cells – 561

## THERMAL CONTROL COATINGS

An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems – 60

First Principles and Multi-Scale Modeling of the Roles of Impurities and Dopants on Thermal Barrier Coating Failure – 88



- Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65
- THERMAL DIFFUSIVITY**  
Thermal Diffusivity and Conductivity Measurements in Diamond Anvil Cells – 561
- THERMAL MAPPING**  
Characterization of a Hall Effect Thruster Using Thermal Imaging – 608  
Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314  
Polarimetric Thermal Imaging – 540
- THERMAL PLASMAS**  
Removal of Elemental Mercury from a Gas Stream Facilitated by a Non-Thermal Plasma Device. Final Report – 258
- THERMAL PROTECTION**  
Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – 212
- THERMAL RADIATION**  
An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234
- THERMAL RESISTANCE**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125
- THERMAL STABILITY**  
Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters – 113  
Supported Metal Catalyst with Improved Thermal Stability – 64
- THERMAL STRESSES**  
Investigation of Lattice and Thermal Stress in GaN/AlGaN Field-Effect Transistors – 194
- THERMOCHEMISTRY**  
Role of Thermochemical Decomposition in Energetic Material Initiation Sensitivity and Explosive Performance – 101
- THERMODYNAMIC EQUILIBRIUM**  
Comparison of Thermodynamic Equilibrium and Non-Equilibrium Representation of Materials – 219
- THERMODYNAMIC PROPERTIES**  
Analysis of the Thermal Shielding Properties of Camouflage Materials Brief – 192  
Characterization of a Hall Effect Thruster Using Thermal Imaging – 607  
Designing of Bulk Nano-Structures With Enhanced Thermoelectric Properties – 553  
Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113
- Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – 91  
Thermal Applications for Advanced Metallic Materials (Preprint) – 18  
Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared – 271
- THERMODYNAMICS**  
Comparison of Thermodynamic Equilibrium and Non-Equilibrium Representation of Materials – 219  
Modeling Damage and Fragmentation in Concrete – 122  
Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81  
Structure-Based Design of Cdk4/6-Specific Inhibitors – 290
- THERMOELASTICITY**  
Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 82
- THERMOELECTRIC MATERIALS**  
Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties – 189
- THERMOELECTRICITY**  
Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties – 189  
Designing of Bulk Nano-Structures With Enhanced Thermoelectric Properties – 553  
Thermal Applications for Advanced Metallic Materials (Preprint) – 18
- THERMOGRAPHY**  
Shuttle Entry Imaging Using Infrared Thermography – 57
- THERMOGRAVIMETRY**  
Molecular Structure Analysis of Aminophenyl Silsesquioxane (Preprint) – 98
- THERMOLUMINESCENCE**  
Correcting the Response of an Albedo Neutron Dosimeter for Energy – 220
- THERMOMETERS**  
Development of a 3-D Defocusing Liquid Crystal Particle Thermometry and Velocimetry (3DDLCPV) System – 111
- THERMONUCLEAR POWER GENERATION**  
Status and Prospects of the Fast Ignition Inertial Fusion Concept – 571
- THERMONUCLEAR REACTIONS**  
Improved Charged Particle Model in CALEICF – 569  
Summary Report--FY2006 ITER Work Accomplished – 575  
Visible and Infrared Optical Design for the ITER Upper Ports – 599
- THERMOPHYSICAL PROPERTIES**  
Nonequilibrium Stagnation-Line Radiative Heating for Fire II – 221
- THERMOPLASTICITY**  
Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81
- THERMOSETTING RESINS**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125
- THESES**  
Resonant Second Generation Slepton Production at the Tevatron – 586
- THICKNESS**  
Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81
- THIN FILMS**  
Compliant, Nanoscale Free-Standing Multilayer Films – 66  
Final Project Report for Terahertz Spectroscopy of Complex Matter – 106  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92  
Infrared and Electrical Properties of Amorphous Sputtered (LaxA1-x)2O3 films – 63  
Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – 211  
Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127  
Substrate/Oxide Interface Interaction in LaAlO3/Si Structures – 96  
Symposium Q: Magnetic Thin Films, Heterostructures, and Device Materials – 197
- THIOLS**  
Crosslinked Compounds and Methods of Making and Using Thereof – 72
- THREAT EVALUATION**  
Sharing the Dragon's Teeth: Terrorist Groups and the Exchange of New Technologies – 643  
Tsunami Risk Reduction for the USA: A Framework for Action – 264
- THREE DIMENSIONAL FLOW**  
IHPRT Improvements to the Solid Performance Program (SPP) – 542
- THREE DIMENSIONAL MODELS**  
Different Approaches for the Creation and Exploitation of 3D Urban Models – 159  
Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development – 371

## THROMBOSIS

Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389

## THRUST VECTOR CONTROL

Technologies for Propelled Hypersonic Flight, Volume 1 - Subgroup 1: Plug Nozzles – 40

## THYRISTORS

Solid State Capacitor Discharge Pulsed Power Supply Design for Railguns – 193

## TIBIA

Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287

Leg Muscle Usage Effects on Tibial Elasticity during Running – 295

## TIDES

Observation of Tidal Effects on LWIR Radiance Above the Mesopause – 262

## TILES

Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58

## TILT ROTOR AIRCRAFT

V-22 Osprey Tilt-Rotor Aircraft – 17

## TIME DEPENDENCE

Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460

IEIST Technologies Enabling TCT Prosecution – 538

Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457

Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122

Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91

## TIME DIVISION MULTIPLE ACCESS

A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – 190

## TIME LAG

Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509

## TIME MEASUREMENT

Dynamic Across-Time Measurement Interpretation: Maintaining Qualitative Understandings of Physical System Behavior – 501

Fermi Timing and Synchronization System – 605

## TIME SERIES ANALYSIS

A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 516

## TIME SYNCHRONIZATION

Time Synchronization in Wireless Sensor Networks – 164

## TIME

Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224

Theory and Applications of Computational Time-Reversal Imaging – 516

## TIRES

Estimating Runflat Stiffness – 552

Preliminary Findings from Noise Testing on PFC Pavements in Texas – 260

## TISSUE CULTURING

Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381

## TISSUE ENGINEERING

Tissue Engineering Research – 307

## TISSUES (BIOLOGY)

Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381

Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597

Ultrasound Phased Arrays – 208

## TITANIUM ALLOYS

Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44

Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion – 116

Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99

Titanium Brazing for Structures and Survivability – 120

## TITANIUM ALUMINIDES

Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint) – 92

## TITANIUM

Double Near-Net Forging of Article – 41

Titanium Brazing for Structures and Survivability – 120

## TOBACCO

Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption – 337

What's in a Name. Examination of Light and Intermittent Smokers. Helping to Set the Tobacco Control Research Agenda. – 257

## TOKAMAK DEVICES

Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 604

Summary Report--FY2006 ITER Work Accomplished – 575

Visible and Infrared Optical Design for the ITER Upper Ports – 599

## TOLERANCES (MECHANICS)

Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31

Prognostic Fusion for Uncertainty Reduction – 35

## TOMOGRAPHY

CCG-LCONE CT Reconstruction Code User and Programmers Guide – 571

Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376

Exploiting Adaptive Optics with Deformable Secondary Mirrors – 231

Three-Dimensional near Infrared Imaging of Pathophysiological Changes within the Breast – 363

## TOPOLOGY

Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – 196

Application of Morse Theory to Analysis of Rayleigh Taylor Topology – 569

Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – 448

Multicast Performance Analysis for High-Speed Torus Networks – 484

Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448

Real-Time Communication and Coordination in Embedded Sensor Networks – 533

Time varying Reeb Graphs. A Topological Framework Supporting the Analysis of Continuous Time varying Data – 438

Time-Base Tree Graphs for Stabilized Force Structure Representations – 539

Topological Close Packing in Structurally Complex Intermetallics (Crystalline, Quasicrystalline and Noncrystalline) – 116

Topology of On/Off Marx Modulator with Protection of Load and Solid State Switches – 579

## TORUSES

Multicast Performance Analysis for High-Speed Torus Networks – 485

Recent Physics Results from NSTX – 571

## **TOUCH**

The Tactile Modality: A Review of Tactile Sensitivity and Human Tactile Interfaces – 423

## **TOUGHNESS**

Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 122

## **TOXIC HAZARDS**

Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model – 375

U.S. Army Toxic and Hazardous Materials Agency Quality Assurance Program – 93

## **TOXICITY**

A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 113

Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – 372

Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – 417

Evaluation of Daphnia Magna Neonate Viability under Low Temperature Exposure Conditions – 310

Long-Term Outcomes of Alternative Brachytherapy Techniques for Early Prostate Cancer – 294

Mechanisms of Alpha-synuclein Aggregation and Toxicity – 330

Mechanisms of p53-Mediated Apoptosis – 350

Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78

Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – 256

Pulmonary Toxicity of Cholinesterase Inhibitors – 382

Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

U.S. Army Toxic and Hazardous Materials Agency Quality Assurance Program – 93

## **TOXINS AND ANTITOXINS**

Discovery of Therapeutics for Ricin Toxicosis – 300

Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403

Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353

Intracellular Survival of Campylobacter jejuni in Human Monocytic Cells and Induction of Apoptotic Death by Cytholethal Distending Toxin – 394

Process Research and Development of Antibodies as Countermeasures for C. Botulinum – 308

Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379

Structural Studies on Intact Clostridium Botulinum Neurotoxins Complexed with Inhibitors Leading to Drug Design – 304

Structural Studies on Toxins and Virulence Factors of Yersinia Pestis – 284

## **TRACKING (POSITION)**

A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37

Advanced Target Tracking Techniques – 175

Tracking and Data Fusion Applications – 177

## **TRACKING RADAR**

Bi- and Multistatic Radar – 176

## **TRADEOFFS**

Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592

## **TRAFFIC**

An Efficient Metaheuristic for Dynamic Network Design and Message Routing – 617

Analysis and Classification of Traffic in Wireless Sensor Network – 159

Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178

Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183

Research Plan for Measuring Noise Levels in Highway Pavements in Texas – 259

The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515

## **TRAINING DEVICES**

The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 9

## **TRAJECTORIES**

A Comparison of Trajectory Determination Approaches for Small UAVs – 11

Advances in Modeling and Simulation Capabilities for Predicting Store Trajectories - Past Success and Future Challenges – 5

Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – 47

Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems – 2

Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48

Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – 21

Sonic Boom Assessment for the Crew Exploration Vehicle – 56

## **TRAJECTORY OPTIMIZATION**

A Distributed Approach for Multi-Constrained Path Selection and Routing Optimization – 640

## **TRAJECTORY PLANNING**

Path Planning Software and Graphics Interface for an Autonomous Vehicle, Accounting for Terrain Features – 480

## **TRANSDUCERS**

Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186

Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 23

Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254

## **TRANSFER FUNCTIONS**

A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 516

## **TRANSFER OF TRAINING**

Incorporating New Technology to Create a Comprehensive Realistic Training Environment for the 91W – 344

## **TRANSFERRING**

Protein Transduction Based Therapies for Breast Cancer – 315

## **TRANSFUSION**

Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

## **TRANSISTORS**

Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters – 113

Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186

## TRANSITION FLIGHT

Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 44

## TRANSLATING

Translational Research from an Informatics Perspective – 416

## TRANSMISSIONS (MACHINE ELEMENTS)

High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction – 35

## TRANSMITTER RECEIVERS

Bi- and Multistatic Radar – 176

Software Communications Architecture (SCA) Compliant Software Defined Radio Design for Interim Standard 95B (IS-95B) Transceiver – 463

T/R Module for Satellite TT&C Ground Link – 200

## TRANSMITTERS

Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters – 113

## TRANSPLANTATION

Proof of Concept for Systematic Collection of Optimal Molecular Quality Anatomically Oriented Normal Prostate from Diverse Age and Race Transplant Donors – 326

Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305

## RESPONDERS

Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement – 181

## TRANSPORT AIRCRAFT

Civil Reserve Air Fleet (CRAF) – 26

Flexible Precision: Air Force's Answer to Army Transformation and Intratheater Airlift on the 21st Century Battlefield – 14

Investigation of the Effect of Fuselage Dents on Compressive Failure Load – 23

Strategic Airlift Modernization: Background, Issues and Options – 14

## TRANSPORT THEORY

Organic Light-Emitting Diodes and Related Hole Transport Compounds – 208

## TRANSPORTATION NETWORKS

Impacts of Traveler Information on Transportation Network Operations and Potential Deployment Technologies – 178

## TRANSPORTATION

Annual Transportation Report for Radioactive Waste Shipments to and from the Nevada Test Site. (Fiscal Year 2006) – 131

Defense Transportation. DOD Needs a Comprehensive Approach to Planning for Implementing Its New Personal Property Program – 659

Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183

Human Error Investigation Software Tool (HEIST) – 427

Reducing the 'Gap of Pain': A Strategy for Optimizing Federal Resource Availability in Response to Major Incidents – 526

Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – 276

Testing for Compliance to NTCIP Standards – 428

Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers – 476

## TRANSVERSE MOMENTUM

Inclusive high-p(T)b anti-b Cross Section Measurement at  $s^{**} (1/2)$  Equals 1.96 TeV – 560

## TRAYS

Development of Nanocomposite Reinforced Polymeric Materials to be Used for Racks for Retorting Polymeric Trays – 123

Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54

Retort Racks for Polymeric Trays in 1400 Style Spray Retorts – 518

## TRICHLOROETHYLENE

Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321

Quarterly Groundwater Monitoring First Quarter Sampling Results fort Dix, New Jersey – 61

## TRISONIC WIND TUNNELS

Shakedown & Determination of Tunnel Control Settings for Refurbished Trisonic Gasdynamic Facility (TGF) – 134

## TRITIUM

Feasibility of Measuring  $^3\text{He}$  Bubble Diameter Populations in Deuterium-Tritium Ice Layers Using Mie Scattering – 573

## TROPICAL REGIONS

A Weighted Consensus Approach to Tropical Cyclone 96-H and 120-H Track Forecasting – 269

## TROPICAL STORMS

A Weighted Consensus Approach to Tropical Cyclone 96-H and 120-H Track Forecasting – 269

Downstream Impacts Due to the Extratropical Transition of Tropical Cyclones Over the Western North Pacific – 267

## TRUCKS

Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 256

Truck Driver Occupational Safety and Health. 2003 Conference Report and Selective Literature Review – 238

## TRYPTOPHAN

IDO Inhibitors for Combination Therapy of Prostate Cancer – 318

## TSUNAMI WAVES

Tsunami Risk Reduction for the USA: A Framework for Action – 264

## TUBERCULOSIS

Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – 398

## TUMOR SUPPRESSOR PROTEINS

Novel Molecular Interactions and Biological Functions of the Neurofibromatosis 2 Tumor Suppressor Protein, Merlin – 328

## TUMORS

A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358

Apoptosis and Tumor Progression in Prostate Cancer – 338

Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells – 303

Characterization of the Role of Breast Tumor Kinase (BRK) in Breast Cancer Cells Non-responsive to EGFR-targeted Agents – 329

Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Development of an Automated Modality-Independent Elastographic Image Analysis System for Tumor Screening – 357

Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340

Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381

Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum – 357

Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor – 281

HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate – 290

Identification of Sonic Hedgehog-Induced Stromal Factors That Stimulate Prostate Tumor Growth – 295

Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – 301

Interactions between Dietary Factors and Inflammation in Prostate Carcinogenesis – 349

Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351

Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287

Mechanism of Tumor Metastasis Suppression by the KA11 Gene – 318

Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy – 363

Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemo-Resistance - Potential Mechanism of PIM Action – 282

Regulation of Apoptosis by AFG3L2, a Potential Oncogene – 293

Studies of Prostate Tumor Development Via CRE/LOXP Technology – 309

The Opposing Roles of Nucleophosmin and the ARF Tumor Suppressor in Breast Cancer – 283

The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis – 322

## **TUNGSTEN ALLOYS**

Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 115

## **TUNGSTEN**

Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69

Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107

Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114

## **TURBINE BLADES**

Tip Clearance Control Using Plasma Actuators – 16

## **TURBINE ENGINES**

3-Dimensional Crack Growth Behavior of Turbine Engine Materials (Preprint) – 555

A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – 550

An Integrated Approach to Conversion, Verification, Validation and Integrity of AFRL Generic Engine Model and Simulation (Postprint) – 6

Cooled Turbine Airfoil – 42

Fuel Property Effects on T700 Exhaust Particulates – 132

## **TURBINES**

Cooled Turbine Airfoil – 42

The Effects of Wind Turbine Farms on Air Defence Radars – 22

The Effects of Wind Turbine Farms on ATC Radar – 134

## **TURBOMACHINERY**

Tip Clearance Control Using Plasma Actuators – 16

Turbulence and Complex Flow Phenomena in Multi-Stage Axial Turbomachines – 582

## **TURBOSHAFTS**

Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – 39

## **TURBULENCE**

Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing – 568

Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 603

Gravity-Wave Dynamics in the Atmosphere – 264

High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77

Hypothesis of the Magnetostatic Turbulence and its Implications for Astrophysics – 671

The Role of Continuity in Residual-Based Variational Multiscale Modeling of Turbulence – 514

Turbulence and Complex Flow Phenomena in Multi-Stage Axial Turbomachines – 582

## **TURBULENT FLOW**

Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 44

Experimental Characterization of Turbulent Flow Around Cylinder Arrays – 219

Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling – 220

## **TURBULENT JETS**

Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling – 220

## **TURBULENT MIXING**

High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77

## **TURTLES**

Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250

## **TWO DIMENSIONAL FLOW**

Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing – 36

## **TYPHOONS**

Downstream Impacts Due to the Extratropical Transition of Tropical Cyclones Over the Western North Pacific – 267

## **TYPHUS**

Cloning and Sequence Analysis of the 22-kDa Antigen Genes of *Orientia tsutsugamushi* Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – 399

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399

## **TYROSINE**

Characterization of the Role of Breast Tumor Kinase (BRK) in Breast Cancer Cells Non-responsive to EGFR-targeted Agents – 329

DRF3 as a Cholesterol-Dependent Regulator of Src in Prostate Cancer – 315

The Impact of Tyrosine Kinase Signaling on Breast Cancer Development – 289

## **UKRAINE**

Ukraine's Search for its Place in Europe: The East or the West? – 548

## **ULLAGE**

A Review of the History of Fire Suppression on U.S. DoD Aircraft – 34

## **ULTRASONIC TESTS**

Structural Diagnostics of CFRP Composite Aircraft Components by Ultrasonic Guided Waves and Built-In Piezoelectric Transducers – 35

## **ULTRASONIC WAVE TRANSDUCERS**

Ultrasound Phased Arrays – 208

## ULTRASONICS

Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 225

Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391

Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – 391

High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350

Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360

Ultrasound Phased Arrays – 208

## ULTRAVIOLET LASERS

Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230

## ULTRAVIOLET RADIATION

Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – 669

## UNCERTAIN SYSTEMS

Systematic Procedure for Assigning Uncertainties to Data Evaluations – 568

## UNDERGROUND STORAGE

Survey of Underground Storage Tanks and Other Subsurface Structures at the Umatilla Depot Activity, Hermiston, Oregon – 239

## UNDERGROUND STRUCTURES

Survey of Underground Storage Tanks and Other Subsurface Structures at the Umatilla Depot Activity, Hermiston, Oregon – 239

## UNDERWATER ACOUSTICS

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 589

Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587

Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model – 514

## UNDERWATER VEHICLES

Center for Coastline Security Technology, Year-2 – 229

Characterization of VSW Environment for UUV-N Operations – 214

Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – 505

Simulating Candidate Missions for a Novel Glider Unmanned Underwater Vehicle – 464

Velocity Estimation Using Forward Looking Sonar – 463

## UNITED KINGDOM

Elicitation of British Army Commanders' Personal Constructs – 621

## UNITED NATIONS

Iran's Nuclear Program: Recent Developments – 594

## UNITED STATES

A Comparative Assessment of Knowledge Management Education Across the USA Department of Defense – 636

Access to Government Information in the USA – 650

Agriculture: The Potential Consequences of Climate Variability and Change for the USA – 277

American Competitiveness Initiative: Leading the World in Innovation – 136

Analysis of Metrics Utilized in U.S. Joint Experimentation of Future C2 Concepts – 171

Analysis of USA' Broadband Policy – 491

Critical Infrastructure Information Disclosure and Homeland Security – 656

Emergency Preparedness and the Year 2000 Challenge – 443

History of Operations Research in the USA Army, Volume 1: 1942-1962 – 546

Libraries and the USA PATRIOT Act – 635

National Security Letters in Foreign Intelligence Investigations: A Glimpse of the Legal Background and Recent Amendments – 633

National Security Letters in Foreign Intelligence Investigations: Legal Background and Recent Amendments – 634

Oil Vulnerabilities and USA Strategy – 241

Regaining the High Ground: The Challenges of Perception Management in National Strategy and Military Operations – 661

Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army – 282

Simulation-Based Learning: Workshops for Researchers and Educators in the Western USA, and the Pacific Rim – 619

The Chaos of Katrina – 267

The Supreme Court's Climate Change Decision: Massachusetts v. EPA – 263

USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling – 277

USNORTHCOM Integrated Architecture: A Means to an End – 494

'Sensitive But Unclassified' Information and Other Controls: Policy and Options for Scientific and Technical Information – 635

## UNIVERSAL TIME

Evolution of Time Scales – 666

## UNIVERSE

Predicting the Cosmological Constant from the Causal Entropic Principle – 671

## UNIVERSITIES

Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631

## UNMANNED GROUND VEHICLES

Establishment of a Center for Defense Robotics – 508

## UNSTRUCTURED GRIDS (MATHEMATICS)

Discrete Data Transfer Technique for Fluid-Structure Interaction – 478

Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – 437

Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – 430

## URACIL

Health Effects Support Document for Terbacil – 73

## URANIUM

A Multireference Density Functional Approach to the Calculation of the Excited States of Uranium Ions – 87

Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570

Far Field Approximation in the Generalized Geometry Holdup (GGH) Model – 581

Iran's Nuclear Program: Recent Developments – 594

Nuclear Safety: DOE's Investigation of Phosgene Gas Contamination was Inadequate, but Experts Conclude that Worker Safety and Facilities Are Not Threatened – 131

Theory of (3He alpha) Surrogate Reactions for Deformed Uranium Nuclei – 582

## URBAN RESEARCH

Different Approaches for the Creation and Exploitation of 3D Urban Models – 159

## URBAN TRANSPORTATION

Mobile Sensor Networks: A Discrete Event Simulation of WMD Threat Detection in Urban Traffic Schemes – 156

## URINE

ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer – 344

Murine Macrophages Kill the Vegetative Form of *Bacillus anthracis* – 394

Validation of Quantitative Multimodality Analysis of Telomerase Activity in Urine Cells as a Noninvasive Diagnostic and Prognostic Tool for Prostate Cancer – 366

## UROLOGY

ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer – 344

## URUGUAY

Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389

## USER MANUALS (COMPUTER PROGRAMS)

ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual – 469

National Solar Radiation Data Base 1991-2005 Update: User's Manual – 245

## USER REQUIREMENTS

Methodology for Rapid Development of C2 Planning Systems – 174

## V-22 AIRCRAFT

V-22 Osprey Tilt-Rotor Aircraft – 17

## VACCINES

Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 403

Cloning and Sequence Analysis of the 22-kDa Antigen Genes of *Orientia tsutsugamushi* Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – 399

Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331

Development of In Vitro Correlate Assays of Immunity to Infection with *Yersinia Pestis* – 327

Establishment of a Non-human Primate *Campylobacter* Disease Model for the Pre-clinical Evaluation of *Campylobacter* Vaccine Formulations – 396

HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397

HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated *Plasmodium falciparum* Malaria and Healthy Controls – 400

Identification, Cloning, Expression, and Characterization of the Gene for *Plasmodium knowlesi* Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389

Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – 301

Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353

Intra-Prostate Cancer Vaccine Inducer – 316

Protection Against Scrub Typhus by a Plasmid Vaccine Encoding the 56-KD Outer Membrane Protein Antigen Gene – 399

Protection with Recombinant *Clostridium botulinum* C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – 369

Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387

Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399

Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) *Francisella tularensis* Vaccination – 332

## VACUUM SYSTEMS

LCLS XTOD Tunnel Vacuum Transport System (XVTS) Final Design Report – 563

## VACUUM

Constraints on Meta-Stable de Sitter Flux Vacua – 579

Electrostatic Modeling of Vacuum Insulator Triple Junctions – 205

Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121

Tension-Compression Fatigue Behavior of a Carbon Fiber/Epoxy (IM7/EPON 862) Composite Fabricated Using Vacuum Assisted Resin Transfer Molding Process – 85

Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses – 203

## VALUE ENGINEERING

A Decision Model for Selecting Energy Efficient Technologies for Low-Sloping Roof Tops Using Value-Focused Thinking – 243

Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140

## VALVES

Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438

## VANADIUM ALLOYS

Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion – 117

## VANGUARD PROJECT

Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems – 2

## VAPOR DEPOSITION

Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 84

Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92

Novel Synthesis of Branched Carbon Nanotubes – 207

Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – 88

## VAPORS

Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 32

## VARIABILITY

Appraising Policies to Reduce Freight Transport Time and Its Variability-A New Method – 430

On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263

Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392

## VARIATIONS

Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224

## VECTOR ANALYSIS

Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 309

Eigenvector Analysis for Multipath – 549

Endothelial Progenitors as Vectors for Systemic Gene Therapy of Breast Cancer – 332

Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – 19

## VEGETATION

Murine Macrophages Kill the Vegetative Form of *Bacillus anthracis* – 395

## VEINS

Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379

## VELOCITY MEASUREMENT

Development of a 3-D Defocusing Liquid Crystal Particle Thermometry and Velocimetry (3DDLCP TV) System – 111

## VENTILATION

Solar Buildings. Transpired Air Collectors Ventilation Preheating – 250

## VENTS

Quality of Service Behavioral Model From Event Trace Analysis – 166

## VERBAL COMMUNICATION

Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459

## VERTICAL LANDING

Solutions Analysis for Helicopter Brown-out – 33

## VERTICAL ORIENTATION

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 227

## VERY LARGE SCALE INTEGRATION

Sharp-Looking Geometric Partitioning – 199

## VESTIBULES

Systems and Methods for Altering Vestibular Biology – 506

## VETERINARY MEDICINE

The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402

## VIABILITY

Evaluation of *Daphnia Magna* Neonate Viability under Low Temperature Exposure Conditions – 310

Hacking Social Networks: Examining the Viability of Using Computer Network Attack Against Social Networks – 491

## VIBRATION MODE

Micromechanical Resonator Device Having a Desired Mode Shape – 201

## VIBRATION

Experimental Methods to Characterize Nonlinear Vibration of Flapping Wing Micro Air Vehicles – 32

Molecular Volume and Electronic and Vibrational Polarizabilities for Amorphous LaAlO<sub>3</sub> – 86

Payload Isolation System for Launch Vehicles – 54

## VIDEO SIGNALS

Advanced Technologies in Safe and Efficient Operating Rooms – 333

Platform Camera Aircraft Detection for Approach Evaluation and Training – 29

Video Enabling the Combatant Commander's Headquarters – 48

## VIRAL DISEASES

Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394

## VIRTUAL REALITY

Advanced Technologies in Safe and Efficient Operating Rooms – 309

Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS) – 625

Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations – 640

The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164

## VIRULENCE

Proteomic Analysis of *Rickettsia prowazekii* – 396

Structural Studies on Toxins and Virulence Factors of *Yersinia Pestis* – 284

## VIRUSES

A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358

An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330

Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331

Cross-Serotype Neutralization of Dengue Virus in *Aotus nancymae* Monkeys – 387

Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321

Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378

Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378

HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397

Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351

Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale – 188

Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330

Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393

Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389

Smallpox Antiviral Drug – 285

## VISCOELASTICITY

Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81

## VISCOPLASTICITY

Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Test – 118

## VISIBILITY

Enhanced Aircraft Conspicuity to Reduce Runway Incursions – 13

## VISION

How Important is Oblique Vision in Aviation? – 597

## VISUAL AIDS

Video Enabling the Combatant Commander's Headquarters – 49

## VISUAL PERCEPTION

Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233

## VISUAL STIMULI

Ultra-fast Object Recognition from Few Spikes – 502

## VOICE COMMUNICATION

Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – 422

Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630

Towards a Computational Model of Sketching – 450

## VOLATILE ORGANIC COMPOUNDS

Extended Research on Detection of Deception Using Volatile Organic Compound (VOC) Emissions. Final Report – 425

Guidance for Estimating VOC and NO<sub>x</sub> Emission Changes from MACT Rules – 257

Novel Technology Evaluation for Volatile Organic Compounds Emission Control – 60



## VORTEX SHEDDING

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 227

## VORTICES

CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 227

Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling – 220

## VOTING

Collective Choice with Uncertain Domain Models – 535

## VULNERABILITY

Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631

Homeland Security -- Reducing the Vulnerability of Public and Private Information Infrastructures to Terrorism: An Overview – 493

Homeland Security Act of 2002: Critical Infrastructure Information Act – 639

Oil Vulnerabilities and USA Strategy – 241

Potential System Vulnerabilities of a Network Enabled Force – 487

Vulnerabilities in Biometric Encryption Systems – 473

## WAFERS

An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 223

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222

Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54

## WALLS

Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors – 216

Multi-Wall Carbon Nanotubes for Flow-Induced Voltage Generation (Preprint) – 95

Numerical Analysis of Chamber Wall Heat Transfer in a GH2/GO2 Sub-Scale Combustor – 98

Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – 225

Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions – 265

The Interactive DataWall – 209

Through-the-Wall Imaging from Electromagnetic Scattered Field Measurements – 553

## WAR GAMES

New Navy Solutions: Developing Simulation Based C4I Applications – 445

Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489

Using Wargames for Command and Control Experimentation – 145

## WARFARE

A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492

A Model of Command and Control Processes for JWARS: Test Results from Controlled Experiments and Simulation Runs – 151

A Model of Tactical Battle Rhythm – 170

A Reference Architecture for Network-Centric Information Systems – 619

A Woven Web of Guesses – 538

An Agent-Based Dynamic Information Security Model in Information Warfare – 643

An Analysis of Small Navy Tactics Using a Modified Hughes' Salvo Model – 541

An Efficient Metaheuristic for Dynamic Network Design and Message Routing – 617

Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations – 284

Bio-Defense Now: 56 Suggestions for Immediate Improvements – 427

Building a Deterrence Policy Against Strategic Information Warfare – 654

Building Information Systems for Network-Centric Warfare – 615

Can GWOT Primary Prevention Strategy More Effectively Impede Religious Extremism? – 390

Combined Enterprise Regional Information Exchange System (CENTRIXS): Supporting Coalition Warfare World-Wide – 486

Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627

Dominating Cyberspace – 660

Effects of the Global War on Terror on Medical Service Corps Retention Rates – 311

Evaluation of Organisational Interoperability in a Network Centric Warfare Environment – 146

Evolution of a Mission Plan – 646

Federally Sponsored Health Care Research Gulf War Illnesses and Beyond – 400

From Stove-pipe to Network Centric Leveraging Technology to Present a Unified View – 616

From the Battlefield to the Homeland: Building the Case for Network-Centric Response – 636

Human Systems Integration Assessment of Network Centric Command and Control – 421

HUMINT Communication Information Systems for Complex Warfare – 642

Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues – 618

Intelligent Agent-Based Software Architecture for Tactical Decision Aid under Overwhelming Information Inflow and Uncertainty – 502

Intelligent Nodes in Coalition Warfare – 630

Issues and Requirements for Cybersecurity in Network Centric Warfare – 446

Joint and Allied Logistics Opportunities and Tools Supporting 21st Century War Fighter Rapid Decisive Operations – 149

Knowledge Management in an Information Age Army – 547

Lessons Learned from War Room Designs and Implementations – 628

Lethality and Autonomous Robots: An Ethical Stance – 504

Lightweight and Advanced Materials for Defense: Materials for Military Ground Vehicles – 85

Modeling and Simulation in Support of Network Centric Warfare Analysis – 143

Modelling a Network of Decision Makers – 610

Modelling Information Age Warfare: Work In Progress – 654

Multinational C2 Experiments Supported by C2 Systems and Modeling and Simulations Addressing Army Transformation of Collaborative Planning and Interoperable Execution in a Coalition Environment – 615

Net-Centric Test & Evaluation – 133

Network Centric Operations: Background and Oversight Issues for Congress – 486

Network Centric Warfare for Coalition Integrated Defense Against Terrorism – 165

Network Centric Warfare in the U.S. Navy's Fifth Fleet. Network-Supported Operational Level Command and Control in Operation Enduring Freedom – 143

Network-Centric Applications and Tactical Networks – 173

Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350

Operational Trust: A New Look at the Human Requirement in Network Centric Warfare – 146

Optimising the Design of Land Force C2 Architectures – 152

Patterns of War Termination: A Statistical Approach – 528

Post Traumatic Stress Disorder: The Facts – 369

Realistic and Affordable Cyberware Opponents for the Information Warfare Battlespace – 537

Regaining the High Ground: The Challenges of Perception Management in National Strategy and Military Operations – 661

Russian and Chinese Information Warfare: Theory and Practice – 628

Stochastic Lanchester Air-To-Air Campaign Model: Methods Used to Generate Model Outputs and a User's Guide: 2007 – 527

The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – 625

The Challenge of New and Emerging Information Operations – 649

Toward an Interoperability Architecture – 646

Towards Dominant Battlespace Comprehension in Network Centric Warfare – 549

Towards the Development of a Defensive Cyber Damage and Mission Impact Methodology – 641

Transforming Coalition Warfare with Network Centric Capabilities – 149

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

Winning the Battle of Ideas in the War on Terrorism – 181

## **WARNING SYSTEMS**

Capacity Building and Sustainment: Focusing on the End-State for Homeland Security – 503

Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash – 580

Evaluation of High Density Surface Observations in Complex Terrain and Their Contribution to the MM5 Model – 268

Making Network Intrusion Detection Work With IPsec – 505

Multimodal Biometric Systems – 472

Tsunami Risk Reduction for the USA: A Framework for Action – 264

Usability and Acceptability of Biometric Security Systems – 473

Wireless Intrusion Detection – 483

## **WASPALOY**

The Effect of As-Large-As (ALA) Grains on the High-Temperature Fatigue Life of Waspaloy – 117

## **WASTE DISPOSAL**

Technical Work Plan for: Near-Field Environment: Engineered Barrier System: Radionuclide Transport Abstraction Model Report – 253

## **WASTE WATER**

Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture – 93

## **WATER COLOR**

BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 280

## **WATER FLOW**

A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California – 222

## **WATER POLLUTION**

Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321

Electronically Induced Redox Barriers for Treatment of Groundwater – 198

Health Effects Support Document for Terbacil – 73

Quarterly Groundwater Monitoring First Quarter Sampling Results fort Dix, New Jersey – 61

Trial Burn Plan for a Transportable Incineration System (TIS) at the Savanna Army Depot Activity (SADA) Washout Lagoon Area – 252

## **WATER QUALITY**

Evaluation of Daphnia Magna Neonate Viability under Low Temperature Exposure Conditions – 310

## **WATER WAVES**

A Geometric Investigation of Acoustical Wavefront Scattering and Healing Induced by Ocean Internal Waves – 588

Ocean Wave Energy Harvesting Devices – 479

## **WATERSHEDS**

A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California – 222

## **WATER**

Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – 138

Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – 138

Heat of Dilution Calculation for 19 Molar Sodium Hydroxide with Water for Use in 241-S-112 – 103

Quarterly Groundwater Monitoring First Quarter Sampling Results fort Dix, New Jersey – 61

Sinodal Decomposition and Order Disorder Transformation in a Water Quenched U-6wtNb Alloy – 70

## **WAVE ATTENUATION**

Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265

## **WAVE DISPERSION**

New Column Designs for MicroGC (Preprint) – 197

## **WAVE EQUATIONS**

Infra-Gravity Wave Input Toolbox (IGWT): User's Guide – 470

WABED Model in the SMS: Part 2. Graphical Interface – 470

## **WAVE FRONTS**

A Geometric Investigation of Acoustical Wavefront Scattering and Healing Induced by Ocean Internal Waves – 588

How Important is Oblique Vision in Aviation? – 596

Wave Front Sensor for Solar Concentrator Control – 52

Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 597

## **WAVE INTERACTION**

Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 225

## **WAVE PROPAGATION**

A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – 589

Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 224

Comparison of Thermodynamic Equilibrium and Non-Equilibrium Representation of Materials – 218

## **WAVEFORMS**

Characterization Of Commonly Encountered Explosives Using Highfield Asymmetric Waveform Ion Mobility Spectrometry Coupled With Mass Spectrometry – 594

## **WAVEGUIDES**

FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures – 29

Integrated Plasmon and Dielectric Waveguides – 587

- Nonclassical Properties of Pulsed Second-Subharmonic Generation in Photonic-Band-Gap Structures – 196
- WEAPON SYSTEMS**
- Advancing Software Security - The Software Protection Initiative – 626
  - Army Digitization Operational Impacts – 661
  - China's Anti-Satellite Weapon Test – 53
  - Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 21
  - Monitoring the Command and Control Weapon System. A Master Caution Panel for C2 System Monitoring – 154
  - Value Added Analysis - VAAFY03 – 532
- WEAR RESISTANCE**
- Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44
- WEAR**
- An Evaluation of High Velocity Wear – 142
  - In-Track Demonstration of Laser-Treated Rail to Reduce Friction and Wear – 74
- WEATHER FORECASTING**
- Implementation of the Immersed Boundary Method in the Weather Research and Forecasting Model – 275
- WEATHERING**
- Weathering the Storm. Leading Your Organization Through a Pandemic – 368
- WEB SERVICES**
- Towards Next Generation WWW: Push, Reuse and Classification – 614
- WEIGHTLESSNESS**
- Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 417
  - Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – 415
- WELLS**
- Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
  - Quarterly Groundwater Monitoring First Quarter Sampling Results fort Dix, New Jersey – 61
- WETTABILITY**
- Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89
- WETTING**
- Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89
- WIDE AREA NETWORKS**
- Coalition Operations with the Combined Enterprise Regional Information Exchange System (CENTRIXS) – 483
  - Distributed Computing and Collaboration Framework (DCCF) – 466
  - Route Optimization for Mobile IPV6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis – 489
  - Web Enabling HLA Compliant Simulations to Support Network Centric Applications – 444
- WIND DIRECTION**
- Aircraft Downwind Hazard Distance After a Chemical Attack – 34
  - Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – 19
- WIND EFFECTS**
- Further Evidence of the Effects of Wind Turbine Farms on AD Radar – 532
  - The Effects of Wind Turbine Farms on Air Defence Radars – 22
  - The Effects of Wind Turbine Farms on ATC Radar – 134
- WIND (METEOROLOGY)**
- The Effects of Wind Turbine Farms on Air Defence Radars – 23
  - The Forcing of 25-Knot Winds at Hickam and Andersen AFB – 270
  - Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – 19
- WIND TUNNEL MODELS**
- Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 4
- WIND TUNNEL TESTS**
- Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4
  - Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 3
  - Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing – 36
- WIND TUNNELS**
- Shakedown & Determination of Tunnel Control Settings for Refurbished Trisonic Gasdynamic Facility (TGF) – 134
- WIND TURBINES**
- Further Evidence of the Effects of Wind Turbine Farms on AD Radar – 532
  - The Effects of Wind Turbine Farms on Air Defence Radars – 22
  - The Effects of Wind Turbine Farms on ATC Radar – 134
- WIND VELOCITY**
- Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – 19
- WINDPOWER UTILIZATION**
- The Effects of Wind Turbine Farms on ATC Radar – 134
- WING LOADING**
- Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing – 36
- WINGS**
- Experimental Methods to Characterize Nonlinear Vibration of Flapping Wing Micro Air Vehicles – 32
- WINTER**
- Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270
  - On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263
  - Summary of the Study of E85 Fuel in the USA, Winter 2006-2007 – 257
- WIRELESS COMMUNICATION**
- A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492
  - Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183
  - Network Aware Tactical Collaborative Environments – 165
  - Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement – 181
  - Time Synchronization in Wireless Sensor Networks – 164
  - Wireless Intrusion Detection – 483
- WIRE**
- Superlattice Nanopatterning of Wires and Complex Patterns – 207
- WOOD**
- Use of Saltcedar and Utah Juniper as Fillers in Wood-Plastic Composites – 83
- WORKLOADS (PSYCHOPHYSIOLOGY)**
- Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – 422
  - Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel – 424
  - Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 460
  - Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability – 33
  - When Do Organizations Need to Change (Part II)? Incongruence in Action – 140

Workload, Stress, and Situation Awareness of Soldiers Who are Controlling Unmanned Vehicles in Future Urban Operations – 408

#### WOUND HEALING

Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383

Molecular Mechanisms of Soft Tissue Regeneration and Bone Formation in Mice: Implications in Fracture Repair and Wound Healing in Humans – 298

#### X RAY ABSORPTION

X-Ray Absorption Edge Detector for High-Resolution Measurement of Undulator Effective K-Parameter – 578

#### X RAY DIFFRACTION

X ray Diffraction Techniques for Structural Determination of Amorphous Materials – 70

#### X RAY IMAGERY

High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 557

Model Based Statistical Estimation of Sandia RF Ohmic Switch Dynamic Operation from Stroboscopic X-ray Imaging – 207

Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – 601

#### X RAY LASERS

High Efficiency Grazing Incidence Pumped X ray Laser – 601

Injector Test Facility for the LCLS. Executive Summary – 566

Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry – 603

Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601

#### X RAY SCATTERING

Changes in Delta-Plutonium Due to Self-Irradiation Aging Observed by Continuous In-Situ X-ray Scattering – 120

#### X RAY SOURCES

High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – 557

Nuclear Photo-Science and Applications with T-Rex Sources – 562

#### X RAYS

Bisphosphonate-Based Contrast Agents for Radiological Imaging of Microcalcifications – 362

Flash X-ray (FXR) Linear Induction Accelerator(LIA) Optimization Upgrade of the OTR Emittance Diagnostic – 575

High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133

LCLS XTOD Tunnel Vacuum Transport System (XVTS) Final Design Report – 563

Nuclear Photo-Science and Applications with T-Rex Sources – 562

Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601

Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – 601

X-Ray Dose in Microfocus Radiographic Inspections – 137

#### XENON ISOTOPES

Searching for Double Beta Decay with the Enriched Xenon Observatory – 566

#### XENON

Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – 582

Searching for Double Beta Decay with the Enriched Xenon Observatory – 566

#### YAG LASERS

Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383

#### YEAST

Microbial Dynamics during Barley Tempeh Fermentation – 104

#### YIELD POINT

Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP<sub>2</sub> – 234

#### YOUTH

How the Car Affects the Activity patterns of Children and Youth – 170

#### YTTRIA-STABILIZED ZIRCONIA

Impedance Analysis of Electrochemical NO<sub>x</sub> Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247

#### YTTRIUM OXIDES

Impedance Analysis of Electrochemical NO<sub>x</sub> Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247

#### YTTRIUM-ALUMINUM GARNET

Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383

#### YTTRIUM

Corrosion Resistance of Structural Amorphous Metal – 105

Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe<sub>48</sub>Mo<sub>14</sub>Cr<sub>15</sub>Y<sub>2</sub>C<sub>15</sub>B<sub>6</sub> and W-Containing Variants – 69

Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe<sub>48</sub>Mo<sub>14</sub>Cr<sub>15</sub>Y<sub>2</sub>C<sub>15</sub>B<sub>6</sub> and Variants – 107

#### ZEOLITES

Mesostructured Zeolitic Materials, and Methods of Making and Using the Same – 77

#### ZINC OXIDES

Surface-Templated Assembly for Mass-Production of ZnO Nanowire-Based Integrated Devices – 90

#### ZINC

Cadmium, Zinc, and Selenium Levels in Carcinoma of the Human Prostate – 356

Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP<sub>2</sub> – 233

Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106

#### ZIRCONIUM OXIDES

Impedance Analysis of Electrochemical NO<sub>x</sub> Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247

Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65

# Personal Author Index

## Aarhold, Eldar

Information Grid in Support of Crisis Management – [625](#)

## Abbel-Mageed, Asim B

Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes – [341](#)

## Abdelhamid, Elkadhi

Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – [457](#)

## Abdel-Hamid, M

Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – [308](#)

## Abdel-Messih, Ibrahim

Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – [379](#)

## Abdelzaher, Tarek F

QoS Negotiation in Real-Time Systems and its Application to Automated Flight Control – [43](#)

Real-Time Communication and Coordination in Embedded Sensor Networks – [533](#)

User-Level QoS-Adaptive Resource Management in Server End-Systems – [485](#)

## Abdollahian, Mark A

Forecasting Complex Political and Military Events: The Application of Expected Utility to Crisis Situations – [653](#)

## Aboona, Jonathan

M1114 -- Golden HMMWV Power: Electrical Systems Used in Theater – [192](#)

## Abramson, Myriam

Cooperative Multi-Agent Systems in Mobile Ad Hoc Networks – [495](#)

Multi-Agent Systems in Mobile Ad hoc Networks – [626](#)

Training Coordination Proxy Agents – [616](#)

## Abrens, M. J.

Perylene N-Type Semiconductors and Related Devices – [205](#)

## Abu-Elyazeed, Remon

Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – [379](#)

## Abuhantash, Medhat A

From Stove-pipe to Network Centric Leveraging Technology to Present a Unified View – [616](#)

## Abu-Safe, H. H.

Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – [604](#)

## Adam, Gina E

Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model – [375](#)

## Adamo, Ron

Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – [471](#)

## Adamovicz, J J

Development of In Vitro Correlate Assays of Immunity to Infection with Yersinia Pestis – [327](#)

## Adams, A G

Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint) – [92](#)

## Adams, Barry D

Integrating the Department of Defense Military Services' Technology Development Programs to Improve Time, Cost, and Technical Quality Parameters – [135](#)

## Adams, Darrell

BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – [279](#)

## Adams, Martin

The Right Information....and Intelligent Nodes – [456](#)

## Adams, Nikki

The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – [193](#)

## Adams, W W

Synthesis, Structure, and Properties of PBO/SWNT Composites – [104](#)

## Adams, Wade

Strategic Partnership for Research in Nanotechnology – [210](#)

## Adhami, Vaqar M

Association between Microtubule Associated Protein -2 and the EGRF Signaling in Breast Cancer – [296](#)

## Adkins, Angela L

Effects of Sarin on the Operant Behavior of Guinea Pigs – [382](#)

## Adkins, Mark

Network Centric Warfare in the U.S. Navy's Fifth Fleet. Network-Supported Operational Level Command and Control in Operation Enduring Freedom – [143](#)

## Adler, Andy

Vulnerabilities in Biometric Encryption Systems – [473](#)

## Adler, Howard L

Validation of Quantitative Multimodality Analysis of Telomerase Activity in Urine Cells as a Noninvasive Diagnostic and Prognostic Tool for Prostate Cancer – [366](#)

## Adler, Michael

Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – [373](#)

Pulmonary Toxicity of Cholinesterase Inhibitors – [382](#)

## Adler, Richard W

Signal Population in the License-Exempt Wireless-Radio Bands at the MOUT Site – [152](#)

The Mitigation of Radio Noise from External Sources at Receiving Sites – [163](#)

## Admire, John H

Transforming Coalition Warfare with Network Centric Capabilities – [149](#)

## Adolphsen, C.

Variable Directional Coupler for an Alternate ILC High-Power RF Distribution Scheme – [605](#)

## Adsit, Phillip

A Modular, Scalable, Architecture for Unmanned Vehicles – [547](#)

## Afaq, Farrukh

Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer – [320](#)

## Aftanas, Jason M

Optimizing the Prioritization of Natural Disaster Recovery Projects – [274](#)

## Agarwal, A. S.

Modeling the Effects of Crevice Former, Particulates, and the Evolving Surface Profile In Crevice Corrosion – [119](#)

## Agarwal, Anant

A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – [184](#)

PCA RAW FABRIC: Architectural Prototyping, Demonstration and Evaluation – [462](#)

## Agee, Forest

The Basic Research Manager for the Air Force – [211](#)

## Agrawal, Krishna C

Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes – [341](#)

## Aguayo, Nicolas

Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – [393](#)

- Aguiar, Joao C**  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404
- Agvaanluvsan, U.**  
Progress on the Europium Neutron-Capture Study Using DANCE – 673
- Ahearn, Marie P**  
Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426
- Ahearn, Marie**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631
- Ahlers, Stephen**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395
- Ahmad, J**  
Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122  
Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91
- Ahmed, Mansoor M**  
Radio-sensitizing Effects of Novel Histone De-Acetylase Inhibitors in Prostate Cancer – 283
- Aitichou, Mohamed**  
Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331
- Akar, Ali O**  
Characteristics and Use of a Parametric End-Fired Array for Acoustics in Air – 224
- Akin, Ahmet**  
First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005 – 9  
Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – 419
- Akkerman, I**  
The Role of Continuity in Residual-Based Variational Multiscale Modeling of Turbulence – 514
- Aksomboon, Ajchara**  
Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 396
- Akylas, Triantaphyllos R**  
Gravity-Wave Dynamics in the Atmosphere – 264
- Alam, Hasan B**  
Far Forward Treatment of Hemorrhagic Shock – 378
- Alama, Uzma**  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404
- Alatishe, Jimmy O**  
RF Design for Tactical Ultra-Light Unmanned Aerial Vehicle Radar System – 27
- Alberts, Christopher**  
Executive Overview of SEI MOSAIC: Managing for Success Using a Risk-Based Approach – 545
- Albery, William B**  
Development of Multisensory Orientation Technology for Reducing Spatial Disorientation Mishaps – 6
- Aldaijy, Ayad Y**  
An Empirical Assessment of the Impact of Requirements Uncertainty on Development Quality Performance – 446
- Aldaijy, Emad Y**  
The Multidimensional Measurements of Geographic Information Systems (GIS) Effectiveness in Crisis Management – 611
- Aldrin, John C**  
The Joy of Computing with Volume-Integrals – 19
- Alexander, Donald J**  
Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear – 80
- Alexander, S.**  
Gravi-Leptogenesis: Leptogenesis from Gravity Waves in Pseudo-Scalar Driven Inflation Models – 673
- Alferiev, I.**  
Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof – 72
- Ali, Asma T**  
Re-Use of Integrated Dictionary Components for C4ISR Architectures – 148
- Ali, Irena M**  
Yet Another Role for Team Building and Work Motivation -Enabler of Knowledge Creation and Knowledge Sharing – 457
- Allan, Catherine**  
Security Strategy for a Biometrics Deployment – 474
- Allard, Yannick**  
Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – 631
- Allbeck, Jan M**  
Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS) – 625
- Allbritton, N.**  
Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72
- Allen, Edward D**  
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77
- Allen, J C**  
A Pareto Approach to Lossy Matching – 203
- Allen, J. C.**  
Assessing Error in PMI (Post-Mortem Interval) Prediction Using a Forensic Entomological Computer Model – 437
- Allen, Mark G**  
Microsystems Research in Japan – 191
- Allen, Steve**  
Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – 631
- Allen, Swati D**  
Integration of SATURN System and GIS – 530
- Allsopp, David**  
Software Agents as Facilitators of Coherent Coalition Operations – 459
- Allwine, K. J.**  
Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – 253
- Alonge, Jr, Frank A**  
High-Speed/-Hypersonic-Weapon-Development-Tool Integration – 22
- Alspaugh, Chris**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – 143
- Alter, Stephen**  
Shuttle Entry Imaging Using Infrared Thermography – 57
- Alter, Wendlyn**  
Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31
- Althouse, Edwin**  
A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – 189
- Alvarez, E.**  
Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.) – 126
- Alvarez, R. A.**  
Spatially Resolved Electromagnetic Property Measurement – 556
- Alverson, S.**  
Development and Implementation of Noise Analysis Standards for ACSA Airports – 255

- Aman, M J**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330
- Amarasinghe, Saman**  
PCA RAW FABRIC: Architectural Prototyping, Demonstration and Evaluation – 462
- Amaratunga, R**  
A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division – 20
- Amatucci, W E**  
On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – 551
- Amatucci, William E**  
Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates – 513
- Ambacher, Oliver**  
Pyroelectric AlGaIn/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 96
- Ambrosio, G.**  
Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558
- Ames, Gregory H**  
Thermally Compensated Fiber Bragg Grating Mount – 236
- Amin, Moeness G**  
Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224
- Amos, Craig**  
Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – 251
- Amundsen, Ruth M.**  
Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59
- An, E**  
Center for Coastline Security Technology, Year-2 – 228
- An, Yi Zhong**  
Molecular Structure Analysis of Aminophenyl Silsesquioxane (Preprint) – 97
- Anandakathir, Robinson**  
Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorencarbonyl Methano[60]Fullerene Pentaads – 87
- Ananthkrishnan, P**  
Center for Coastline Security Technology, Year-2 – 228
- Anaya, Elizabeth**  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404
- Andersen, Ellen M**  
Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386
- Anderson, Bonnie**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
- Anderson, D. G.**  
pH Triggerable Polymeric Particles – 66
- Anderson, D Z**  
Atomtronics: Ultracold Atom Analogs of Electronic Devices – 194
- Anderson, Dana R**  
Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110
- Anderson, John R**  
Learning Robustly From Instructions – 519
- Anderson, Ken**  
Privacy and Biometrics: The Human Factors – 477
- Anderson, Lee**  
Solutions Analysis for Helicopter Brownout – 33
- Anderson, Michael G**  
Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 223
- Anderson, Murray B**  
A Comparison of Trajectory Determination Approaches for Small UAVs – 11
- Anderson, Robert L**  
The Potential Impact of an Auction Based Retention Bonus and Other Factors on Continuation Rates of General Dentists Completing Their Initial Obligation – 525
- Anderson, S. R.**  
Code Verification Results of an LLNL ASC Code on Some Tri-Lab Verification Test Suite Problems – 562
- Anderson, S.**  
Nuclear Photo-Science and Applications with T-Rex Sources – 562
- Anderson, Wesly S**  
Design, Construction, and Validation of the AFIT Small Scale Combustion Facility and Sectional Model of the Ultra-Compact Combustor – 139
- Anderson, William**  
An Examination of a Structural Modeling Risk Probe Technique – 544
- Andersson, B.**  
Pilot Study: Parasitic and Passive Radar – 179
- Andersson, P.**  
Demonstratore Foer Stoerskydd av GNSS-Mottagare (Demonstrator for Anti-Jamming of GNSS Receivers) – 204
- Anderton, Gary L**  
Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – 45
- Andreev, N.**  
Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558
- Andrews, M L**  
Interaction of Intense Electron Beams with Plasma – 582
- Andrews, M.**  
Rayleigh Taylor Instability induced Mixing. Initial Conditions Modeling, Three Dimensional Simulations and Comparisons with Experiment – 570
- Aningsih, Erlin L**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Anisimov, Surgey**  
Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease – 343
- Annable, Michael D**  
Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD – 139
- Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – 138
- Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – 138
- Antao, Rohit S**  
Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478
- Antich, Peter P**  
Leg Muscle Usage Effects on Tibial Elasticity during Running – 295
- Antoine, C.**  
Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565
- Antoine, David**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Antonangeli, D.**  
Thermal Diffusivity and Conductivity Measurements in Diamond Anvil Cells – 561
- Apicelli, Anthony J**  
The Opposing Roles of Nucleophosmin and the ARF Tumor Suppressor in Breast Cancer – 283

- Apostoaie, A I**  
Screening Doses for Induction of Cancers Calculated With the Interactive Radio Epidemiological Program (IREP) – [306](#)
- Apostoaie, Julian A**  
Screening Doses for Induction of Cancers Calculated with the Interactive RadioEpidemiological Program (IREP) – [348](#)
- Appelt, Christopher**  
Operator Influence of Unexploded Ordnance Sensor Technologies – [227](#)
- Arakai, Dean**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – [193](#)
- Arambula, E.**  
Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – [74](#)  
System for the Evaluation of Moisture Damage Using Fundamental Material Properties – [74](#)
- Arceo, D**  
A Pareto Approach to Lossy Matching – [203](#)
- Ardelean, Emil**  
Chamber Core Structures for Firing Acoustic Mitigation – [50](#)
- Arevalo, Nicole**  
Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – [336](#)
- Arkani-Hamed, Sanaz**  
Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation – [365](#)
- Arkin, Ronald C**  
Lethality and Autonomous Robots: An Ethical Stance – [504](#)
- Armstrong, D.**  
AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – [254](#)
- Armstrong, David G**  
A Modular, Scalable, Architecture for Unmanned Vehicles – [547](#)
- Armstrong, N. R.**  
Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – [204](#)
- Armstrong, R B**  
Communications Architecture Recommendations to Enable Joint Vision 2020 – [488](#)
- Armstrong, Robert**  
Weathering the Storm. Leading Your Organization Through a Pandemic – [368](#)
- Arnaud, Francoise**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – [395](#)
- Arnaud, Francxoise**  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – [385](#)
- Arnold, Fred E**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – [104](#)
- Arreola, Manuel**  
Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – [314](#)
- Arrospeide, Nancy**  
Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – [380](#)
- Aruguete, D. M.**  
Structural Investigations of Surface and Orientation-Specific Phenomena in Nanocrystals and Their Assemblies – [203](#)
- Arvizo, Adrian**  
Field Level Computer Exploitation Package – [464](#)
- Asanovic, Krste**  
Victim Migration: Dynamically Adapting Between Private and Shared CMP Caches – [442](#)
- Asce, M.**  
Probabilistic Modeling of Space Shuttle Debris Impact – [58](#)
- Ashby, M. L. N.**  
All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets – [674](#)
- Asher, Ludmila**  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – [385](#)
- Asplund, C L**  
Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – [121](#)
- Asquith, W. H.**  
Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – [276](#)
- Atashbar, Massood**  
Early Detection of Prostate Cancer – [323](#)
- Atkins, Ella M**  
QoS Negotiation in Real-Time Systems and its Application to Automated Flight Control – [43](#)
- Atwood, Alice I**  
Development of Subscale Fast Cookoff Test – [134](#)
- Augustine, Thomas H**  
Framework for Information Age Assessment Metrics – [171](#)  
Information Age Architectures Must Be Enterprise Architecture – [171](#)
- Auguston, Mikhail**  
Experiments with the Sun Java Real-Time System -- Part 2 – [466](#)
- Aurass, H**  
Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – [669](#)
- Autermann, C.**  
Resonant Second Generation Slepton Production at the Tevatron – [586](#)
- Avila, Maria M**  
Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – [393](#)
- Awschalom, David D**  
Spin Electronics – [189](#)
- Aydinoi, M. K.**  
Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – [246](#)
- Ayers, C. W.**  
Motor Frame Cooling with Hot Liquid Refrigerant and Internal Liquid – [76](#)
- Aytug, T.**  
Superconductors on Iridium Substrates and Buffer Layers – [606](#)
- Azada, Abdu F**  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – [404](#)
- Baan, Andy**  
'COM as Shooter' Operational Planning using C2 for Confronting and Collaborating – [169](#)
- Babbitt, D P**  
IHPRT Improvements to the Solid Performance Program (SPP) – [542](#)
- Babcock, Sandy**  
Canadian Network Enabled Operations Initiatives – [144](#)
- Babiskin, Robert**  
New Approaches C4I Data Warehousing for Crisis Action - Synchronization, Replication, Sustainment Design Implications – [645](#)
- Babuska, Vit**  
Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – [53](#)
- Baca, D.**  
Quantitative Experiments with Electrons in a Positively Charged Beam – [606](#)



- Bach, D.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415
- Bach, Eric**  
A Model of Tactical Battle Rhythm – 170
- Bachrach, Jonathan**  
Simultaneous Localization, Calibration, and Tracking in an ad Hoc Sensor Network – 536
- Bach-y-Rita, P.**  
Systems and Methods for Altering Vestibular Biology – 506
- Backman, M.**  
Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72
- Baclawski, Ken**  
New Metrics for Blog Mining – 622
- Bacon, David J**  
The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites – 404
- Bader, B. W.**  
Pattern Analysis of Directed Graphs Using DEDICOM: An Application to Enroll Email – 439
- Badler, Norman I**  
Advanced Visual and Instruction Systems for Maintenance Support (AVIS-MS) – 625
- Bae, Byunghoon**  
A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 112
- Baehr-Jones, T.**  
Integrated Plasmon and Dielectric Waveguides – 587
- Bagaglio, M. J.**  
Tag Device, Luggage Tag, and Method of Manufacturing a Tag Device – 200
- Bagrodia, Rajive**  
Optimizing Parallel Execution of Detailed Wireless Network Simulation – 624
- Bagshaw, Michael**  
Fundamentals of Aerospace Medicine: Cosmic Radiation – 412
- Bagwell, K.**  
Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report – 109
- Bailey, C. G.**  
Single Cell Chromatography, LDRD, Feasibility Study – 105
- Bailey, Landon C**  
Refinement of an Instrument to Assess Readiness for Knowledge Management – 641
- Bailey, Timothy J**  
US/UK Sensor-To-Shooter Multinational C4 Interoperability Study Force-On-Force Effectiveness Methodology – 179
- Bailey, William**  
Symposium Q: Magnetic Thin Films, Heterostructures, and Device Materials – 197
- Baillie, Les**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377
- Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – 394
- Role of Superoxide in the Germination of Bacillus Anthracis Endospores – 380
- Bair, Elisabeth L**  
Effects of Modifications in the Laminin-10 Basal Laminina on Prostate Cancer Invasion – 376
- Baird, R G**  
Development and Assessment of a Complete ATR Algorithm Based on ISAR Euler Imagery – 468
- Baker, David A**  
The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401
- Balakumar, P.**  
Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4
- Balas, Benjamin**  
Receptive Field Structures for Recognition – 190
- Balash, John A**  
An Experimental 3-D Framework to Support C2 – 458
- Balasundaram, Ramkumar**  
Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454
- Balbach, Harold E**  
Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250
- Baldis, H.**  
Laser Plasma Interactions in High Energy Density Plasmas – 602
- Baldwin, T.**  
Development and Implementation of Noise Analysis Standards for ACSA Airports – 255
- Balick, Bruce**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665
- Ball, Catherine N**  
A Methodology for End-to-End Evaluation of Arabic Document Image Processing Software – 468
- Ballard, Donna**  
Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99
- Ballard, John R**  
Finishing Together: Coalition End-State Development Since 1990 – 161
- Making the Mix Work: Coalition C2 Interoperability during Recent Operations – 161
- Baltar, James Y**  
Simulation and Analysis of Dart Dispense Events with Collisions – 235
- Baltrusaitis, Daniel**  
USAF Command Doctrine of Centralized Control with Decentralized Execution: Never Divide the Fleet – 170
- Baltzell, Kimberly**  
Exploring Early Detection Methods: Using the Intraductal Approach to Predict Breast Cancer – 326
- Banania, Jo-Glenna**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Bandopadhyay, S.**  
Oxygen Transport Ceramic Membranes. Quarterly Report from October 2006 through December 2006 – 126
- Banerjee, Partha P**  
Prevention of Prostate Cancer by Inositol Hexaphosphate – 361
- Baney, R. H.**  
Dynamically Modifiable Polymer Coatings and Devices – 126
- Bangalan, Rolan T**  
Client Location in 802.11 Networks – 639
- Bangs, Michael J**  
Behavioral Responses to DDT and Pyrethroids Between Anopheles Minimus Species A and C Malaria Vectors in Thailand – 393
- Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Banks, Sheila B**  
Issues and Requirements for Cybersecurity in Network Centric Warfare – 446
- Realistic and Affordable Cyberware Opponents for the Information Warfare Battlespace – 537
- Bansal, Narottam P**  
Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear – 80
- Bapat, S**  
Sharp-Looking Geometric Partitioning – 199

- Baqar, Shahida**  
Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 396
- Baraceros, Maria F**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Barazi, E.**  
Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558
- Barbee, T.**  
Stab Sensitivity of Energetic Nanolaminates – 84
- Barber, K S**  
Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452
- Barber, P. W.**  
Southern Nevada Air Quality Study – 236
- Barboss, Arnoldo**  
Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379
- Bardeen, W. A.**  
Weak Mixing and Rare Decays in the Littlest Higgs Model – 563
- Bares, Michel**  
Levels of Interoperability in Coalition Systems – 646
- Barge, Hezekiah**  
Shared Situational Awareness Environment for Tactical Level Humanitarian Emergency Operations – 454
- Barlat, F**  
Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Text – 117
- Barmashenko, Boris**  
Improving COIL Efficiency By Iodine Pre-Dissociation Via Corona Discharge In The Transonic Section Of The Secondary Flow – 234
- Barnes, Christopher**  
Communication and Decision Making in C4ISR Sustained Operations: An Experimental Approach – 409  
  
Distributed Command and Control Research: Networking Multiple Simulation Platforms – 495  
  
Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – 166  
  
Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts) – 411
- Barnes, J W**  
Preliminary Findings: Design of Experiments University XXI (FY05) Research and Support for the US Army – 621
- Barnes, John**  
Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99
- Barney, B.**  
Purple Computational Environment with Mappings to Ace Requirements for the General Availability User Environment Capabilities. Version 2.0 – 433
- Barr, Paul C**  
Applying Executable Architectures to Support Dynamic Analysis of C2 Systems – 482
- Barrie, J D**  
Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54
- Barthel, Vincent**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375
- Bartis, James T**  
Constraints on JP-900 Jet Fuel Production Concepts – 128
- Barton, N.**  
Collaborations in Nuclear Reactors – 559
- Barton, W. B.**  
Heat of Dilution Calculation for 19 Molar Sodium Hydroxide with Water for Use in 241-S-112 – 103
- Bartosek, L.**  
Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – 582
- Barty, A.**  
EUV Inspection of Reticle Defect Repair Sites – 599
- Bashaw, J**  
Development of In Vitro Correlate Assays of Immunity to Infection with Yersinia Pestis – 327
- Baskin, Steven I**  
Pulmonary Toxicity of Cholinesterase Inhibitors – 382  
  
Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110
- Bassett, Jennifer**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335
- Basu, Subhendu**  
Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – 394
- Bates, Edgar**  
'How Much is a Pound of C4ISR Worth?' An Assessment methodology to Evolve Network Centric Measures and Metrics for Application to FORCEnet – 173
- Bates, R W**  
Experimental and Numerical Investigations of RP-2 Under High Heat Fluxes – 130
- Battles, J. J.**  
Climate Change Impact on Forest Resources. White Paper – 277
- Batygin, Y. K.**  
Beam Dynamics in a Spectrometer for the Polarized Positron Production Experiment – 584
- Bauer, P.**  
Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565
- Baur, Jeff W**  
Multi-Wall Carbon Nanotubes for Flow-Induced Voltage Generation (Preprint) – 95
- Baur, Jeff**  
Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 16
- Bausch, Daniel G**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Baustista, Christian T**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- Bavari, Sina**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330  
  
Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332
- Bayat, Jahan B**  
Position Analysis of Planar Tensegrity Structures – 583
- Bayne, Jay S**  
Performance Measurement in C2 Systems – 496
- Bayuse, T.**  
The Need for an Aerospace Pharmacy Residency – 419
- Bayuse, Tina M.**  
The Need for an Aerospace Pharmacy Residency – 419

- Bazan, Elizabeth B**  
Intelligence Reform and Terrorism Prevention Act of 2004: 'Lone Wolf' Amendment to the Foreign Intelligence Surveillance Act – 664
- Bazilevs, Y**  
The Role of Continuity in Residual-Based Variational Multiscale Modeling of Turbulence – 514
- Beal, Scott A**  
Assessment of Two Desk-Top Computer Simulations Used to Train Tactical Decision Making (TDM) of Small Unit Infantry Leaders – 481
- Beamer, Raymond**  
USNORTHCOM Integrated Architecture: A Means to an End – 494
- Beamish, Clark J**  
HUMINT Communication Information Systems for Complex Warfare – 642
- Bean, E.**  
Defect Prevention and Detection in Software for Automated Test Equipment – 430
- Beard, Les P**  
Evaluation of airborne Electromagnetic Systems for Detection and Characterization of unexploded ordnance (uXo) – 12
- Bearinger, J. P.**  
Single-Cell Level Investigation of Cytoskeletal/Cellular Response to External Stimuli – 107
- Beasley, Joseph N**  
Wave Front Sensor for Solar Concentrator Control – 52
- Beaujean, P P**  
Center for Coastline Security Technology, Year-2 – 228
- Beautement, Patrick**  
Software Agents as Facilitators of Coherent Coalition Operations – 459
- Beck, Belinda**  
Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287
- Beck, Eric V**  
A Multireference Density Functional Approach to the Calculation of the Excited States of Uranium Ions – 87
- Becker, F. E.**  
Storage, Generation, and Use of Hydrogen – 69
- Becker, J. A.**  
Progress on the Europium Neutron-Capture Study Using DANCE – 673
- Beckett, Charmagne G**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Beckett, Jonathon**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Beckley, Christopher M**  
Sizing Mobility Readiness Spares Packages for Today's Warfighting Units – 21
- Beckman, Erin M**  
Requirements and Information Metadata System – 632
- Becu, Guislain**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Behbahani, Al**  
A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – 550  
An Integrated Approach to Conversion, Verification, Validation and Integrity of AFRL Generic Engine Model and Simulation (Postprint) – 6
- Behbahani, Alireza R**  
Achieving AFRL Universal FADEC Vision With Open Architecture Addressing Capability and Obsolescence for Military and Commercial Applications (Preprint) – 5  
Need for Robust Sensors for Inherently Fail-Safe Gas Turbine Engine Controls, Monitoring, and Prognostics (Postprint) – 23
- Behrman, Robert**  
Modeling the Structure and Effectiveness of Intelligence Organizations: Dynamic Information Flow Simulation – 626
- Bein, Donald P**  
A Review of the History of Fire Suppression on U.S. DoD Aircraft – 33
- Bejcek, Bruce E**  
Early Detection of Prostate Cancer – 323
- Belak, J.**  
Ultrafast, In Situ Probing of Shocked Solids at the Mesoscale and Beyond: a New Paradigm for Materials Dynamics – 573
- Belenky, Gregory**  
A Collaborative Study of Sleep, Performance and Health Relationships – 382
- Bell, M. G.**  
Recent Physics Results from NSTX – 571
- Bell, R. E.**  
Recent Physics Results from NSTX – 571
- Bell, Tom**  
Adaptive and Iterative Processing Techniques for Overlapping Signatures – 555
- Belmusto-Worn, Vivian E**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- Belzberg, Allan J**  
Neurofibromatosis and the Painful Neuroma – 315
- Belzer, M. H.**  
Truck Driver Occupational Safety and Health. 2003 Conference Report and Selective Literature Review – 238
- Benaskeur, Abder**  
Sensor Management in Command & Control – 632
- Benedetto, Michael**  
A Possible Solution for the U.S. Navy's Addiction to Petroleum: A Business Case Analysis for Transitioning the U.S. Navy From Petroleum to Synthetic Fuel Resources – 63
- Benevides, Luis A**  
Correcting the Response of an Albedo Neutron Dosimeter for Energy – 219
- Benford, Dominic**  
GISMO – 231
- Beng, Wang W**  
Analysis and Classification of Traffic in Wireless Sensor Network – 159
- Ben-Jonathan, Nira**  
Antagonism of Taxol Cytotoxicity by Prolectin: Implications for Patient Resistance to Chemotherapy – 364
- Benkley, Carl**  
Air Force Information Workflow Automation through Synchronized Air Power Management (SAPM) – 610
- Bennett, C. L.**  
Persistent Monitoring Platforms – 36
- Bennett, C. V.**  
Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) – 177
- Bennett, John G**  
Analysis of the Thermal Shielding Properties of Camouflage Materials Brief – 192  
Analysis of the Thermal Shielding Properties of Camouflage Materials – 191  
Software to Generate 3-Dimensional Displays of Inverse Synthetic aperture Radar Data – 455  
Techniques for the Statistical Analysis of Observer Data – 524
- Bensky, Thomas**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193

- Benton, Betty J**  
DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – [383](#)
- Berchuck, Andrew**  
Biological Basis for Chemoprevention of Ovarian Cancer – [359](#)
- Berens, Patrick**  
Introduction to Synthetic Aperture Radar (SAR) – [175](#)  
Very High Resolution SAR and Multi-channel SAR/MTI – [175](#)
- Berezon, Dmitri**  
The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites – [404](#)
- Berg, Olav**  
Information Grid in Support of Crisis Management – [625](#)
- Berger, J. M.**  
High Throughput Screening of Crystallization of Materials – [71](#)
- Bergman, Gabrielle**  
Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – [287](#)
- Bergman, Margo**  
The Control of Multi-Agent Systems (MAS) – [609](#)
- Bergstroem, T.**  
Kapillaarelektrofores i Tva Dimensioner. Slutrapport Fran Innovationsprojekt 14215 (Two-Dimensional Capillary Electrophoresis Final Report of the Innovative Project 14215) – [68](#)
- Bergstrom, R.**  
Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – [109](#)
- Berker, D R**  
IHPRPT Improvements to the Solid Performance Program (SPP) – [542](#)
- Berlin, Andrew A**  
Microsystems Research in Japan – [191](#)
- Berman, Jonathan D**  
Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – [386](#)
- Bernreuther, David**  
Building Alternative-Energy Partnerships with Latin America – [249](#)
- Bernstam, Elmer**  
Translational Research from an Informatics Perspective – [416](#)  
Translational Research in Space Exploration – [413](#)
- Bernstein, L. A.**  
LDRD Final Report: Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057) – [563](#)
- Berriman, Matthew**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – [388](#)
- Berry, Scott A.**  
Boundary Layer Transition Experiments in Support of the Hypersonics Program – [1](#)
- Berry, Scott**  
Shuttle Entry Imaging Using Infrared Thermography – [57](#)
- Bertozi, M**  
Integrated Stereo Infrared and Color Human Detection on the ART platform – [226](#)
- Berzins, Valdis**  
Quality of Service Behavioral Model From Event Trace Analysis – [166](#)
- Berzins, V**  
Evolution of C4I Systems – [174](#)
- Betts, S.**  
Nuclear Photo-Science and Applications with T-Rex Sources – [562](#)
- Beu, S. C.**  
High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – [71](#)
- Beyerle, John A**  
Link Analysis for Dynamic Planning and Scheduling – [502](#)
- Bharj, S. S.**  
T/R Module for Satellite TT&C Ground Link – [200](#)
- Bhasin, A.**  
Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – [74](#)  
System for the Evaluation of Moisture Damage Using Fundamental Material Properties – [74](#)
- Bhaskaran, Shylesh**  
Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – [337](#)
- Bhat, K R**  
DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – [383](#)
- Bhattacharyya, A**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – [230](#)
- Bhattacharyya, Arup R**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – [104](#)
- Bhattacharyya, Rumi S**  
Selective Androgen Receptor Downregulators (SARDs): A New Prostate Cancer Therapy – [303](#)
- Bhatti, Nina**  
User-Level QoS-Adaptive Resource Management in Server End-Systems – [485](#)
- Bhimarasetti, G.**  
Tubular Carbon Nano/micro Structures and Method of Making Same – [74](#)
- Bialek, J. M.**  
Recent Physics Results from NSTX – [571](#)
- Bieniosek, F. M.**  
Overview of the Pulse Line Ion Accelerator – [577](#)
- Bienvenu, Michael P**  
The DoD Architecture Framework Views as Requirements Vehicles in a Model Driven Architecture Systems Development Process – [496](#)
- Biesiada, J.**  
B0 to K0K0bar and Other Hadronic b to d Decays – [567](#)
- Biggar, S F**  
Preflight and Vicarious Calibration of Hyperspectral Imagers – [598](#)
- Bigger, Clinton R**  
The Department of Defense Net-Centric Data Strategy: Implementation Requires a Joint Community of Interest (COI) Working Group and Joint COI Oversight Council – [659](#)
- Bihari, B. L.**  
Code Verification Results of an LLNL ASC Code on Some Tri-Lab Verification Test Suite Problems – [562](#)
- Bilgen, M.**  
Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – [103](#)
- Billhartz, Tom**  
A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – [189](#)
- Billingsley, M C**  
Experimental and Numerical Investigations of RP-2 Under High Heat Fluxes – [130](#)
- Biltoft, P.**  
Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash – [580](#)
- Binderbauer, M.**  
Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma – [574](#)
- Binger, M. W.**  
Physical Renormalization of Quantum Field Theories – [556](#)
- Binseel, Mary S**  
Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – [630](#)

- The Tactile Modality: A Review of Tactile Sensitivity and Human Tactile Interfaces – [423](#)
- Birkmire-Peters, Deborah P**  
UH-USA Agreement - A Telemedicine Research Proposal – [624](#)
- Birmingham, M P**  
A Multiservice Switch for Advanced Avionics Data Networks – [42](#)
- Bisbing, John**  
Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – [378](#)
- Biskner, Adam C**  
2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – [82](#)
- Biswas, Gautam**  
PHM Integration with Maintenance and Inventory Management Systems (Preprint) – [498](#)
- Bizup, David**  
A Centripetal Acceleration Statistic for Tracking Maneuvering Targets with Radar – [225](#)
- Bjoerklund, S.**  
Pilot Study: Parasitic and Passive Radar – [179](#)
- Bjorn, Vance**  
DigitalPersona - Case Study: Department of Defense – [475](#)
- Black, Heather**  
Unexploded Ordnance Site Investigation of US Military Ranges in Panama: Empire, Balboa West and Pina Ranges – [135](#)
- Black, Jesse H**  
Solid State Capacitor Discharge Pulsed Power Supply Design for Railguns – [193](#)
- Blackshire, James L**  
Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – [211](#)
- Blackwell, D D**  
On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – [551](#)
- Blackwell, Jerry L**  
Endothelial Progenitors as Vectors for Systemic Gene Therapy of Breast Cancer – [332](#)
- Blahe, M D**  
Hypothermia Induction and Recovery in Free-Ranging Rats – [409](#)
- Blair, Aaron M**  
Assessing Perceptions of Knowledge Management Maturity/Capabilities: A Case Study of SAF/FM – [649](#)
- Blair, Patrick J**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – [378](#)  
Human Spotted Fever Rickettsial Infections – [386](#)  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – [404](#)
- Blair, Peter L**  
The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – [401](#)  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – [404](#)
- Blakney, G. T.**  
High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – [71](#)
- Blalock, James**  
Data Alignment between Army C4I Databases and Army Simulations – [653](#)
- Blanchard, Robert**  
Shuttle Entry Imaging Using Infrared Thermography – [57](#)
- Blanton, P. S.**  
Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – [59](#)
- Blatt, Nicole**  
Operational Trust: A New Look at the Human Requirement in Network Centric Warfare – [146](#)
- Blazek, R. J.**  
Microsystem Enclosure and Method of Hermetic Sealing – [71](#)
- Blazer, Doug**  
Capability Based Resourcing for DPEM – [9](#)
- Blazevich, Ryan**  
A Model of Tactical Battle Rhythm – [170](#)
- Bleuel, D.**  
LDRD Final Report: Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057) – [563](#)
- Blichtein, D**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – [403](#)
- Bilom, J. A.**  
Method and Apparatus for Providing an Asymmetric Watermark Carrier – [430](#)
- Blomshield, Fred S**  
Lessons Learned in Solid Rocket Combustion Instability – [93](#)
- Blosser, Max L.**  
Characterization and Evaluation of a Mass Efficient Heat Storage Device. – [237](#)
- Blum, Marguerite**  
Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – [407](#)
- Boardman, Jill L**  
Combined Enterprise Regional Information Exchange System (CENTRIXS): Supporting Coalition Warfare Worldwide – [486](#)
- Boatz, Jerry**  
Pentazole-Based Energetic Ionic Liquids: A Computational Study (Preprint) – [97](#)
- Bober, R.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – [420](#)
- Bodhidatta, Ladaporn**  
Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – [396](#)
- Bodt, Barry**  
Data Mining Techniques Applied to Urban Terrain Command and Control Experimentation – [615](#)  
Identifying Battlefield Metrics Through Experimentation – [158](#)
- Boedo, J. A.**  
Recent Physics Results from NSTX – [571](#)
- Boehm, A. K.**  
Liquid Mixing Reactor for Biochemical Assays – [71](#)
- Boehmer, Greg**  
Application of NCO Conceptual Framework to US/UK Coalition Combat Operations during Operation Iraqi Freedom – [494](#)
- Boerjesson, A.**  
Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments – [205](#)
- Bogart, George**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – [321](#)
- Bogen, Kenneth T**  
PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans – [302](#)
- Boger, Dan**  
Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – [471](#)
- Boghosian, Bruce**  
Proceedings of the Quantum Computation for Physical Modeling Workshop Held in North Falmouth, Massachusetts on October 18-19, 2000 – [519](#)

- Bogue, Charles R**  
Counter-Trafficking Integrated Display System (CIDS): A GIS-Based Command & Control Environment for Coalition Nations – 470
- Bohn, C. C.**  
Dynamically Modifiable Polymer Coatings and Devices – 126
- Bolender, Michael A**  
Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – 21
- Bolkcom, Christopher**  
Civil Reserve Air Fleet (CRAF) – 25  
Military Helicopter Modernization: Background and Issues for Congress – 28  
Navy-Marine Corps Tactical Air Integration Plan: Background and Issues for Congress – 9  
Potential Military Use of Airships and Aerostats – 28  
Strategic Airlift Modernization: Background, Issues and Options – 14  
Unmanned Aerial Vehicles: Background and Issues for Congress – 30  
V-22 Osprey Tilt-Rotor Aircraft – 17  
VXX Presidential Helicopter: Background and Issues for Congress – 29
- Bollino, Kevin P**  
Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48
- Bolton, Christopher**  
Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249
- Bonabeau, Eric**  
Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 537
- Bonaceto, B.**  
Low Cost Parachute – 2
- Bonanni, Pierino**  
Prognostic Fusion for Uncertainty Reduction – 35
- Bond, T**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Bone, Elizabeth**  
Unmanned Aerial Vehicles: Background and Issues for Congress – 30
- Bonnell, D. A.**  
Electronic and Optoelectronic Devices and Methods for Preparing Same – 213  
Spatially Resolved Electromagnetic Property Measurement – 556
- Bonner, B. P.**  
Controls of Fluid Chemistry on Fracture Growth – 105
- Boock, Jared J**  
Characterization Of Commonly Encountered Explosives Using Highfield Asymmetric Waveform Ion Mobility Spectrometry Coupled With Mass Spectrometry – 594
- Bordeaux, John**  
Self-Organized Air Tasking: Examining a Non-Hierarchical Model for Joint Air Operations – 499
- Bordetsky, Alex**  
A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492  
A Model of Tactical Battle Rhythm – 170  
Network Aware Tactical Collaborative Environments – 165
- Born, Frank**  
Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488
- Borovies, Drew A**  
Particle Filter Based Tracking in a Detection Sparse Discrete Event Simulation Environment – 541
- Boroyevich, D**  
Standard-Cell, Open-Architecture Power Conversion Systems – 247
- Borro, C.**  
Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565
- Bosco, Emily E**  
The Role of RB in the Therapeutic Response of Breast Cancer – 301
- Bosco, Wayne**  
Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488
- Bostic, Elizabeth**  
Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249  
Smart Fuel Cell C20-MP Hybrid Fuel Cell Power Source – 249
- Botchkina, Galina I**  
Validation of Quantitative Multimodality Analysis of Telomerase Activity in Urine Cells as a Noninvasive Diagnostic and Prognostic Tool for Prostate Cancer – 366
- Bourakov, Eugene**  
Network Aware Tactical Collaborative Environments – 165
- Bourguet, Claire C**  
Prevalence and Outcomes of Restless Legs Syndrome Among Veterans – 346
- Boury-Brisset, Anne-Claire**  
Information Engineering in Support of Multilateral Joint Operational Interoperability – 611
- Bouso, R.**  
Predicting the Cosmological Constant from the Causal Entropic Principle – 671
- Boutros, Karim**  
Investigation of Lattice and Thermal Stress in GaN/AlGaIn Field-Effect Transistors – 194
- Boutwell, B. A.**  
Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65
- Bova, G S**  
Pilot Comparison of Stromal Gene Expression among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men – 313  
Proof of Concept for Systematic Collection of Optimal Molecular Quality Anatomically Oriented Normal Prostate from Diverse Age and Race Transplant Donors – 326
- Bowden, Fred D**  
System Instantiation Comparison Method: A Technique for Comparing Military Headquarters – 542
- Bower, Kraig S**  
Evaluation of the Safety and Efficacy of Excimer Laser Keratorefractive Surgery in U.S. Army Soldiers using the latest Battlefield Technologies – 233
- Bowman, Gregory R**  
Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – 386
- Boxer, Phillip**  
An Examination of a Structural Modeling Risk Probe Technique – 544
- Bradley, Robert Kelley**  
A Study of the Attraction Forces of Lunar Dust Simulant – 664
- Bradshaw, Jeffrey M**  
Software Agents as Facilitators of Coherent Coalition Operations – 459
- Brady, Edward**  
Assessing C3I in Support of Dismounted Operations in Complex Terrain – 539
- Bragg, M. B.**  
Characteristics of Runback Ice Accretions and Their Aerodynamic Effects – 1
- Braham, S.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415
- Branch, Jason**  
10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 190
- Branco, V. C.**  
Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – 74

- System for the Evaluation of Moisture Damage Using Fundamental Material Properties – 74
- Brand, C**  
Fort Holabird Defense Investigative Service (DIS), Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II – 422
- Brandt, Kevin**  
Modeling and Simulation Links with Command & Control (C2) Systems: Considerations in Architecture Designs – 162  
Report Out of the C4I Study Group – 162
- Braue Jr , Ernest H**  
Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- Braun, G. W.**  
Experience Scaling-Up Manufacturing and Emerging Photovoltaic Technologies – 245
- Braun, Jason C**  
Effects of Temperature and Environment on Creep Behavior of an Oxide-Oxide Ceramic Matrix Composite – 103
- Bray, K.**  
Method, System and Device for Microscopic Examination Employing Fiber-Prepared Sample Grasping Element – 206
- Bray, Kevin R**  
Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – 91
- Breaker, R. R.**  
Bioreactive Allosteric Polynucleotides – 69
- Brecht, Karen M**  
Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – 372
- Breen, Beverly**  
Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426
- Breen, T.**  
Development and Implementation of Noise Analysis Standards for ACSA Airports – 255
- Brem, Sarah**  
Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666
- Bremer, P. T.**  
Application of Morse Theory to Analysis of Rayleigh Taylor Topology – 569
- Brennan, A. B.**  
Dynamically Modifiable Polymer Coatings and Devices – 126
- Brevet, Carol A**  
Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306
- Brewer, Joe E**  
10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 190
- Breysse, J**  
Radon Screening of Buildings at the Umatilla Depot Activity, Hermiston, Oregon – 94
- Brickhouse, Mark D**  
Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31
- Briggs, R. J.**  
Overview of the Pulse Line Ion Accelerator – 577
- Brimfield, A A**  
Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – 384
- Brimfield, Alan A**  
NMR Analysis of Thiodiglycol Oxidation by Mammalian Alcohol Dehydrogenases – 371
- Bringa, E.**  
Collaborations in Nuclear Reactors – 559  
Final Report LDRD 04-ERD-021 – 67
- Brio, M**  
Computational Nonlinear Optics: Femtosecond Atmospheric Light String Applications – 266
- Brittingham, Katherine C**  
Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332
- Britton, David W**  
A Security Risk Measurement for the RAdAC Model – 490
- Brodsky, S. J.**  
AdS/CFT and QCD – 572  
Conformal Template and New Perspectives for Quantum Chromodynamics – 574
- Broeren, A. P.**  
Characteristics of Runback Ice Accretions and Their Aerodynamic Effects – 1
- Brogdon, Mandy L**  
The Effect of As-Large-As (ALA) Grains on the High-Temperature Fatigue Life of Waspaloy – 117
- Broggi, A**  
Integrated Stereo Infrared and Color Human Detection on the ART platform – 226
- Brooks, Benjamin A**  
Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261
- Brooks, Craig**  
Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31
- Brower, R. C.**  
National Software Infrastructure for Lattice Quantum Chromodynamics – 581
- Brown, B. M.**  
1958-2006 Precipitation Climatology for Lawrence Livermore National Laboratory, Livermore Site and Site 300 – 275
- Brown, C**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230
- Brown, D. A.**  
Test Suite for Nuclear Data I. Deterministic Calculations for Critical Assemblies and Replacement Coefficients – 574
- Brown, D.**  
HEND: A Database for High Energy Nuclear Data – 559
- Brown, Ian A**  
A Security Risk Measurement for the RAdAC Model – 490
- Brown, J D**  
GaN Wide Band Power Integrated Circuits (Preprint) – 95  
Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192
- Brown, J**  
Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95
- Brown, Jr, Martin J**  
Monitoring the Command and Control Weapon System. A Master Caution Panel for C2 System Monitoring – 154
- Brown, Leroy**  
Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – 166
- Brown, O B**  
Microphysics of Air-Sea Exchanges – 274
- Brownsword, Lisa**  
An Examination of a Structural Modeling Risk Probe Technique – 544
- Broyles, James W**  
Framework for Information Age Assessment Metrics – 171

- Bruce, R. W.**  
Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65
- Bruins, Henderikus B**  
Retort Racks for Polymeric Trays in 1400 Style Spray Retorts – 518
- Brundin, Patrik**  
Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease – 343
- Bruns, H. C.**  
Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – 601
- Brunsvold, Amy L**  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- Brunton, Ryan P**  
Web Enabling HLA Compliant Simulations to Support Network Centric Applications – 444
- Bruton, C. J.**  
Controls of Fluid Chemistry on Fracture Growth – 105
- Bryan, J. F.**  
Object Detection in Electro-Optic Sensor Images – 208
- Bryant, Michael T**  
Forecasting the KC-135 Cost Per Flying Hour: A Panel Data Analysis – 8
- Bryant, Russell E**  
Joint and Allied Logistics Opportunities and Tools Supporting 21st Century War Fighter Rapid Decisive Operations – 149
- Bryant, Thomas E**  
Command and Control Automation - MIP and MSC2 FOSC – 161  
The Right Information....and Intelligent Nodes – 456
- Brygoo, S.**  
Creating the Core Conditions of Extra-Solar and Solar Giant Planets – 672
- Bryk, Darryl**  
Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597
- Brykowsky, Mark**  
The Interactive DataWall – 209
- Bryzik, Walter**  
Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120
- Buchanan, Dennis J**  
Off-Axis Creep Behavior of Oxide/Oxide Nextel(Trademark)720/AS-0 (Preprint) – 122
- Buchheister, John B**  
Net-Centric Test & Evaluation – 133
- Buck, Eugene H**  
Acoustic Thermometry of Ocean Climate: Marine Mammal Issues – 587
- Buckner, Greg**  
Systems Engineering for Rapid Prototyping: Friendly Marking Device – 227
- Buddenberg, Rex**  
Toward an Interoperability Architecture – 646
- Buell, Louis H**  
Wireless Intrusion Detection – 483
- Burger, Wolfram**  
Space-Time Adaptive Processing: Algorithms – 177  
Space-Time Adaptive Processing: Fundamentals – 177
- Buettner, Raymond R**  
Computational Experimentation in C2 – 140  
Computational Experimentation with the Virtual Design Team: Bridging the Chasm between Laboratory and Field Research in C2 – 445
- Buhrman, Robert A**  
Spin Electronics – 189
- Bujanda, Andres**  
Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121
- Buldum, Alper**  
Atomistic Calculation of Elastic Moduli in Strained Silicon – 187
- Bull, Robert L**  
Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403
- Bultman, J E**  
Oxygen Plasma Treatment and Deposition of CNx on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121  
Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127
- Bumgarner, Adam**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Bunbury, Lloyd G.**  
Real Time Identification – 475
- Burans, James P**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Burch, James A**  
Capacity Building and Sustainment: Focusing on the End-State for Homeland Security – 503
- Burcin, Laura**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Burden, Art R**  
Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers – 272
- Burges, Robin B**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Burgess, Lawrence P**  
UH-USA Agreement - A Telemedicine Research Proposal – 624
- Burgess, Timothy**  
Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378
- Burgoyne, Madeline**  
Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418
- Burke, J.**  
LDRD Final Report: Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057) – 563
- Burkins, Matthew S**  
Ballistic Evaluation of Magnesium Alloy AZ31B – 117
- Burnett, James C**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330
- Burnett, Mark**  
Sense Making - Underpinning Concepts and Relation to Military Decision-Making – 617
- Burnham, A. K.**  
Comparison of Isoconversional and Model Fitting Approaches to Kinetic Parameter Estimation and Application Predictions – 108
- Burns, Brian S**  
Autonomous Unmanned Aerial Vehicle Rendezvous for Automated Aerial Refueling – 11
- Burns, L. A.**  
USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling – 277
- Burr, Arnold**  
Unexploded Ordnance Site Investigation of US Military Ranges in Panama: Empire, Balboa West and Pina Ranges – 135
- Burr, Donald H**  
Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403
- Bursell, Sven-Erik**  
Diabetes Care and Treatment Project: A Joslin Telemedicine Initiative – 373



- Burton, Dennis T**  
Evaluation of Daphnia Magna Neonate Viability under Low Temperature Exposure Conditions – [310](#)
- Burton, G.**  
Large-eddy Simulation of Round Turbulent Jets Using the Inertial LES Method with Multifractal Subgrid-Scale Modeling – [220](#)
- Burton, Robert**  
The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – [625](#)
- Busani, T**  
Molecular Volume and Electronic and Vibrational Polarizabilities for Amorphous LaAlO<sub>3</sub> – [86](#)  
On the Importance of Atomic Packing in Determining Dielectric Permittivities – [553](#)  
Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures – [96](#)
- Busch, Christoph**  
Challenges for Biometrics Systems: Performance and Fake Resistance – [475](#)
- Busch, Timothy**  
Joint Synthetic Battlespace: Cornerstone for Predictive Battlespace Awareness – [455](#)
- Bushman, Wade**  
Identification of Sonic Hedgehog-Induced Stromal Factors That Stimulate Prostate Tumor Growth – [295](#)
- Butler, C**  
Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – [251](#)
- Butterworth, Jeffrey A**  
Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – [597](#)
- Buttner, L. M.**  
A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – [414](#)
- Buttram, Greg**  
Systems Engineering for Rapid Prototyping: Friendly Marking Device – [227](#)
- Bykanova, Lucy**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – [297](#)
- Bylsma, Wesley**  
Estimating Runflat Stiffness – [552](#)
- Byrd, Aaron R**  
A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California – [221](#)
- Byrd, J.**  
Fermi Timing and Synchronization System – [605](#)
- Byrne, W R**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – [335](#)
- Cabezas, Cesar**  
Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – [380](#)
- Cabot, Myles C**  
A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect – [406](#)
- Cabot, W. H.**  
Application of Morse Theory to Analysis of Rayleigh Taylor Topology – [569](#)
- Cahpman, E. G.**  
Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – [253](#)
- Cai, Xinli**  
Atomistic Calculation of Elastic Moduli in Strained Silicon – [187](#)
- Cain, Anthony**  
Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – [133](#)
- Cain, J B**  
A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – [189](#)
- Cain, J.**  
Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool – [600](#)
- Callaghan, Michael**  
Using Templates to Support Crisis Action Mission Planning – [455](#)
- Callihan, Hubert D**  
An Experimental 3-D Framework to Support C2 – [458](#)
- Calo, V M**  
The Role of Continuity in Residual-Based Variational Multiscale Modeling of Turbulence – [514](#)
- Calvet, L E**  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – [92](#)
- Cambier, J L**  
Effect of Thermal Conductivity on the Knudsen Layer at Ablative Surfaces – [607](#)
- Cameron, Gregory J**  
An Evaluation of High Velocity Wear – [142](#)
- Campbell, C.**  
AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – [254](#)
- Campbell, Charlotte H**  
Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III – [650](#)
- Campbell, G.**  
Ultrafast, In Situ Probing of Shocked Solids at the Mesoscale and Beyond: a New Paradigm for Materials Dynamics – [573](#)
- Campisi, Judith**  
Cellular Senescence and Breast Cancer – [292](#)
- Canami, Anthony**  
Incident, Action, Recovery, and Recommissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – [202](#)
- Candler, Graham**  
Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – [216](#)
- Candon, Sharron**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – [631](#)
- Candy, J.**  
Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – [603](#)
- Canepa, A.**  
Search for Chargino and Neutralino at Run II of the Tevatron Collider – [576](#)
- Canfield, D. V.**  
Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – [419](#)
- Canfield, Dennis V**  
First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005 – [9](#)
- Cannon, Monte**  
Systems Engineering for Rapid Prototyping: Friendly Marking Device – [227](#)
- Cantin, Marco**  
The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective – [623](#)
- Cao, Guan-Liang**  
Role of Superoxide in the Germination of Bacillus Anthracis Endospores – [380](#)
- Capitaine, N**  
Progress Report of the IAU Working Group on Precession and the Eclipse – [665](#)
- Caponnetto, Andrea**  
Empirical Effective Dimension and Optimal Rates for Regularized Least Squares Algorithm – [524](#)

- Risk Bounds for Regularized Least-Squares Algorithm with Operator-Value Kernels – 524
- Cappelli, Dawn M**  
Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497
- Carballo, J. A.**  
Method and System for Interactive Modeling of High-Level Network Performance with Low-Level Link Design – 436
- Card, Stuart K**  
A New Perspective on Use of the Critical Decision Method with Intelligence Analysts – 609
- Cardenas, Rebecca**  
Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – 166
- Cargile, James D**  
A Multipurpose Projectile for Penetrating Urban Targets – 519
- Carley, Kathleen M**  
Information Technology and Knowledge Distribution in C3I teams – 627  
Inhibiting Adaptation – 169
- Carley, Kathleen**  
Modeling the Structure and Effectiveness of Intelligence Organizations: Dynamic Information Flow Simulation – 626
- Carlton, Jane M**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 388
- Carman, K. R.**  
Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78
- Carnes, B.**  
Report to the Institutional Computing Executive Group (ICEG) August 14, 2006 – 433
- Caro, A.**  
Collaborations in Nuclear Reactors – 559
- Carpen, Olli**  
Novel Molecular Interactions and Biological Functions of the Neurofibromatosis 2 Tumor Suppressor Protein, Merlin – 327
- Carpenter, Beth M**  
Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335
- Carpenter, Thomas**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Carr, J S**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226
- Carr, J**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Carr, Jean K**  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- Carr, Ryan W**  
Quantifying Non-Equilibrium in Hypersonic Flows Using Entropy Generation – 219
- Carr, Virgil J**  
Firefighting Agent Research, Phase I – 10
- Carra, John H**  
Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353
- Carrano, C. J.**  
Mitigating Atmospheric Effects in High-Resolution Infra-Red Surveillance Imagery with Bispectral Speckle Imaging – 675
- Carraway, Robert E**  
Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – 352
- Carrion, Gladys**  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- Carroll, Bruce**  
Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551
- Carroll, Darin S**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Carroll, David L**  
Charge Transfer Nanocomposites: The Effects of Scale-Hierarchy – 111
- Carson, John**  
Software Agents as Facilitators of Coherent Coalition Operations – 459
- Carstens, Christian B**  
Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – 225
- Carter, Brad**  
Coalition Operations with the Combined Enterprise Regional Information Exchange System (CENTRIXS) – 483
- Carter, E. A.**  
Supported Metal Catalyst with Improved Thermal Stability – 64
- Carter, Emily A**  
First Principles and Multi-Scale Modeling of the Roles of Impurities and Dopants on Thermal Barrier Coating Failure – 88
- Carucci, Daniel J**  
The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404
- Carver, Jeffrey C**  
A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – 478
- Casey, Leo**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184
- Casey, Rachael**  
Utility of DF-1 for Radioprotection in Lymphocytes – 420
- Casper, Matthew S**  
CFD Investigation of Flow Past Idealized Engine Nacelle Clutter – 226
- Cassata, James R**  
Correcting the Response of an Albedo Neutron Dosimeter for Energy – 219
- Cassell, A M**  
Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121
- Cassell, E.**  
Cfetool. A General Purpose Tool for Anomaly Detection in Periodic Data – 439
- Castleton, K. J.**  
Concepts Associated with Transferring Temporal and Spatial Boundary Conditions Between Modules in the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) – 431
- Castor, J. I.**  
Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry – 603
- Castranova, Vince**  
Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335
- Castro, V. A.**  
A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414
- Catalino, Joseph**  
COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care – 368
- Catania, Glen A**  
Bilateral Interoperability through Enterprise Architecture – 493

- Cates, Michael S**  
Corporate Entrepreneurship Assessment Instrument (CEAI): Refinement and Validation of a Survey Measure – 136
- Catherino, Henry A**  
Complex Processes in Electrochemical Systems – 114  
Heat Generation during Overcharge in Sealed Cells – 248
- Cattafesta, III, Louis N**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – 588  
Adaptive Identification of Fluid-Dynamic Systems – 215
- Cattafesta, L**  
Design and Validation of an Aeroacoustic Anechoic Test Facility – 587
- Cattafesta, Lou**  
Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314
- Cattafesta, Louis N**  
Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – 133
- Cattafesta, Louis**  
Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215  
Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551  
MEMS Shear Stress Sensors: Promise and Progress – 190  
Optimization of Synthetic Jet Actuators – 235
- Caulk, Ryan F**  
Outlier Detection in Hyperspectral Imaging Using Closest Distance to Center with Ellipsoidal Multivariate Trimming – 223
- Cavallaro, Kristen L**  
Analyzing the Interdiction of Sea-Borne Threats Using Simulation Optimization – 451
- Cazacu, O**  
Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Text – 117
- Cecchine, Gary**  
Hurricane Katrina: Lessons for Army Planning and Operations – 163  
Medical Risk in the Future Force Unit of Employment. Results of the Army Medical Department Transformation Workshop V – 304
- Ceder, G.**  
Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – 246
- Celeste, J. R.**  
Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – 601
- Celliers, P. M.**  
Creating the Core Conditions of Extra-Solar and Solar Giant Planets – 672
- Celluzzi, Christina**  
Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378
- Cenko, A**  
Advances in Modeling and Simulation Capabilities for Predicting Store Trajectories - Past Success and Future Challenges – 5  
Use of Statistical Tools to Improve Modeling and Simulation of Store Separation – 4
- Centeno, Jose A**  
Cadmium, Zinc, and Selenium Levels in Carcinoma of the Human Prostate – 356
- Cerasoli, D M**  
Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374
- Cercone, Eric J**  
Severe Weather Forecasting for Laughlin AFB, TX – 267
- Cervantes, O.**  
Stab Sensitivity of Energetic Nanolaminates – 84
- Cesaretti, Jamie A**  
ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer – 344
- Cespedes, Manuel**  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404
- Chadwell, Charles**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Chae, W H**  
High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133
- Chahin, J T**  
Preliminary Findings: Design of Experiments University XXI (FY05) Research and Support for the US Army – 621
- Chaiken, Scott**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- Chait, Richard**  
Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 21
- Chaka, Anne M**  
Applications of Molecular and Materials Modeling – 94
- Chaki, Nabendu**  
Quality of Service Behavioral Model From Event Trace Analysis – 166
- Chakrabarti, Kaushik**  
An Approach to Integrating Query Refinement in SQL – 530  
Locally Dimensionality Reduction: A New Approach to Indexing High Dimensional Spaces (Preprint) – 612  
The Hybrid Tree: An Index Structure for High Dimensional Feature Spaces (Preprint) – 529
- Chalk, Peter**  
Sharing the Dragon's Teeth: Terrorist Groups and the Exchange of New Technologies – 643
- Chambal, Stephen P**  
Modeling the U.S. Military Intelligence Process – 448
- Chamberlain, Sam**  
A Unifying Strategy for Data Integration for Global Force Management (Briefing Charts) – 147  
An Enterprise Identifier Strategy for Global Naming Across Arbitrary C4I Systems – 459  
Multinational Interoperability Requirements -- A Core Competency – 645  
Time-Base Tree Graphs for Stabilized Force Structure Representations – 539
- Chami, Malik**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Champagne, Victor**  
Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99
- Champion, Howard R**  
Mapping of WDMET in AIS 2005 and AIS 2005 Military – 644
- Chan, Philemon**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Chan, Teik-Chye**  
Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399
- Chandler, Phillip R**  
A Review of Recent Algorithms and a New and Improved Cooperative Control Design for Generating a Phantom Track (Preprint) – 26

- Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – 19
- Chandrasekaran, Venkataraman**  
Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – 133
- Chang, Chau-Lyan**  
Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet – 221
- Chang, Chawnshang**  
Knockout AR in Prostate – 280
- Chang, Cheng-Jong**  
How Important is Oblique Vision in Aviation? – 596
- Chang, Irene**  
Air Force Information Workflow Automation through Synchronized Air Power Management (SAPM) – 610
- Chang, M. C. O.**  
Southern Nevada Air Quality Study – 236
- Chang, Yong**  
Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – 102
- Chao, C C**  
Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388  
Proteomic Analysis of Rickettsia prowazekii – 395
- Chao, Chien-Chung**  
Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399
- Chao, William**  
Cooperative Multi-Agent Systems in Mobile Ad Hoc Networks – 495  
Multi-Agent Systems in Mobile Ad hoc Networks – 626  
Training Coordination Proxy Agents – 616
- Chapman, Gail**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377
- Chapman, H.**  
Ultra Fast Coherent Diffraction Imaging of Single Particles, Clusters and Biomolecules – 572
- Chapman, K. S.**  
Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 237  
Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237
- Chappell, S.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415
- Chapront, J**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – 665
- Charbonneau, Steven**  
Using a Shortest Path Algorithm for Identifying Areas of Interest in An Area of Operations – 543
- Chareonviriyaphap, Theeraphap**  
Behavioral Responses to DDT and Pyrethroids Between Anopheles Minimus Species A and C Malaria Vectors in Thailand – 393
- Charoenvit, Yupin**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Chattopadhyay, Rana**  
Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389
- Chattopadhyay, Schismita**  
Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399
- Chaturvedi, A. K.**  
Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – 419
- Chaturvedi, Arvind K**  
First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005 – 9
- Chauca, G**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403
- Chaum, Erik**  
Coalition Interoperability Ontology: Sharing Situational Awareness with Allies and Agents – 619
- Cheah, Mervyn**  
Command Control and Information Systems in the Age of Knowledge-Centricity – 143
- Chee Ping, Tan**  
Command Control and Information Systems in the Age of Knowledge-Centricity – 143
- Chehroudi, B**  
A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT) – 218
- Chehroudi, Bruce**  
Dark Core Analysis of Coaxial Injectors at Sub-, Near-, and Supercritical Conditions in a Transverse Acoustic Field – 589
- Chelius, D**  
Proteomic Analysis of Rickettsia prowazekii – 395
- Chemla, D. S.**  
New Strategic Plan Takes the ALS into the Future – 576
- Chen, C D**  
High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133
- Chen, C**  
Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121
- Chen, Chun-Ting**  
The Role of Oncogene/Tumor Suppressor Interaction with the Centrosome Protein Pericentrin in Prostate Tumorigenesis – 322
- Chen, D.**  
Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors – 600
- Chen, Fang-Jenq**  
Boundary Layer Transition Experiments in Support of the Hypersonics Program – 1
- Chen, H W**  
Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388
- Chen, H**  
Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398
- Chen, In-Gann**  
Synthesis of One-dimensional Nanosized Defects in High Tc Superconductor – 552
- Chen, J**  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92  
Molecular Random Access Memory Cell – 441  
Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions – 187  
Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122  
Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91
- Chen, Lili**  
MR Imaging Based Treatment Planning for Radiotherapy of Prostate Cancer – 349

- Chen, Michael M**  
Design of Experiments Study of the Initial Extended Area Protection and Survivability (EAPS) Projectile System – 527  
Stochastic Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile – 427  
Structural Design and Analysis of Initial Extended Area Protection and Survivability (EAPS) Projectile Configurations – 216
- Chen, Pin**  
Systems and Capability Relation Management in Defence Systems-of-System Context – 616
- Chen, Shih-Yun**  
Synthesis of One-dimensional Nanosized Defects in High Tc Superconductor – 552
- Chen, W. H.**  
Ultrasound Phased Arrays – 208
- Chen, Xiaoyuan**  
Imaging Primary Prostate Cancer and Bone Metastasis – 325
- Chen, Yu-Wen**  
3D Photonic Crystals Build Up By Self-Organization Of Nanospheres – 450
- Cheng, H.**  
Multi-Description Coding for Video Delivery Over Networks – 440
- Cheng, K. T.**  
Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry – 603
- Cheng, P.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Chernoff, Jonathan**  
Analysis of p21-Activated Kinase Function in Neurofibromatosis Type 2 – 315
- Chesley, Gary**  
America's Energy Security Policy: Goals for 2025 – 129
- Cheung, Jeffrey T**  
Ocean Wave Energy Harvesting Devices – 479
- Chew, Teng-Leong**  
Molecular Mechanisms in Compromised Endothelial Barrier during Breast Cancer Metastasis – 377
- Chi, Dong-Pyo**  
Quantum Algorithms and Initialization – 547
- Chiang, L. G.**  
Far Field Approximation in the Generalized Geometry Holdup (GGH) Model – 581  
Self Attenuation Correction for Holdup Measurements. An Historical Perspective – 581
- Chiang, Long Y**  
Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorenocarbonyl Methano[60]Fullerene Pentaads – 87
- Chiang, Y. M.**  
Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – 246
- Chidester, Matthew C**  
Adaptive Sampling for Network Management – 485  
Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – 448  
Parallel Simulation of Chip-Multiprocessor Architectures – 447  
Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448
- Chien, Jason**  
National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397
- Childress, III, Earl F**  
Ocean Wave Energy Harvesting Devices – 479
- Childs, H.**  
Visual Spreadsheets in VisIt – 432
- Chin, Y. H.**  
Closed Orbit Distortion and the Beam-Beam Interaction – 556
- Ching, W M**  
Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388  
Proteomic Analysis of Rickettsia prowazekii – 395
- Ching, W**  
Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398
- Ching, Wei-Mei**  
Cloning and Sequence Analysis of the 22-kDa Antigen Genes of Orientia tsutsugamushi Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – 399  
Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399
- Chinn, S. C.**  
Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – 67
- Chinnock, R. B.**  
Polarized Optical Probes – 599
- Chiu, Huei-huang**  
Fundamental Study on Quantum Nanoparticles – 548
- Chiu, M. N.**  
Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178  
Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183
- Chiu, Y. C.**  
Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178  
Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183
- Cho, J. Y.**  
Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR) – 276
- Cho, Kilseok**  
Fault-Tolerant Parallel Algorithms for Adaptive Matched-Field Processing on Distributed Array Systems – 509
- Chockler, Gregory**  
Proving Atomicity: An Assertional Approach – 487
- Choi, J.**  
Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 130
- Choi, Peter M**  
The Effects of Social Network Centrality on Group Satisfaction – 477
- Choi, Sung R**  
Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear – 80
- Cholli, A. L.**  
Post-Coupling Synthetic Approach for Polymeric Antioxidants – 65
- Choppy, K J**  
Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44
- Chou, Wei-Yang**  
Novel Organic Field Effect Transistors via Nano-Modification – 197
- Choudhan, Meelan**  
Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 43
- Choukha, Mohamed F**  
A Partnership Training Program in Breast Cancer Diagnosis: Concept Development of the Next Generation Diagnostic Breast Imaging Using Digital Image Library and Networking Techniques – 296

- Chow, H-H**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339
- Chow, J. C.**  
Southern Nevada Air Quality Study – 236
- Christianson, D.**  
Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115
- Christie, Douglas R**  
Detection of Atmospheric Explosions at IMS Monitoring Stations using Infrared Sound Techniques – 265
- Christie, M**  
Modular Structures in a Multinational Force Headquarters – 147
- Christophides, Georges K**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 388
- Chu, Isabel**  
cSrc and Her2 Signaling Pathways Cooperate with Estrogen to Promote ER Phosphorylation, Ubiquitination and Proteolysis in ER Negative Breast Cancers – 356
- Chuang, R**  
Fort Holabird Defense Investigative Service (DIS), Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II – 422
- Chuang, Shui-Nan**  
Probabilistic Analysis for the Mechanical Properties of Cross-Ply Fiber-Reinforced Composite Laminate (Postprint) – 115
- Chun, M R**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226
- Chun, M**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Chung, B. W.**  
Changes in Delta-Plutonium Due to Self-Irradiation Aging Observed by Continuous In-Situ X-ray Scattering – 120  
Radiation Damage Effects on the Magnetic Properties of Pu(1-x)Am(x) (x=0.224) – 562
- Chung, Chris V**  
Simulation of Radiowave Propagation in a Dense Urban Environment – 554
- Chung, H. K.**  
Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions – 603
- Chung, Peter W**  
Atomistic Calculation of Elastic Moduli in Strained Silicon – 187
- Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187  
On the Correlation Between the Self-Organized Island Pattern and Substrate Elastic Anisotropy – 552
- Chunga, A**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403
- Church, J. A.**  
LDRD Final Report: Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057) – 563
- Church, J.**  
Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash – 580
- Ciaravella, A**  
Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – 668
- Cissoko, Yacouba**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Clapp, Isabella**  
Army Facility Energy Demand and the Impact on National Security – 243
- Clark, D. S.**  
Isochoric Implosions for Fast Ignition – 570
- Clark, Doug**  
A Case Study for the Naval Training Meta-FOM (NTMF): Analyzing the Requirements from MAGTF FOM – 629
- Clark, Graham**  
A Review of Australian and New Zealand Investigations on Aeronautical Fatigue During the Period April 2005 to March 2007 – 2
- Clark, Richard E**  
The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq – 367  
The Use of Cognitive Task Analysis and Simulators for the After Action Review of Medical Events in Iraq – 618
- Clark, Thea**  
Evaluation of Organisational Interoperability in a Network Centric Warfare Environment – 146  
Organisational Interoperability: Evaluation and Further Development of the OIM Model – 651
- Clarke, Christina A**  
Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285
- Claustre, Herve**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Clayton, John D**  
Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187  
Modeling Damage and Fragmentation in Concrete – 122
- Cleary, Margot P**  
Role of Obesity in Prostate Cancer Development – 336
- Clemons, C.**  
Use of Saltcedar and Utah Juniper as Fillers in Wood-Plastic Composites – 82
- Clemons, Larry**  
The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8
- Cleveland, Jr, William B**  
Electromigration Related Effects At Metal-Metal Interfaces: Application To Railguns – 96
- Cleveland, T. G.**  
Summary of Dimensionless Texas Hypetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – 276
- Clinton, Gail M**  
Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on Hormonal Responsiveness of Breast Cancer – 362
- Coats, D E**  
IHPRPT Improvements to the Solid Performance Program (SPP) – 542
- Cobas, L. F.**  
Proceedings of the Symposium on Ferroelectricity and Piezoelectricity (IMRC 2005) – 76
- Cobb, Rich**  
Systems Engineering for Rapid Prototyping: Friendly Marking Device – 227
- Cobb, Wesley**  
Acoustic Identification of Filler Materials in Unexploded Ordnance – 82
- Cochran, Larry**  
A Conceptual Operational Model for Command and Control of International Missions in the Canadian Forces – 180
- Coehn, R.**  
Quantitative Experiments with Electrons in a Positively Charged Beam – 606
- Cohen, Henry**  
Journalists' Privilege: Overview of the Law and 109th Congress Legislation – 657
- Cohen, Pinchas**  
Humanin: A Novel Therapeutic Target in Prostate Cancer – 319

- Cohn, Richard**  
Fully Reusable Access to Space Technology (FAST) Methane Rocket – 46
- Cohoon, J P**  
Sharp-Looking Geometric Partitioning – 199
- Cole, III, George P**  
Feasibility Study of Variance Reduction in the Logistics Composite Model – 522
- Cole, M. W.**  
Proceedings of the Symposium on Ferroelectricity and Piezoelectricity (IMRC 2005) – 76
- Coleman, J. E.**  
Overview of the Pulse Line Ion Accelerator – 577
- Colina, Olga**  
Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386
- Collazo, Arlene**  
Systems Engineering for Rapid Prototyping: Friendly Marking Device – 227
- Collins, G. W.**  
Creating the Core Conditions of Extra-Solar and Solar Giant Planets – 672
- Collup, Justin W**  
Forecasting Demand for Civilian Pilots: A Cost Savings Approach to Managing Air Force Pilot Resources – 27
- Colombi, John**  
Solutions Analysis for Helicopter Brownout – 33  
Systems Engineering for Rapid Prototyping: Friendly Marking Device – 227
- Comanor, Katherine**  
Sustaining Air Force Space Systems: A Model for the Global Positioning System – 26
- Combs, Vaughn**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Comfort, Louise K**  
Organizational Fragility Curves: Sense-making under Stress – 544
- Compton, Paul**  
Towards Next Generation WWW: Push, Reuse and Classification – 614
- Comtois, J. M.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415
- Cong, Lianli**  
Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265
- Conklin, D. J.**  
Electronic and Optoelectronic Devices and Methods for Preparing Same – 213
- Conklin, Douglas S**  
Functional Genomic Analysis of Breast Cancer Cell Tumorigenicity Using a Novel Gene Silencing Resource – 325
- Conley, D**  
Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft – 583
- Conlon, J P**  
GaN Wide Band Power Integrated Circuits (Preprint) – 95
- Connell, J. W.**  
Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83
- Connor, Dan**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125
- Connors, M.**  
Flight Attendant Fatigue – 412
- Conrad, Thomas P**  
The Quest for Effective Interoperability - Issues in Achieving a Naval Coalition Force Virtual Combat System – 645
- Conti, Claudio J**  
Studies of Prostate Tumor Development Via CRE/LOXP Technology – 309
- Convertino, Victor A**  
Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354
- Cook, A. W.**  
Application of Morse Theory to Analysis of Rayleigh Taylor Topology – 569
- Cook, A.**  
Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – 67
- Cook, Ashley**  
Modelling Operational Command Structures Using ORGAHEAD – 451
- Cook, Glenn R**  
A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492
- Cook, R. L.**  
Releaseable Corrosion Inhibitor Compositions – 108
- Cook, Thomas S**  
Experiments with the Sun Java Real-Time System -- Part 2 – 466
- Cooke, K. H.**  
Large Synoptic Survey Telescope and Foundations for Data Exploitation of Petabyte Data Sets – 673
- Cooke, R.**  
Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – 65
- Coombe, Scott**  
Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249
- Coomer, C.**  
Motor Frame Cooling with Hot Liquid Refrigerant and Internal Liquid – 76
- Cooper, C.**  
Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565
- Cooper, L S**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Cooter, Mark A**  
Airborne Armed Full Motion Video: The Nexus of OPS/INTEL Integration in the Joint/Coalition Environment – 229
- Coovert, Michael D**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- Coovert, Michael**  
Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts) – 411
- Copeland, Craig**  
Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89
- Coppo, Patricia A**  
Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305
- Coppola, Edward N**  
Perchlorate Removal, Destruction, and Field Monitoring Demonstration – 101
- Corbin, M H**  
Novel Technology Evaluation for Volatile Organic Compounds Emission Control – 60
- Cordes, B. W.**  
Object Detection in Electro-Optic Sensor Images – 208
- Cordova, C**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339
- Corke, Thomas C**  
Tip Clearance Control Using Plasma Actuators – 16

- Corless, Christopher**  
The Role of CRELD1 Isoform 9B in the Pathogenesis of Breast Cancer – 280
- Corman, David E**  
IEIST Technologies Enabling TCT Prosecution – 538
- Corrie, Tanya D**  
Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243
- Costanzo, Philip**  
Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121
- Courand, Gregg**  
Risk Advised Course of Action (COA) Analysis – 532
- Couriel, Daniel**  
National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397
- Courtney, Valencia V**  
A Comparable Market Study of RFID for Manual Item-Level Accountability Inventory and Tracking Systems – 155
- Coverdale, C. A.**  
Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601
- Covo, M. K.**  
Quantitative Experiments with Electrons in a Positively Charged Beam – 606
- Cowan, J. H.**  
Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277
- Cowley, S.**  
Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 603
- Cox, Ingemar J**  
Digital Watermarking Using Syndrome Codes – 516
- Cox, J. A.**  
Vertical Cavity Surface Emitting Laser Having a Gain Guide Aperture Interior to an Oxide Confinement Layer – 599
- Coy, E B**  
Code Validation of CFD Heat Transfer Models for Liquid Rocket Engine Combustion Devices – 217
- Coy, Edward**  
Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – 99  
  
Numerical Analysis of Chamber Wall Heat Transfer in a GH2/GO2 Sub-Scale Combustor – 98
- Coy, Lawrence**  
On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263
- Craft, Krisit J**  
First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005 – 9
- Cragin, Kim**  
Sharing the Dragon's Teeth: Terrorist Groups and the Exchange of New Technologies – 643
- Craig, Duncan**  
North West Shelf Unmanned Aerial System Trial – 18
- Craighead, H. G.**  
Electrospray Emitter for Microfluidic Channel – 205
- Cramer, S. M.**  
High Throughput Screening of Potential Displacer Molecules – 73
- Crane, Carl D**  
A Modular, Scalable, Architecture for Unmanned Vehicles – 547
- Crawford, Brian P**  
Approximate Analysis of an Unreliable M/M/2 Retrial Queue – 494
- Crawford, Jr, Byron**  
Functional Characterization of Two Novel Human Prostate Cancer Metastasis Related Genes – 341
- Creigh, Robert H**  
Service Oriented Architecture for Coast Guard Command and Control – 633
- Criscuolo, Carolyn J**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377
- Cristiani, Jonathan H**  
Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249
- Crockett, Robert**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Croft, W. J.**  
Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 83
- Cropley, David**  
Optimising the Design of Land Force C2 Architectures – 152
- Cross, Alan S**  
Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – 394
- Crosse, Marcia**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
- Crovella, Mark**  
Analysis of Origin Destination Flows (Raw Data) – 521
- Crow, Bruce E**  
Automating Behavioral Health Screening - Addressing Risk Communication Electronically – 306
- Crowley, John**  
Air Force Information Workflow Automation through Synchronized Air Power Management (SAPM) – 610
- Crowley, Thomas D**  
Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243
- Crowner, Christopher**  
Automated Information Extraction System (AIES) Capability Enhancement and Support – 614
- Croxton, L M**  
Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379
- Cruse, Thomas**  
Nanoscience and Technology at the Air Force Research Laboratory (AFRL) – 54
- Cruz, M**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403
- Cruz, P.**  
A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414
- Cruz-Saldarriaga, Maria**  
Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386
- Csontos, Aladar A**  
The Effect of Inhomogeneous Plastic Deformation on the Ductility and Fracture Behavior of Age Hardenable Aluminum Alloys – 115
- Cuccaro, Joseph T**  
Site Inspection at Fort Allen, Puerto Rico Preliminary Assessments at San Juan ASSF, Puerto Rico and Blair Hangar AASF, St. Croix, USVI – 87
- Cuchi, Paloma**  
Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393
- Cucinotta, F. A.**  
Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations – 370



- Cucinotta, Francis A.**  
Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676
- Cucionotta, Francis A.**  
Fundamentals of Aerospace Medicine: Cosmic Radiation – 412
- Cuhadar-Doenszelmann, T.**  
Radiative Penguin Decays at the B Factories – 578
- Cukier, Michel**  
An Adaptive Quality of Service Aware Middleware for Replicated Services – 521
- Cullen, D. E.**  
POINT 2007: A Temperature Dependent ENDF/B-VII.0 Data Cross Section Library – 562
- Cullen, Richard**  
USNORTHCOM Integrated Architecture: A Means to an End – 494
- Cummings, Peter T**  
Applications of Molecular and Materials Modeling – 94
- Cunningham, Albert R**  
Investigating the Mechanism of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens – 405
- Cunningham, W B**  
Towards Dominant Battlespace Comprehension in Network Centric Warfare – 549
- Currie, Stephen**  
Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – 417
- Curry, Michael**  
Decentralized Control Using Global Optimization (DCGO) (Preprint) – 495
- Curtis, Keith P**  
Multinational Information Sharing and Collaborative Planning Limited Objective Experiments – 655
- Curtis, Keith**  
Developing an Information Superiority-Command and Control Joint Experimentation Strategy – 648
- Cushion, Jennifer**  
Capability Based Resourcing for DPEM – 9
- Cushman, B M**  
Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44
- Cutler, David J**  
Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – 386
- Cybyk, Bohdan Z**  
SparkJet Actuators for Flow Control – 235
- Czapiga, Meggan**  
Human Platelets Exhibit Chemotaxis using Functional N-Formyl Peptide Receptors – 386
- Czaplewski, D. A.**  
Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems – 204
- Daddario-DiCaprio, Kathleen M**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331
- Daddario-DiCaprio, Kathleen**  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330
- Dadvar, Puyan**  
Potential Thermal Security Risks – 441
- Daggert, L**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Dahel, Karim S.**  
Challenges and Potential Research Areas in Biometrics – 476
- Dahlburg, Jill P**  
Naval Research Laboratory Space Science Division Newsletter: 01/2007 – 669
- Dahleh, Munther A**  
New Tools for Hybrid Systems – 517
- Dahmann, Judith**  
Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461
- Dai, Liming**  
Multi-Wall Carbon Nanotubes for Flow-Induced Voltage Generation (Preprint) – 95
- Dai, Liming**  
Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81
- Dalal, Stephen J**  
Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- Dalal, Stephen J**  
Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110
- Dalrymple, Mathieu**  
Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – 166
- Dalrymple, Mathieu**  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503
- Dalrymple, Mathieu**  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- Dalton, Jeffrey S**  
An Integrated Approach to Conversion, Verification, Validation and Integrity of AFRL Generic Engine Model and Simulation (Postprint) – 6
- Daly, John**  
C4I Tactical Applications Utilizing Embedded Simulations – 150
- Daly, John**  
C4I-Simulation Interoperability Using the DII COE and HLA – 468
- Daly, Sara A**  
Sharing the Dragon's Teeth: Terrorist Groups and the Exchange of New Technologies – 643
- Danczyk, S A**  
A Method to Predict Atomization Performance in Gas-Centered Swirl-Coaxial Injectors – 218
- Danczyk, Stephen A**  
Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors – 216
- D'Andrea, Elizabeth R**  
Counter-Trafficking Integrated Display System (CIDS): A GIS-Based Command & Control Environment for Coalition Nations – 470
- Dang, Thuy D**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- Dang, Tuan Q**  
Client Location in 802.11 Networks – 639
- Dang, Xinglai**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Daniel, Dale**  
Agile Coalition Environment (ACE) – 613
- Daniel, Larry W**  
Platelet Activating Factor: A Growth Factor for Breast Cancer – 341
- Danilov, Y. P.**  
Systems and Methods for Altering Vestibular Biology – 506
- d'Anjou, Richard**  
Generic Organisation Data Integration Solution: The Fast and Convenient Way to Integrate Data – 644
- Danko, E. T.**  
Hydrogen Technology Research at the Savannah River National Laboratory. Center for Hydrogen Research and the Hydrogen Technology Research Laboratory – 109
- Dannert, T.**  
Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 603

- Dao, Modibo**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Darcy, Jeannette**  
IMMR Phase 1 Prototyping Plan Inputs – 663  
MDS MIC Catalog Inputs – 416
- Dardano, C.**  
Operational Aspects of Space Radiation Analysis – 676
- Darolia, R.**  
Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65
- Darrell, Trevor**  
Conditional Random People: Tracking Humans with CRFs and Grid Filters – 505
- Das Allen, A.**  
Climate Change Impact on Forest Resources. White Paper – 277
- Das, Digendra K**  
Enhancement of the Computational Efficiency of Membrane Computing Models – 550
- Das, Digendra**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Das, S.**  
Global Local Dynamic Models – 572
- Dasgupta, Amitava**  
Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416
- Dash, Russell E**  
Service Oriented Architecture for Coast Guard Command and Control – 633
- Dauffy, L. S.**  
Particle Splitting for Monte-Carlo Simulation of the National Ignition Facility – 561
- Daughton, James M**  
Spin Electronics – 189
- Davaney, Anthony J**  
Theory and Applications of Computational Time-Reversal Imaging – 516
- Dave, Nikhil**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – 143
- Davidson, Jack**  
Protection of Software-based Survivability Mechanisms – 447
- Davis, Andrea**  
Perchlorate Removal, Destruction, and Field Monitoring Demonstration – 101
- Davis, D W**  
A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT) – 218
- Davis, Gregg**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184
- Davis, J. F.**  
Development of Technologies to Utilize Laser Plasma Radiations Sources for Radiation Effects Sciences – 600  
Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601
- Davis, Jeffrey R.**  
Integrated Crew Health Care System for Space Flight – 412
- Davis, Jim A**  
Bio-Defense Now: 56 Suggestions for Immediate Improvements – 427
- Davis, Judy W**  
Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305
- Davis, Lynn E**  
Hurricane Katrina: Lessons for Army Planning and Operations – 163
- Davis, M B**  
Relaxed Fidelity CFD Methods Applied to Store Separation Problems – 5
- Davis, Mark S**  
Shared Situational Awareness Environment for Tactical Level Humanitarian Emergency Operations – 454
- Davis, M.**  
All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets – 674  
Best Practice in Adhesive-Bonded Structures and Repairs – 67
- Davis, P. J.**  
Materials and Fabrication Issues for Large Machined Germanium Immersion Gratings – 575
- Davis, Scott C**  
Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging – 376
- Davis, Tana**  
Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426
- Davis-Street, Janis**  
Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411
- Davol, Andrew**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Daw, C S**  
Adsorption and Desorption of Dinitrotoluene on Activated Carbon – 91
- Dawidowicz, Edward**  
Intelligent Nodes in Coalition Warfare – 630  
The Right Information....and Intelligent Nodes – 456
- Day , Jr , William A**  
Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335
- Day, D.**  
Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 130
- Day, S. D.**  
Corrosion Resistance of Structural Amorphous Metal – 104  
X ray Diffraction Techniques for Structural Determination of Amorphous Materials – 69
- Day, S.**  
Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69  
Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107  
High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe49.7Cr17.7Mn1.9Mo7.4W1.6B15.2C3.8Si2.4 – 107
- de la Vega, Patricia**  
The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401
- de Rijk, G.**  
Preliminary Study of Using 'Pipetron'-Type Magnets for a Pre-Accelerator for the LHC – 566
- De Roche, R.**  
Testing for Compliance to NTCIP Standards – 428
- de Supinski, B. R.**  
Regression Strategies for Parameter Space Exploration. A Case Study in Semicoarsening Multigrid and R – 435
- de Teramond, G. F.**  
AdS/CFT and QCD – 572
- De Vito, Ernesto**  
Empirical Effective Dimension and Optimal Rates for Regularized Least Squares Algorithm – 524

- Risk Bounds for Regularized Least-Squares Algorithm with Operator-Value Kernels – [524](#)
- Dea, John R**  
High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations – [526](#)
- Dea, Jonathan M**  
Downstream Impacts Due to the Extratropical Transition of Tropical Cyclones Over the Western North Pacific – [267](#)
- Deaconu, Stelu**  
Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – [99](#)
- Deaett, M. A.**  
Method for Constructing Antennas from Textile Fabrics and Components – [179](#)
- Dean, K.**  
Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool – [600](#)
- Dear, Bernard H.**  
Composite Materials Containing a Nanostructured Carbon Binder Phase and High Pressure Process for Making the Same – [83](#)
- Deatz, Richard C**  
Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III – [650](#)
- Dec, John A.**  
Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – [59](#)
- Deckert, Robin R**  
Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – [383](#)
- Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – [373](#)
- DeCoste, Dennis M**  
Dynamic Across-Time Measurement Interpretation: Maintaining Qualitative Understandings of Physical System Behavior – [500](#)
- DeFord, Michelle S**  
Effects of Sarin on the Operant Behavior of Guinea Pigs – [382](#)
- Deheyn, Dimitri**  
Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems – [354](#)
- Deisseroth, Albert B**  
Adjuvant Immunotherapy for Patients at High Risk of Recurrence Following Radiation Therapy for Prostate Cancer – [298](#)
- Deist, David W**  
Critical Review of the U.S. Marine Corps' Space Cadre Strategy – [674](#)
- Del Guercio, Miguel**  
Incident, Action, Recovery, and Re-commissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – [202](#)
- DeLorme, Richard D**  
Ballistic Evaluation of Magnesium Alloy AZ31B – [117](#)
- Demaree, J D**  
Nanoengineered Additives for Active Coatings – [61](#)
- DeMarzo, Angelo M**  
Interactions between Dietary Factors and Inflammation in Prostate Carcinogenesis – [349](#)
- DeMeo, G. A.**  
Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – [273](#)
- Demers, David**  
Recommendations for Network- and Internet-based Synchronized E-activities for Location- and Time-dependent Information – [457](#)
- Demirbilek, Zeki**  
Infra-Gravity Wave Input Toolbox (IGWT): User's Guide – [470](#)
- WABED Model in the SMS: Part 2. Graphical Interface – [470](#)
- Demirdjian, David**  
Conditional Random People: Tracking Humans with CRFs and Grid Filters – [505](#)
- Demetry, Peter**  
COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care – [368](#)
- Dempsey, Cyril**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – [279](#)
- Deng, Yiming**  
Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Post-print) – [534](#)
- Denham, M.**  
Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report – [109](#)
- Dennis, William E**  
Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – [335](#)
- Derbenev, Y.**  
Studies of a Gas-Filled Helical Muon Beam Cooling Channel – [565](#)
- DeRoshina, C.**  
Flight Attendant Fatigue – [412](#)
- Desai, Akash G**  
Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – [497](#)
- Desaulniers, Helen**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – [321](#)
- Descalle, M. A.**  
Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash – [580](#)
- Test Suite for Nuclear Data I. Deterministic Calculations for Critical Assemblies and Replacement Coefficients – [574](#)
- DeSchepper, Daniel**  
Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – [121](#)
- Deshpande, M R**  
Microfabrication of a Mechanically Controllable Break Junction in Silicon – [186](#)
- Desimone, Roberto**  
Flexible UAV Mission Management Using Emerging Technologies – [23](#)
- Deste, Jean-Francois**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – [279](#)
- DeTar, C. E.**  
National Software Infrastructure for Lattice Quantum Chromodynamics – [581](#)
- Dev, Parvati**  
Simulation-Based Learning: Workshops for Researchers and Educators in the Western USA, and the Pacific Rim – [619](#)
- Devanbu, Premkumar**  
Willow System Demonstration – [449](#)
- Devich, J.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – [420](#)
- Devine, R A**  
Infrared and Electrical Properties of Amorphous Sputtered (La<sub>x</sub>Al<sub>1-x</sub>)<sub>2</sub>O<sub>3</sub> films – [63](#)
- Molecular Volume and Electronic and Vibrational Polarizabilities for Amorphous LaAlO<sub>3</sub> – [86](#)
- On the Importance of Atomic Packing in Determining Dielectric Permittivities – [553](#)
- Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds – [90](#)
- Substrate/Oxide Interface Interaction in LaAlO<sub>3</sub>/Si Structures – [96](#)
- DeVoe, R.**  
Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – [582](#)

- DeWeese, Richard**  
Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10
- DeWitt, John**  
The Effect of Increasing Mass on Locomotion – 413
- Dharmasena, K**  
An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems – 60
- Dhawan, A.**  
Post-Coupling Synthetic Approach for Polymeric Antioxidants – 65
- Diamond, David B**  
Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243
- Diarra, Issa**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Dibble, Catherine**  
The GeoGraph 3D Computational Laboratory – 538
- Dibelka, Jessica**  
Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121
- DiCarlo, James J**  
Ultra-fast Object Recognition from Few Spikes – 501
- Dichter, Marc A**  
Preventing Epilepsy after Traumatic Brain Injury – 366
- Didonato, Armido**  
An Inverse of the Circular Coverage Function – 525  
An Inverse of the Elliptic Coverage Function – 525  
An Inverse of the Generalized Circular Error Function – 525  
An Inverse of the Incomplete Beta Function (F-(Variance Ratio) Distribution Function) – 467
- Diedrich, Frederick J**  
When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141  
When Do Organizations Need to Change (Part II)? Incongruence in Action – 140
- Diefenbach, Michael A**  
Evaluating an Interactive, Multimedia Education and Decision Program for Early-Stage Prostate Cancer Patients in a Randomized Controlled Trial – 342
- Diegert, C.**  
Model Based Statistical Estimation of Sandia RF Ohmic Switch Dynamic Operation from Stroboscopic X-ray Imaging – 207
- Diels, J C**  
Computational Nonlinear Optics: Femtosecond Atmospheric Light String Applications – 266
- Dierdorf, Douglas S**  
Firefighting Agent Research, Phase I – 10
- Dietrich, D.**  
Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570
- Dietrich, Erich J**  
Effects of the Global War on Terror on Medical Service Corps Retention Rates – 311
- Dietrich, F. S.**  
Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106
- Dietz, John M**  
Microbial Degradation of Fuel Oxygenates under Aerobic Conditions – 113
- Dietz, William E**  
Simulation and Analysis of Dart Dispense Events with Collisions – 235
- Dillman, III, J F**  
Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379
- Dillman III, James F**  
Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor kB Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling – 388
- DiMarco, J.**  
AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605
- Dimits, A.**  
Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 603
- Dimotakis, Paul E**  
High-Speed Digital-Image Data Acquisition, Processing, and Visualization System for Turbulent Mixing and Combustion – 77
- Ding, Vivanne**  
Midkine Promoter-Driven Adenovirus as Potential Therapy for NF1 – 341
- Dinterman, Richard E**  
Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353
- Diot, Christophe**  
Analysis of Origin Destination Flows (Raw Data) – 521
- Dixon, B.**  
AFCI Storage and Disposal FY-06 Progress Report – 106
- Dixon, H. E.**  
Database Manipulations Using Group Theory – 435
- Djalali, C.**  
Implementation of the Polarized HD Target at the Thomas Jefferson National Accelerator. Reporting Period for January 1, 2002 to December 31, 2006 – 583
- D'Mello, Santosh R**  
Molecular Analysis of Neurotoxin-Induced Apoptosis – 323
- Dobner, Paul**  
Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – 352
- Dodd, Lorraine**  
From Simple Prescriptive to Complex Descriptive Models: An Example from a Recent Command Decision Experiment – 147
- Dodd, Marylin**  
Exploring Early Detection Methods: Using the Intraductal Approach to Predict Breast Cancer – 326
- Doerr, Harold K.**  
Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415
- Doesch, Curt**  
Army Fire Support Investment Framework – 472
- Doherty, Kevin J**  
Titanium Brazing for Structures and Survivability – 120
- Dolbec, Michael R**  
Velocity Estimation Using Forward Looking Sonar – 463
- Dolev, Shlomi**  
Autonomous Virtual Mobile Nodes – 535  
Self-Stabilizing Mobile Node Location Management and Message – 511  
Virtual Stationary Automata for Mobile Networks – 536
- Doll, William**  
Evaluation of airborne Electromagnetic Systems for Detection and Characterization of unexploded ordnance (uXo) – 12
- Dolmatov, Valerii**  
Detonation Nanodiamonds and Related Materials. Bibliography Index, Issue 1 – 102
- Doman, David B**  
A Method for Including Control Effector Interactions in the Control Allocation Problem (Preprint) – 461

- Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – [48](#)
- Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – [21](#)
- Domasky, Scott P**  
Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – [31](#)
- Dombrock, Ryan M**  
Automating the Shadow Method for Aerosol Optical Depth Retrieval – [462](#)
- Donelan, M A**  
Microphysics of Air-Sea Exchanges – [274](#)
- Dong, Feng**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – [395](#)
- Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – [385](#)
- Dong, Yan**  
GKLF as a Novel Target in Selenium Chemoprevention of Prostate Cancer – [361](#)
- Donoghue, Daniel J**  
FGFR4 Downregulation of Cell Adhesion in Prostate Cancer – [376](#)
- Doolittle, L.**  
Fermi Timing and Synchronization System – [605](#)
- Doran, Karen**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – [321](#)
- Dordick, J.**  
High Throughput Screening of Potential Displacer Molecules – [73](#)
- Dore, Steve**  
Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – [227](#)
- Dorion, Eric**  
Information Engineering in Support of Multilateral Joint Operational Interoperability – [611](#)
- Dorofee, Audrey**  
Executive Overview of SEI MOSAIC: Managing for Success Using a Risk-Based Approach – [545](#)
- Incident Management Capability Metrics Version 0.1 – [482](#)
- d'Ortenzio, Fabrizio**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – [279](#)
- Doschek, George A**  
Naval Research Laboratory Space Science Division Newsletter: 01/2007 – [669](#)
- Dossey, T.**  
Preliminary Findings from Noise Testing on PFC Pavements in Texas – [260](#)
- Research Plan for Measuring Noise Levels in Highway Pavements in Texas – [259](#)
- Doty, Pete**  
Solutions Analysis for Helicopter Brownout – [33](#)
- Dougherty, T. J.**  
Battery System – [246](#)
- Doumo, Ogobara K**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – [400](#)
- Doupe, Cole**  
Fully Reusable Access to Space Technology (FAST) Methane Rocket – [46](#)
- Downard, Ian**  
Cooperative Multi-Agent Systems in Mobile Ad Hoc Networks – [495](#)
- Downer, Charles W**  
A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California – [221](#)
- Doxsey, Stephen J**  
Centrosome-Based Mechanisms, Prognostics and Therapeutics in Prostate Cancer – [345](#)
- Doxzon, Bryce F**  
Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – [373](#)
- Doyle, Charles**  
Libraries and the USA PATRIOT Act – [635](#)
- National Security Letters in Foreign Intelligence Investigations: A Glimpse of the Legal Background and Recent Amendments – [633](#)
- National Security Letters in Foreign Intelligence Investigations: Legal Background and Recent Amendments – [634](#)
- Privacy: An Abbreviated Outline of Federal Statutes Governing Wiretapping and Electronic Eavesdropping – [156](#)
- The USA PATRIOT Act: A Legal Analysis – [638](#)
- The USA PATRIOT Act: A Sketch – [633](#)
- Drafahl, Kristine A**  
FGFR4 Downregulation of Cell Adhesion in Prostate Cancer – [376](#)
- Drago, Raymond J.**  
High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction – [35](#)
- Drake, David L**  
Web Enabling HLA Compliant Simulations to Support Network Centric Applications – [444](#)
- Drake, Gregory**  
Alkene- and Alkyne- Substituted Methylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – [100](#)
- Drake, S K**  
Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – [308](#)
- Dresher, Daniel**  
Assured Reference Technology Research (ARTHR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – [596](#)
- Drewes, J. A.**  
Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – [438](#)
- Dreyer, Jason T**  
A Model for Predicting Intelligibility of Binaurally Perceived Speech – [153](#)
- Druker, Brian J**  
Mechanisms of Disease Persistence in Chronic Myelogenous Leukemia (CML) – [318](#)
- Drummond, John**  
Quality of Service Behavioral Model From Event Trace Analysis – [166](#)
- Drusinsky, Doron**  
Experiments with the Sun Java Real-Time System -- Part 2 – [466](#)
- D'Spain, Gerald L**  
Characterization of VSW Environment for UUV-N Operations – [214](#)
- Dube, Real**  
The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective – [621](#)
- DuBois, Terry**  
Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – [249](#)
- DuBose, D A**  
Hypothermia Induction and Recovery in Free-Ranging Rats – [409](#)
- Ducey, Roch**  
Proceedings of the 1st Army Installation Energy Security and Independence Conference – [245](#)
- Duchow, Erin M**  
High-Speed/-Hypersonic-Weapon-Development-Tool Integration – [22](#)
- Duffy, LorRaine**  
A Model of Tactical Battle Rhythm – [170](#)
- Distributed Computing and Collaboration Framework (DCCF) – [466](#)

- Dukovich, John A**  
Stochastic Lanchester Air-To-Air Campaign Model: Methods Used to Generate Model Outputs and a User's Guide: 2007 – 527
- Dumaras, P.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Dumesic, J. A.**  
Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – 105
- Dumonteil, Romain**  
Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – 505
- Dunaway, John**  
Human Systems Integration Assessment of Network Centric Command and Control – 421
- Duncan, David**  
Rapid Runway Repair (RRR): An Optimization for Minimum Operating Strip (MOS) Selection – 45
- Duncan, K**  
Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398
- Duncomb, Robert**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Dunn, J.**  
High Efficiency Grazing Incidence Pumped X ray Laser – 601  
Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry – 603
- Dunn, S S**  
IHPRT Improvements to the Solid Performance Program (SPP) – 542
- Durbano, Steven**  
Network-Centric Applications and Tactical Networks – 173
- Durrenberger, D.**  
Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 255
- Dutta, Sheetij**  
Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379
- Dutton, Rollie E**  
Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint) – 92
- Dyson, Mark**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Dyson, Peter L**  
Inversion of Ionospheric Backscatter Radar Data in Order to Map and Model the Ionosphere – 260
- Dzenis, Y A**  
Novel Continuous Carbon Nanofibers for the Next Generation Lightweight Structural Nanocomposites – 112
- Eapen, Kalathil C**  
Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – 591
- Eastman, L F**  
Pyroelectric AlGaIn/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 96
- Ebbage, Louise**  
Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – 422
- Ebeling, Robert M**  
Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions – 265
- Ebert, David S**  
Task Adaptable Display of Information for Training, Maintenance, and Emergency Response – 654
- Eblen, Brian S**  
Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403
- Echevarria, Carlos**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX- (Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- Echevarria, Juan**  
Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386
- Echeverria, D.**  
Towards Multi Level Optimization. Space Mapping and Manifold Mapping – 433
- Echols, Robert**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Eckermann, Stephen D**  
On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263
- Eckhause, Jeremy M**  
Stochastic Lanchester Air-To-Air Campaign Model: Methods Used to Generate Model Outputs and a User's Guide: 2007 – 527
- Eden, J.**  
Closed Orbit Distortion and the Beam-Beam Interaction – 556
- Eden, Timothy J**  
Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99
- Edis, T.**  
Stratospheric Relaxation in IMPACTs Radiation Code – 275
- Edlund, C.**  
Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – 256
- Edwards, A H**  
On the Importance of Atomic Packing in Determining Dielectric Permittivities – 553
- Edwards, R. G.**  
National Software Infrastructure for Lattice Quantum Chromodynamics – 581
- Edwards, S**  
Standard-Cell, Open-Architecture Power Conversion Systems – 247
- Eggert, J. H.**  
Creating the Core Conditions of Extra-Solar and Solar Giant Planets – 672
- Eggleston, Robert G**  
Using Work-Centered Support System Technology to Enhance Command and Control – 488
- Egolfopoulos, Fokion N**  
Experimental and Detailed Numerical Studies of Fundamental Flame Properties of Gaseous and Liquid Fuels – 37
- Eklund, Neil**  
Prognostic Fusion for Uncertainty Reduction – 35
- Elbaum, D.**  
Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115
- Elfresh, M. W.**  
Radiation Damage Effects on the Magnetic Properties of Pu(1-x)Am(x) (x=0.224) – 562
- El-Ghoreb, Nemat**  
Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379
- Elias, Bart**  
Homeland Security: Protecting Airspace in the National Capital Region – 25
- Elias, J H**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226
- Elias, J**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592

- Elim, Hendry I**  
Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorenocarbonyl Methano[60]Fullerene Pentaads – 87
- Elkin, Michael**  
Involvement and Regulation of Heparanase in Prostate Cancer Progression – 318
- Elledge, Stephen J**  
Genomic Approaches for Detection and Treatment of Breast Cancer – 346
- Elliot, Cathy**  
Russian and Chinese Information Warfare: Theory and Practice – 628
- Elliot, Linda R**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459
- Elliott, Greg**  
Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – 216
- Elliott, Linda R**  
Distributed Command and Control Research: Networking Multiple Simulation Platforms – 495  
  
Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – 166  
  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- Elliott, Linda**  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503  
  
Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts) – 411
- Ellis, M. D.**  
Method, System and Device for Microscopic Examination Employing Fibre-Prepared Sample Grasping Element – 206
- Elson, Jeremy E**  
Time Synchronization in Wireless Sensor Networks – 164
- Elzey, Sherrie**  
Pentazole-Based Energetic Ionic Liquids: A Computational Study (Preprint) – 97
- Emami, Kamal**  
Utility of DF-1 for Radioprotection in Lymphocytes – 420
- Emmerman, Philip J**  
Focused Knowledge to the Warfighter – 617
- Endicott, George**  
C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security – 629
- C2 Interoperability: Simulation, Architecture and Information Security – 642
- Engelfried, J.**  
SELEX: Recent Progress in the Analysis of Charm-Strange and Double-Charm Baryons – 557
- Englehart, Michael**  
The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314
- English, Allan**  
Using the Command and Control Framework to Analyse Command Challenges – 151
- English, Ralph**  
A Modular, Scalable, Architecture for Unmanned Vehicles – 547
- Enlow, Mark A**  
Firefighting Agent Research, Phase I – 10
- Entin, Elliot E**  
When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141  
  
When Do Organizations Need to Change (Part II)? Incongruence in Action – 140
- Epstein, Judith E**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Erbacher, John K**  
Aircraft Battery Design Concept for Improved Ultra Low Temperature Performance (Postprint) – 17
- Erdman, Susan E**  
Are Anti-Inflammatory Lymphocytes Able to Induce Remission of Breast Cancer. Addendum – 364
- Eriksson, H.**  
Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – 256
- Erlich, Henry A**  
Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285
- Ernest, Richard D**  
Application of the Community Radiative Transfer Model to Evaluate Satellite-Based Measurements Across the African Easterly Jet Over Western Africa – 47
- Erricolo, Danilo**  
Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – 195
- Ervin, Matthew F**  
Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114
- Escher, J. E.**  
LDRD Final Report: Surrogate Nuclear Reactions and the Origin of the Heavy Elements (04-ERD-057) – 563  
  
Theory of (3He alpha) Surrogate Reactions for Deformed Uranium Nuclei – 582
- Escubedo, Edward F.**  
An Enterprise Solution for Biometric Authentication and Identification – 473
- Esken, Robert L**  
A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37
- Esperanza, Christine**  
3-Dimensional Crack Growth Behavior of Turbine Engine Materials (Preprint) – 555
- Essigmann, John M**  
Development of Novel Bifunctional Compounds that Induce Apoptosis in Prostate Cancer Cells – 365
- Estephan, Habib**  
Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224
- Esteve, Francisco J**  
Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers – 322
- Estrada, Arthur**  
Preliminary Assessment of Stroboscopic Shutter Glasses on Motion Sickness in Helicopter Passengers – 30
- Etyemezian, V. R.**  
Southern Nevada Air Quality Study – 236
- Eure, Kenneth W.**  
Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 3
- Evans, III, Carl P**  
Development of a Geospatial Data-Sharing Method for Unmanned Vehicles Based on the Joint Architecture for Unmanned Systems (JAUS) – 662
- Evans, J. E.**  
Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR) – 276
- Evans, J. W.**  
High Contrast Imaging Using Adaptive Optics for Extrasolar Planet Detection – 666
- Evans, Jack R**  
A Verification of Optical Depth Retrievals From High Resolution Satellite Imagery – 225

- Evans, K. J.**  
Crevice Repassivation Potentials for Alloy 22 in Simulated Concentrated Ground Waters – 119
- Evans, R H**  
Microphysics of Air-Sea Exchanges – 274
- Evans, Roger**  
Software to Generate 3-Dimensional Displays of Inverse Synthetic aperture Radar Data – 455
- Evers, Johnny H**  
A Comparison of Trajectory Determination Approaches for Small UAVs – 11
- Ewing, Daniel F**  
Cross-Serotype Neutralization of Dengue Virus in *Aotus nancymae* Monkeys – 387
- Eylon, S.**  
Overview of the Pulse Line Ion Accelerator – 577
- Eyzaguirre, Lindsay M**  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- Facchetti, A.**  
Perylene N-Type Semiconductors and Related Devices – 205
- Faisal, Indra**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Falconi, Eduardo**  
Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium falciparum Malaria in Peru – 380
- Falvo, Michael**  
Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale – 188
- Famely, J**  
Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – 251
- Fang, X.**  
Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – 276
- Farber, D. L.**  
Thermal Diffusivity and Conductivity Measurements in Diamond Anvil Cells – 561
- Farfan, E. B.**  
Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – 255
- Farmer, J. C.**  
Corrosion Resistance of Structural Amorphous Metal – 104
- Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe<sub>48</sub>Mo<sub>14</sub>Cr<sub>15</sub>Y<sub>2</sub>C<sub>15</sub>B<sub>6</sub> and W-Containing Variants – 69
- X ray Diffraction Techniques for Structural Determination of Amorphous Materials – 69
- Farmer, J.**  
Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe<sub>48</sub>Mo<sub>14</sub>Cr<sub>15</sub>Y<sub>2</sub>C<sub>15</sub>B<sub>6</sub> and Variants – 107
- High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe<sub>49.7</sub>Cr<sub>17.7</sub>Mn<sub>1.9</sub>Mo<sub>7.4</sub>W<sub>1.6</sub>B<sub>15.2</sub>C<sub>3.8</sub>Si<sub>2.4</sub> – 107
- Farrington, Dewey L**  
Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186
- Fast, L.**  
Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments – 205
- Fay, Anne M**  
Taiwan - AFOSR Nanoscience Initiative Status – 198
- Fechner, P.**  
Self-Aligned Body Tie for a Partially Depletion SOI Device Structure – 201
- Fedder, Gary K**  
Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope – 140
- Fedorov, Alexander V**  
Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – 518
- Feinberg, B.**  
New Strategic Plan Takes the ALS into the Future – 576
- Feiveson, Alan H.**  
Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676
- Feldman, G.**  
Proposal to Upgrade the MIPP Experiment – 563
- Feldman, Philip G**  
The GeoGraph 3D Computational Laboratory – 538
- Feldmann, Friederike**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331
- Feldmann, Heinz**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331
- Felliccia, V. L.**  
Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115
- Felices, Vidal**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404
- Felisa, M**  
Integrated Stereo Infrared and Color Human Detection on the ART platform – 226
- Feltovich, Nick**  
The Control of Multi-Agent Systems (MAS) – 609
- Feng, X. M.**  
Microbial Dynamics during Barley Tempeh Fermentation – 104
- Fenstermacher, M. E.**  
Visible and Infrared Optical Design for the ITER Upper Ports – 599
- Fenton, Matthew J**  
Murine Macrophages Kill the Vegetative Form of *Bacillus anthracis* – 394
- Ferguson, Ronald W**  
Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666
- Towards a Computational Model of Sketching – 450
- Fernandez, D.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Fernandez, Richard**  
Secure Enterprise Access Control (SEAC) Role Based Access Control (RBAC) – 483
- Fernandez, S. M.**  
Electro-Optic Array Interface – 213
- Fernandez-Vina, Marcelo A**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Fernando, Raymond**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Fernsler, R F**  
On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – 551



- Ferrandiz, J M**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – [665](#)
- Fewell, Matthew**  
The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – [625](#)
- Fewell, Suzanne**  
Evaluation of Organisational Interoperability in a Network Centric Warfare Environment – [146](#)  
  
Organisational Interoperability: Evaluation and Further Development of the OIM Model – [651](#)
- Fey, A L**  
Relativistic Jets in the Radio Reference Frame Image Database. 1. Apparent Speeds From the First 5 Years of Data – [670](#)  
  
The Status and Future of the ICRF – [665](#)
- Fiegel, Gregg**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – [193](#)
- Fienga, A**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – [665](#)
- Fierlinger, P.**  
Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – [582](#)
- Figliola, Patricia M**  
The Federal Networking and Information Technology Research and Development Program: Funding Issues and Activities – [480](#)
- Filipovich, Alexandra H**  
National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – [397](#)
- Finley, Dennis**  
Relaxed Fidelity CFD Methods Applied to Store Separation Problems – [5](#)
- Florentini, Lisa**  
Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – [21](#)
- Firkin, Eric C**  
Network Centric Warfare for Coalition Integrated Defense Against Terrorism – [165](#)
- Fischer, Joe**  
Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – [166](#)
- Fisher, David A**  
A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – [478](#)  
  
Conditions for Achieving Network-Centric Operations in Systems of Systems – [465](#)
- Fisher, George H**  
Understanding Magnetic Eruptions in the Sun and Their Interplanetary Consequences – [667](#)
- Fisher, R. A.**  
Reconfigurable Linear Sensor Arrays for Reduced Channel Count – [208](#)
- Fisher, S**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – [592](#)
- Fishman, M.**  
Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States – [439](#)
- Fitsos, P. J.**  
High-Energy Neutron Imaging Development at LLNL – [567](#)
- Fitzgerald, Dennis**  
A Distributed Parallel Processing System for Command and Control Imagery – [466](#)
- Fitzpatrick, Helen M**  
Partnerships: The Path to Improving Crisis Communication – [156](#)
- Fivelman, Quinton L**  
The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – [401](#)
- Flanagan, Richard**  
Eyekon: Distributed Augmented Reality for Soldier Teams – [655](#)
- Flatte, M E**  
Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – [102](#)
- Fleeger, J. W.**  
Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – [78](#)
- Fleischmann, H H**  
Interaction of Intense Electron Beams with Plasma – [582](#)
- Fleix, A. M.**  
Chiral Multichromic Single Crystals for Optical Devices – [580](#)
- Flinn, Andrew**  
An Open Architecture Approach to Network Enabled Capability – [656](#)
- Flint, A. L.**  
Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – [273](#)
- Flint Jr , G T**  
Constraints on JP-900 Jet Fuel Production Concepts – [128](#)
- Flint, Matthew**  
Decentralized Control Using Global Optimization (DCGO) (Preprint) – [495](#)
- Florens, Laurence**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – [388](#)
- Flores, W**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – [403](#)
- Flory, John**  
Capability Based Resourcing for DPEM – [9](#)
- Flourncy, W S**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – [395](#)
- Flournoy, William S**  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – [385](#)
- Fluss, M. J.**  
Radiation Damage Effects on the Magnetic Properties of Pu(1-x)Am(x) (x=0.224) – [562](#)
- Flynn, Aaron M**  
Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety and Regulation – [129](#)
- Flynn, Barbara J**  
HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – [397](#)
- Flynn, John E**  
Joint and Allied Logistics Opportunities and Tools Supporting 21st Century War Fighter Rapid Decisive Operations – [149](#)
- Flynn, John P**  
Terrorism Information Management Within the New York City Fire Department: Past, Present and Future – [634](#)
- Fofanov, Yurly**  
Tools for Ultraspecific Probe/Primer Design – [327](#)
- Fogarty, Ryan**  
Real-Time Sonar Beamforming on High-Performance Distributed Computers – [596](#)

- Folchi, John S**  
RIDE vs. CLASP Comparison and Evaluation: Models and Parameters – 662
- Foley, M.**  
Eddy Current Scanning of Niobium for SRF Cavities at Fermilab – 565
- Foley, Tico**  
Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425
- Follo, P.**  
Pilot Study: Parasitic and Passive Radar – 179
- Fomin, Pavel**  
Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249  
Smart Fuel Cell C20-MP Hybrid Fuel Cell Power Source – 249
- Fong, Moira T**  
A GSSHA Model of the Perris Basin of the San Jacinto River Watershed, Riverside County, California – 221
- Fonti, Jr, Mark A**  
Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31
- Foore, Larry**  
A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – 189
- Forbus, Kenneth D**  
AI on the Battlefield: An Experimental Exploration (Preprint) – 501  
Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666  
Introducing Actions into Qualitative Simulation – 499  
The Logic of Occurrence – 500  
Towards a Computational Model of Sketching – 450
- Forester, Joan**  
Identifying Battlefield Metrics Through Experimentation – 158
- Forney, J R**  
Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392  
White Blood Cell Counts and Malaria – 400
- Forrester, W T**  
On the Relationship of SAPS to Storm-Enhanced Density – 263
- Forsberg, K.**  
Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – 109
- Forster, Ellen E**  
Federally Sponsored Health Care Research Gulf War Illnesses and Beyond – 400
- Forster, Richard A**  
Army and Air Force Transformation - Are They Synchronized? – 157
- Fortkamp, U.**  
Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – 109
- Fortson, Jr, Larry W**  
Towards the Development of a Defensive Cyber Damage and Mission Impact Methodology – 641
- Fosness, Eugene R**  
Payload Isolation System for Launch Vehicles – 54
- Foster, Dean C**  
Decks for Rapid Runway Mat Application (Postprint) – 45
- Foster, J C**  
On the Relationship of SAPS to Storm-Enhanced Density – 263
- Fouad, Salwa**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375
- Foulkes, William**  
Locating a Prostate Cancer Susceptibility Gene on the X Chromosome by Linkage Disequilibrium Mapping Using Three Founder Populations in Quebec and Switzerland – 352
- Fountain, Darrell D**  
Knowledge Management in an Information Age Army – 547
- Fournier, Adam**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Fournier, K. B.**  
Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601
- Fox, George E.**  
Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – 675
- Fox, J. D.**  
Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 580
- Francis, Paul**  
Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426
- Franck, C. P.**  
Liquid Mixing Reactor for Biochemical Assays – 71
- Franco, G.**  
Climate Change Impacts and Adaptation in California. Staff Paper – 279
- Frank, K. H.**  
Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – 240
- Frankart, Carla**  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396
- Franklin, Diana**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Franklin, Jude E**  
S&T Implications for Net Centric Operations – 611
- Frantz, Albert G**  
Link Analysis for Dynamic Planning and Scheduling – 502
- Franzon, J.**  
Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments – 205
- Fraser, Daine**  
CANPASS Air/NEXUS Air - Border Clearance in the Blink of an Eye – 476
- Frazer, L N**  
Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261
- Freed, Tali**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Freeman, Jared**  
Collaborative Critical Thinking – 148  
Performance Measurement for Diagnosing and Debriefing Distributed Command and Control Teams – 150
- Freeman, Michael R**  
DRF3 as a Cholesterol-Dependent Regulator of Src in Prostate Cancer – 315
- Freeman, Reed B**  
Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – 45
- Fregly, B J**  
A Parallel Particle Swarm Optimizer – 533  
Parallel Global Optimization with the Particle Swarm Algorithm (Preprint) – 533  
Scale-Independent Biomechanical Optimization – 521
- Fregly, Benjamin J**  
Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – 511

- Freilich, Daniel A**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Freilich, Daniel**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395
- Freitag, Thomas A**  
The Independent Readiness Team (IRRT) of SMC – 49
- French, Geoffrey S**  
Building a Deterrence Policy Against Strategic Information Warfare – 654
- French, James C**  
Comparing the Performance of Collection Selection Algorithms – 613
- Freneck ,Jr , Robert W**  
Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379
- Freneck, Robert W**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396  
Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385
- Frensley, William R**  
Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186
- Friedlander, Arthur M**  
Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335
- Friedman, A.**  
Overview of Theory and Simulations in the Heavy Ion Fusion Science Virtual National Laboratory – 559  
Self-Consistent Simulations of High-Intensity Beams and E-Clouds with WARP POSINST – 568
- Friedmann, T. A.**  
Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems – 204
- Fries, E. F.**  
Technology Review of Smart Sensors with Wireless Networks for Applications in Hazardous Work Environments – 168
- Fries-Carr, Sandra**  
Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – 91
- Frisk, G**  
Center for Coastline Security Technology, Year-2 – 228
- Fritz, David**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335
- Fritz, Elizabeth A**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330
- Froelind, P. O.**  
Pilot Study: Parasitic and Passive Radar – 179
- Frolov, Sergi M**  
Confined Detonations and Pulse Detonation Engines – 42
- Frost, John W**  
Large Scale Green Synthesis of 1,2,4-Butanetriol – 66
- Fu, Thomas C**  
A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 515
- Fu, Thomas K**  
A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 515
- Fukushima, T**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – 665
- Fuller, Claudette L**  
Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332
- Fullerton, Anne M**  
A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 515
- Fullerton, Kathy L**  
A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37
- Fultz, George W**  
Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – 123
- Funk, Stuart D**  
Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243
- Fuqua, P D**  
Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54
- Furht, Borko**  
Center for Coastline Security Technology, Year-2 – 228
- Furlow, John S**  
Parametric Dynamic Load Prediction of a Narrow Gauge Rocket Sled – 135
- Furman, M.**  
Closed Orbit Distortion and the Beam-Beam Interaction – 556
- Furness, Zach**  
C4I-Simulation Interoperability Using the DII COE and HLA – 468  
Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461
- Gagliardi, R. M.**  
Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) – 177
- Gaherty, James**  
Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – 262
- Gahm, Gregory**  
Automating Behavioral Health Screening - Addressing Risk Communication Electronically – 306
- Gaillard, J. B.**  
Novel Synthesis of Branched Carbon Nanotubes – 207
- Galayda, J. N.**  
X-Ray Absorption Edge Detector for High-Resolution Measurement of Undulator Effective K-Parameter – 577
- Galdorisi, George**  
Analysis of Network-Enabled ASW Concepts of Operation – 529  
Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel – 424  
Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590
- Gallagher, D. W.**  
Enhanced Aircraft Conspicuity to Reduce Runway Incursions – 13
- Gallas, Quentin**  
Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215  
Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551  
Optimization of Synthetic Jet Actuators – 235
- Gallegos, G.**  
AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – 254
- Galloway, Darrell R**  
Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – 386
- Galluzzo, Thomas C**  
Simultaneous Planning and Control for Autonomous Ground Vehicles – 507

- Galyaev, E.**  
Inclusive high-p(T)b anti-b Cross Section Measurement at s \*\* (1/2) Equals 1.96 TeV – 560
- Gamble, Christopher S**  
Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340  
  
The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402
- Gamey, T J**  
Evaluation of airborne Electromagnetic Systems for Detection and Characterization of unexploded ordnance (uXo) – 12
- Gamiz, Victor L**  
Coherence and Polarization Properties of Far Fields Generated by Quasi-Homogeneous Planar Electromagnetic Sources (Postprint) – 602  
  
Coherence Solution for Bidirectional Reflectance of Surfaces with Wavelength-Scale Statistics (Postprint) – 528
- Ganger, Robert**  
Automated Information Extraction System (AIES) Capability Enhancement and Support – 614
- Ganguli, Gurudas**  
Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates – 513  
  
Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere – 261
- Ganguli, Sabyasachi**  
Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81
- Gao, Ji-Liang**  
Human Platelets Exhibit Chemotaxis using Functional N-Formyl Peptide Receptors – 386
- Garber, P M**  
Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192
- Garcia-Luna-Aceves, J J**  
A Distributed Approach for Multi-Constrained Path Selection and Routing Optimization – 640  
  
Channel Hopping Multiple Access with Packet Trains for Ad Hoc Networks – 161
- Gardener, Tim**  
Modelling a Network of Decision Makers – 610
- Gardiner, K.**  
Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States – 439
- Gardiner, Robert**  
Development of a Novel, Non-Invasive Diagnostic Test for Prostate Cancer – 284
- Gardner, Lori**  
Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 336
- Garland, L**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339
- Garrambone, Michael**  
Experimentation with Evolving C2 Operation Centers - Implications for the Human Element – 137
- Garraway, Isla**  
Development of a Mouse Model for Prostate Cancer Imaging and Study of Disease Progression – 321
- Garrett, Lamar**  
Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSS) on Speech Communication: Talk-Through Systems – 630
- Garvey, John**  
Air Force-Navy Team Achieves Important Flight Test Milestone for Responsive Space Lift – 50
- Gasbarre, Joseph F.**  
Thermal Modeling of the Mars Reconnaissance Orbiter's Solar Panel and Instruments during Aerobraking – 59
- Gash, A.**  
Stab Sensitivity of Energetic Nanolaminates – 84
- Gasser, Jr , Robert A**  
Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392  
  
White Blood Cell Counts and Malaria – 400
- Gassier, David**  
Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – 505
- Gatchel, Robert**  
A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 332
- Gateau, James**  
Extending Simple Network Management Protocol (SNMP) Beyond Network Management: A MIB Architecture for Network-Centric Services – 490
- Gaudiano, Paolo**  
Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 537
- Gay, Tanya**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Ge, Hong**  
Cloning and Sequence Analysis of the 22-kDa Antigen Genes of *Orientia tsutsugamushi* Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – 399
- Gedil, M A**  
Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles – 381
- Gehrke, Stevin H**  
Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454
- Geisberger, A.**  
Method, System and Device for Microscopic Examination Employing Fibre-Prepared Sample Grasping Element – 206  
  
Microconnectors and Non-Powered Microassembly Therewith – 202
- Geisbert, Joan B**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331  
  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330
- Geisbert, Thomas W**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331  
  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330
- Geist, Steve**  
Mediators in Infrastructure Survivability Enhancement – 449
- Gelder, L. F.**  
Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – 59
- Genovese, Samuel**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Gentili, Bernard**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Gentner, Dedre**  
Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666
- George, A D**  
A Distributed Parallel Embedded System for Autonomous Sonar Arrays – 450

- A Multiservice Switch for Advanced Avionics Data Networks – 42
- A Parallel Particle Swarm Optimizer – 533
- Parallel Global Optimization with the Particle Swarm Algorithm (Preprint) – 533
- George, A**  
 Multicast Performance Analysis for High-Speed Torus Networks – 484
- Scale-Independent Biomechanical Optimization – 521
- George, Alan D**  
 Adaptive Sampling for Network Management – 485
- Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – 448
- Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – 511
- Fault Tolerance in Autonomous Acoustic Arrays – 185
- Fault-Tolerant Parallel Algorithms for Adaptive Matched-Field Processing on Distributed Array Systems – 509
- Parallel Simulation of Chip-Multiprocessor Architectures – 447
- Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448
- Real-Time Sonar Beamforming on High-Performance Distributed Computers – 596
- George, T.**  
 Operational Aspects of Space Radiation Analysis – 676
- Gereben Schaefer, Agnes**  
 Hurricane Katrina: Lessons for Army Planning and Operations – 163
- Geri, George A**  
 Visual Simulation S&T: Summary of Accomplishments – 7
- Gershman, V**  
 A Multiservice Switch for Advanced Avionics Data Networks – 42
- Getino, J**  
 Progress Report of the IAU Working Group on Precession and the Ecliptic – 665
- Gettayacamin, Montip**  
 Establishment of a Non-human Primate *Campylobacter* Disease Model for the Pre-clinical Evaluation of *Campylobacter* Vaccine Formulations – 396
- Ghanmi, Ahmed**  
 Workforce Configuration of a Canadian Forces Gematics Division – 539
- Ghidoni, S**  
 Integrated Stereo Infrared and Color Human Detection on the ART platform – 226
- Ghose, S.**  
 Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83
- Ghosh, Rita**  
 Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 336
- Ghoshal, Sudipto**  
 PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498
- Gianella, Alberto**  
 Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Giaya, Arjan**  
 Nanoengineered Additives for Active Coatings – 61
- Gibb, S R**  
 Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95
- Gibb, S**  
 GaN Wide Band Power Integrated Circuits (Preprint) – 95
- Gibbard, S.**  
 Adaptive Optics Views of the Hubble Deep Fields Final Report on LLNL LDRD Project 03-ERD-002 – 672
- Gibson, D.**  
 Nuclear Photo-Science and Applications with T-Rex Sources – 562
- Giffin, Ralph E**  
 A Woven Web of Guesses – 538
- Gifford, Andrew R.**  
 Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237
- Gilardi, Richard D**  
 A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125
- Gilbert, David**  
 Electronically Induced Redox Barriers for Treatment of Groundwater – 198
- Gilbert, Seth**  
 Autonomous Virtual Mobile Nodes – 535
- Virtual Stationary Automata for Mobile Networks – 536
- Gillless, J. K.**  
 Climate Change Impact on Forest Resources. White Paper – 277
- Gilliard, Jr, Richard**  
 Steps Towards Determining the Right Number of Dental Recruits the Navy Should Access to Meet the Projected Targets for Navy Dental Corps Officers – 311
- Gillis, Jennifer**  
 Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597
- Gimpel, T. L.**  
 Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – 584
- Ginsberg, M. L.**  
 Database Manipulations Using Group Theory – 435
- Giraldo, Francis X**  
 High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations – 526
- Gjersing, E. L.**  
 Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – 67
- Glaser, Sally L**  
 Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285
- Glass, R. S.**  
 Impedance Analysis of Electrochemical NOx Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247
- Glassman, Robert**  
 Incident, Action, Recovery, and Re-commissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – 202
- Glavatska, Nadiia I**  
 High Temperature Magnetic Shape Memory Ni-Mn-Ga Alloys for a New Class of Actuators and Sensor – 119
- Glegg, Stewart**  
 Center for Coastline Security Technology, Year-2 – 228
- Glenn, William**  
 Center for Coastline Security Technology, Year-2 – 228
- Glide, Gary A**  
 Titanium Brazing for Structures and Survivability – 120
- Glinn, S. M.**  
 Double Near-Net Forging of Article – 41
- Glosser, A.**  
 Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States – 439
- Gluck, Kevin A**  
 Knowledge Tracing and Prediction of Future Trainee Performance – 531
- Glumac, Nick**  
 Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – 216
- Glumm, Monica M**  
 Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153
- Gnoffo, Peter A.**  
 Simulation of Stagnation Region Heating in Hypersonic Flow on Tetrahedral Grids – 430

- Goddard, III, William A**  
Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454
- Goddard, III, William A**  
Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92
- Godwin, Keith A**  
The DoD Architecture Framework Views as Requirements Vehicles in a Model Driven Architecture Systems Development Process – 496
- Goebel, Kai**  
Prognostic Fusion for Uncertainty Reduction – 35
- Goerz, D. A.**  
Electrostatic Modeling of Vacuum Insulator Triple Junctions – 205  
Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses – 203
- Goh, Han C**  
Intrusion Deception in Defense of Computer Systems – 462
- Golas, Katharine C**  
The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8
- Goldberg, D. E.**  
Methods and Program Products for Optimizing Problem Clustering – 435
- Goldberg, K. A.**  
Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool – 600
- Goldberg, K.**  
EUV Inspection of Reticle Defect Repair Sites – 599
- Goldman, R**  
Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308
- Goldman, Scott M**  
Relationship of Complexity Factor Ratings With Operational Errors – 513
- Gollery, Steven**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Gomez, Francisco**  
Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261
- Gomez, Reynaldo J.**  
Probabilistic Modeling of Space Shuttle Debris Impact – 58
- Gonda, S. R.**  
Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations – 370
- Gonzales, Daniel**  
Measuring the Value of High Level Fusion – 608
- Gonzalez, Damian M**  
Performance Modeling and Evaluation of Topologies for Low-Latency SCI Systems – 448
- Gonzalez, J**  
Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398
- Gonzalez, L.**  
Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 255
- Go, Young A**  
Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy – 316
- Gooch, William A**  
Ballistic Evaluation of Magnesium Alloy AZ31B – 117
- Gooding, James C**  
Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53
- Goodie, Jeffrey**  
A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 332
- Goodman, L**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339
- Goodman, Michael**  
Experimentation with Evolving C2 Operation Centers - Implications for the Human Element – 137
- Goodson, Christopher J**  
Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics – 635
- Goodyear, Chuck**  
A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37
- Gordon, C J**  
Hypothermia Induction and Recovery in Free-Ranging Rats – 409
- Gordon, Donald J**  
Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354
- Gordon, G. R.**  
Assessing Technology, Methods, and Information for Committing and Combating Cyber Crime – 428
- Gordon, Mark S**  
Pentazole-Based Energetic Ionic Liquids: A Computational Study (Preprint) – 97
- Gordon, R W**  
Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft – 583
- Gordon, Thomas R**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- Gordon, Thomas**  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503
- Gorelov, I. V.**  
First Observation of Bottom Baryon Sigma(b) States at CDF – 586
- Goren, Bernard**  
C2 Product-Centric Approach to Transforming Current C4ISR Information Architectures – 612  
Using a Combination of UML, C2RM, XML, and Metadata Registries to Support Long-Term Development/Engineering – 452
- Gori, Ronnie**  
Systems and Capability Relation Management in Defence Systems-of-System Context – 616
- Gorman, M. D.**  
Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65
- Gorrilla, Michael**  
Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52
- Gospodinova, K**  
Relativistic Jets in the Radio Reference Frame Image Database. 1. Apparent Speeds From the First 5 Years of Data – 670
- Goss, Kay C**  
Emergency Preparedness and the Year 2000 Challenge – 443
- Gothard, N. W.**  
Novel Synthesis of Branched Carbon Nanotubes – 207
- Gouin, Denis**  
Coalition CINC 21 - Leading-Edge Information Technologies to Support Coalition Operations – 627
- Gould, Philip**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375
- Gowayed, Y**  
Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122

- Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91
- Gozalo, Alfonso S**  
Cross-Serotype Neutralization of Dengue Virus in Aotus nancymae Monkeys – 387
- Gradi, W.**  
Charmless B Decays – 577
- Grady, Dennis**  
Proceedings of the 1st Army Installation Energy Security and Independence Conference – 245
- Graham, John S**  
Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383  
Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- Gralow, Julie R**  
Modulation of Postmenopausal Steroid Hormone Levels by Phytoestrogens and Correlation with Breast Proliferative Activity and Menopausal Symptoms – 324
- Granata, R**  
Center for Coastline Security Technology, Year-2 – 228
- Granquist-Fraser, Domhnull**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665
- Grant, K.**  
Stratospheric Relaxation in IMPACTs Radiation Code – 275
- Granuzzo, J**  
Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140
- Graziano, Michael**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Grappel, R D**  
Guidance Material for Mode S-Specific Protocol Application Avionics – 37
- Graser, Tom**  
Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452
- Graveline, William R**  
Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426
- Gray, Harry B**  
Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92
- Green, Brian M**  
DNA Damage and Genomic Instability Induced by Inappropriate DNA Replication – 336
- Green, D S**  
GaN Wide Band Power Integrated Circuits (Preprint) – 95  
Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95  
Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192
- Green, D.**  
Human Error Investigation Software Tool (HEIST) – 427
- Green, Tom**  
Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10
- Greenberg, Philip D**  
Developing Models to Facilitate the Appropriate Selection and Effective Targeting of Candidate Antigens for Specific Cellular Immunotherapy of Prostate Cancer – 349
- Greene, Geoffrey L**  
Structural Determination of Certain Novel ER Complexes – 304
- Greenwood, J. A.**  
Massive Metrology: Development and Implementation of a 3D Reference Frame for the Realignment of Fermilab's Tevatron – 606
- Gregg, S. J.**  
Cooled Turbine Airfoil – 42
- Gregory, Timothy C**  
Integration of SATURN System and VGIS – 530
- Grein, Christoph H**  
Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – 102
- Greisler, Howard P**  
Tissue Engineering Research – 307
- Grendahl, Scott**  
Shot-Peening Sensitivity of Aerospace Materials – 5
- Griego, Manuel**  
Solutions Analysis for Helicopter Brownout – 33
- Griffith, D T**  
Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53
- Griffith, Jeffrey K**  
Evaluation of Genomic Instability in the Abnormal Prostate – 405  
Prognostic Significance of Telomere Attrition in Ductal Carcinoma in Situ of the Breast – 390
- Griffith, K N**  
Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- Griffith, Linda**  
Tissue Engineering Research – 307
- Grimshaw, Andrew S**  
Exploiting Data-Flow for Fault-Tolerance in a Wide-Area Parallel System – 447
- Grinfeld, Michael A**  
Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187
- Grivell, Ian**  
The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – 625
- Groen, Herman**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377
- Grolla, Allen**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331
- Grote, D. P.**  
Self-Consistent Simulations of High-Intensity Beams and E-Clouds with WARP POSINST – 568
- Grote, James G**  
Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – 63
- Grote, R. J.**  
Impedance Analysis of Electrochemical NOx Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247
- Groth, M.**  
Visible and Infrared Optical Design for the ITER Upper Ports – 599
- Grubbs, R. H.**  
Telechelic Alkadiene Polymers with Crosslinkable End Groups and Methods for Making the Same – 73
- Gruner, S. V.**  
Assessing Error in PMI (Post-Mortem Interval) Prediction Using a Forensic Entomological Computer Model – 437
- Grynovicki, Jock O**  
Case Study of a Prototype Set of Behaviorally Anchored Rating Scales (BARS) for C2 Assessment – 135
- Grzywacz, Norberto M**  
Next-Generation Image and Sound Processing Strategies: Exploiting the Biological Model – 598
- Gschwender, Lois J**  
Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – 123
- Guan, Jennifer Z**  
A Computer Tool for Modeling C4I Applications – 167
- Guan, Luqi**  
A Computer Tool for Modeling C4I Applications – 167

- Gue, Kevin R**  
Puzzle-Based Storage Systems – 518
- Guelta, Mark A**  
Measurement of Fog Oil Penetration into Model Underground Burrow and Hollow Tree Nest Cavities – 250
- Guenthner, Andrew J**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- Gurry, Patricia**  
Cell-surface Alpha-glucan in *Campylobacter jejuni* 81-176 – 401  
Intracellular Survival of *Campylobacter jejuni* in Human Monocytic Cells and Induction of Apoptotic Death by Cytholethal Distending Toxin – 394  
Mosaic Structure of a Multiple-Drug-Resistant, Conjugative Plasmid from *Campylobacter jejuni* – 407
- Guevel, Pierre**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Guha, S**  
Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – 102
- Guhathakurta, P.**  
All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets – 674
- Gula, R. J.**  
Intrusion and Misuse Deterrence System Employing a Virtual Network – 432
- Guleypoglu, Suleyman**  
Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452
- Gull, Theodore**  
Eta Carinae: Viewed from Multiple Vantage Points – 674
- Gundersen, Martin A**  
A Study of Communicating Science and Engineering – 142
- Gundersen, M**  
Energy Efficient Transient: Plasma Ignition: Physics and Technology – 111
- Gunderson, Stephen L**  
Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – 123
- Gunn, C. A.**  
Far Field Approximation in the Generalized Geometry Holdup (GGH) Model – 581  
Self Attenuation Correction for Holdup Measurements. An Historical Perspective – 581
- Gunter, Dave**  
Estimating Runflat Stiffness – 552
- Gunzelmann, Glenn**  
Knowledge Tracing and Prediction of Future Trainee Performance – 531
- Guo, Tzung-Fang**  
Novel Organic Field Effect Transistors via Nano-Modification – 197
- Guo, Xiaoling**  
10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 190
- Gupta, Deepnarayan**  
Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441
- Gupta, N. K.**  
Improving Thermal Performance of Radioactive Material Drum Type Packages by Using Heat Pipes – 131
- Gupta, Ramesh C**  
Pulmonary Toxicity of Cholinesterase Inhibitors – 382
- Gupta, Rashmi**  
Origin and Properties of Prostatic Stem Cells – 299
- Gupta, Seema**  
Radio-sensitizing Effects of Novel Histone De-Acetylase Inhibitors in Prostate Cancer – 283
- Gurney, Jennifer**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395
- Guruli, Georgi**  
Activation and Protection of Dendritic Cells in the Prostate Cancer Environment – 312
- Gussio, Rick**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330
- Gust, K. A.**  
Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78
- Gutbrod, H.**  
Proposal to Upgrade the MIPP Experiment – 563
- Guthrie, Verner**  
Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – 637
- Gutierrez, Sonia**  
Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – 380
- Haaland-Pullus, Christina**  
Evaluation of Genomic Instability in the Abnormal Prostate – 405
- Haas, C.**  
Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178  
Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183
- Hada, Megumi**  
Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations – 370
- Haddad, Darren H**  
The Matrix Pencil and its Applications to Speech Processing – 589
- Haddad, Timothy S**  
Molecular Structure Analysis of Aminophenyl Silsesquioxane (Preprint) – 97  
Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81
- Haderka, Ondrej**  
Nonclassical Properties of Pulsed Second-Subharmonic Generation in Photonic-Band-Gap Structures – 196
- Hafften, Michael**  
High-Energy Laser Weapon Integration with Ground Vehicles – 234
- Haftka, R T**  
A Parallel Particle Swarm Optimizer – 533  
Parallel Global Optimization with the Particle Swarm Algorithm (Preprint) – 533  
Scale-Independent Biomechanical Optimization – 521
- Haftka, Raphael T**  
Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – 511
- Hagan, R. Donald**  
The Effect of Increasing Mass on Locomotion – 413
- Hagen, Jeff**  
A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620
- Hagen, Josh A**  
Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – 63
- Hagenberger, M. J.**  
Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – 240
- Hagmann, C.**  
Neutron Production by Muon Spallation I: Theory – 571
- Haider, Sajjad**  
An Approximation Technique for Belief Revision in Timed Influence Nets – 520



- Haire, R. G.**  
Radiation Damage Effects on the Magnetic Properties of Pu(1-x)Am(x) (x=0.224) – 562
- Hajdu, J.**  
Ultra Fast Coherent Diffraction Imaging of Single Particles, Clusters and Biomolecules – 572
- Hajian, Arsen R**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665
- Hakim, Iman A**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339
- Hale, L. C.**  
Materials and Fabrication Issues for Large Machined Germanium Immersion Gratings – 575
- Hall, C.**  
Searching for Double Beta Decay with the Enriched Xenon Observatory – 566
- Hall, Eric R**  
Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379
- Hall, Fred**  
Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488
- Hall, J. M.**  
High-Energy Neutron Imaging Development at LLNL – 567
- Hall, J.**  
Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash – 580
- Hall, Leslie**  
Alkene- and Alkyne- Substituted Methyylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – 100
- Hall, Neil**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 388
- Hall, R.**  
Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report – 109
- Halloway, III, Kenneth E**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Halwey, W. G.**  
AFCI Storage and Disposal FY-06 Progress Report – 106
- Hamad-Schifferli, Kimberly**  
Control of DNA Dehybridization via Nanoparticle Antennas for Antisense Gene Therapy – 383
- Hamann, Cathleen**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
- Hamilton, Jr , John A**  
Bilateral Interoperability through Enterprise Architecture – 493  
C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security – 629  
C2 Interoperability: Simulation, Architecture and Information Security – 642
- Hamilton, Tracey A**  
Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383
- Hammett, Mike**  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385
- Hammond, Dianne**  
Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – 417
- Han, Guang**  
A Strong Zero-One Law for Connectivity in One-Dimensional Geometric Random Graphs With Non-Vanishing Densities – 527
- Handley, Holly A**  
Levels of Interoperability in Coalition Systems – 646
- Hanjoong, Jo**  
Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411
- Hanna, James P**  
Modeling the Joint Battlespace Infosphere – 644
- Hannon, Gregory J**  
A MicroRNA Cluster as a Potential Breast Cancer Oncogene – 358  
Detection of Genes Modifying Sensitivity to Proteasome Inhibitors Using a shRNA Library in Breast Cancer – 364
- Hansen, C. L.**  
High Throughput Screening of Crystallization of Materials – 71
- Hansen, Wilhelm A**  
Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243
- Hanson, B**  
Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388
- Hanson, Christopher M**  
Long-Range Operational Military Forecasts for Iraq – 269
- Hanson, James**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Hanssen, Kelly A**  
Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- Harbaugh, Bradley J**  
Freezing Fog Formation in a Supercooled Boundary Layer: Solving the Winter Fog Forecasting Challenge for Elmendorf Air Force Base, Alaska – 270
- Harbell, John W**  
2006 In Vitro Biology Meeting. Volume 42 – 291
- Harder, Adam D**  
Experimental Characterization of Turbulent Flow Around Cylinder Arrays – 219
- Harding, D. J.**  
AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605
- Hardisky, Benjamin**  
Shot-Peening Sensitivity of Aerospace Materials – 5
- Hare, S. R.**  
Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277
- Harfenist, Steven**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Harlor, Debora**  
Coalition Operations with the Combined Enterprise Regional Information Exchange System (CENTRIXS) – 483
- Harmon, Gregory**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631
- Harms, Kelly L**  
Mechanisms of p53-Mediated Apoptosis – 350
- Harn, M**  
Evolution of C4I Systems – 174
- Harnik, R.**  
Predicting the Cosmological Constant from the Causal Entropic Principle – 671
- Harrell, Ryan M**  
A Multivariate Magnitude Robust Control Chart for Mean Shift Detection and Change Point Estimation – 510
- Harriott, L**  
Fabrication of Nanoscaled Systems – 229

- Harris, J. R.**  
Notes on Longitudinal Dynamics in UMER – [568](#)
- Harris, R B**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – [339](#)
- Harshman, R. A.**  
Pattern Analysis of Directed Graphs Using DEDICOM: An Application to Enroll Email – [439](#)
- Hart, Aaron**  
TARDEC National Automotive Center - Selfridge Air National Guard Base – [132](#)
- Hart,**  
Exploiting Adaptive Optics with Deformable Secondary Mirrors – [231](#)
- Hartel, Robert**  
Command and Control Automation - MIP and MSC2 FOSC – [161](#)  
Multinational Interoperability Requirements -- A Core Competency – [645](#)
- Hartemann, F.**  
Nuclear Photo-Science and Applications with T-Rex Sources – [562](#)
- Hartings, Justin M**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – [335](#)
- Hartlage, Robert B**  
An Efficient Metaheuristic for Dynamic Network Design and Message Routing – [617](#)
- Hartman, George A**  
Infrared Damage Detection System (IDDS) for Real-Time, Small-Scale Damage Monitoring – [118](#)
- Hartouni, E.**  
Nuclear Photo-Science and Applications with T-Rex Sources – [562](#)
- Hartanft, Thomas J**  
Proceedings of the 1st Army Installation Energy Security and Independence Conference – [245](#)
- Hartzman, R J**  
Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – [394](#)
- Haslam, J.**  
Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – [69](#)  
Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – [107](#)
- High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe49.7Cr17.7Mn1.9Mo7.4W1.6B15.2C3.8Si2.4 – [107](#)
- Hass, A.**  
Development and Implementation of Noise Analysis Standards for ACSA Airports – [255](#)
- Hass, D D**  
An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems – [60](#)
- Hassan, Sazzad**  
Prostate Cancer Cell Growth: Stimulatory Role of Neurotensin And Mechanism of Inhibition by Flavonoids as Related to Protein Kinase C – [352](#)
- Hatfield, Kirk**  
Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD – [139](#)  
Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – [138](#)  
Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – [138](#)
- Hau, I. D.**  
Superconducting High Resolution Fast-Neutron Spectrometers – [564](#)
- Hauge, Robert H**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – [104](#)
- Haugh, Jason M**  
Integration of Soluble and Adhesive Gradient Signals in Directed Cell Migration – [310](#)
- Hau-Riege, S.**  
Gas Detector LCLS Engineering Specifications Document – [573](#)
- Hauser, P. J.**  
Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – [103](#)
- Havel, Timothy**  
Proceedings of the Quantum Computation for Physical Modeling Workshop 2004. Held in North Falmouth, MA on 12-15 September 2004 – [592](#)
- Hawkiins, Tommy**  
Alkene- and Alkyne- Substituted Methylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – [100](#)
- Hayano, Ryugo S**  
Development of a Charged-Particle Accumulator Using an RF Confinement Method – [593](#)
- Hayano, Ryugo**  
Development of a Charged-particle Accumulator Using an RF Confinement Method II – [591](#)
- Hayat, Mathew**  
Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – [676](#)
- Hayes, James A**  
Evolution of a Mission Plan – [646](#)
- Hayhoe, G. F.**  
Subgrade CBR Values for Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility – [13](#)
- Haynes, J D**  
Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – [379](#)
- Hazard, C. R.**  
Reconfigurable Linear Sensor Arrays for Reduced Channel Count – [208](#)
- Hazen, Mark G**  
The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – [625](#)
- He, Guang S**  
New Generation Photonics Materials: Design, Development, Characterization, and Applications – [210](#)
- He, Linli**  
Modeling Command and Control in Multi-Agent Systems – [452](#)
- Heacox, Nancy J**  
Evolution of a Mission Plan – [646](#)
- Heard, J. T.**  
Development and Manufacture of Cost Effective Composite Drill Pipe. 2006 Annual Technical Progress Report – [84](#)
- Heath, Bradley**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – [184](#)
- Heath, J. R.**  
Superlattice Nanopatterning of Wires and Complex Patterns – [207](#)
- Heath, James E**  
The Challenge of New and Emerging Information Operations – [649](#)
- Heaton, Harley L**  
Non-Thermal, On-Site Decontamination and Destruction of Practice Bombs – [141](#)
- Heck, John G**  
Value Added Analysis - VAAFY03 – [532](#)
- Heffelfinger, Grant S**  
Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – [454](#)

**Heidtke, Curtis L**

Reducing the 'Gap of Pain': A Strategy for Optimizing Federal Resource Availability in Response to Major Incidents – 526

**Heilman, Eric**

Data Mining Techniques Applied to Urban Terrain Command and Control Experimentation – 615

Identifying Battlefield Metrics Through Experimentation – 158

**Heimbigner, Dennis**

Willow System Demonstration – 449

**Heimdahl, Mats P**

Formal Methods for Developing High Assurance Computer Systems: Working Group Report – 471

**Hein, P. W.**

Non-Multiple Delay Element Values for Phase Shifting – 199

**Heine, Henry S**

Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335

Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340

**Heitmeyer, Constance L**

Formal Methods for Developing High Assurance Computer Systems: Working Group Report – 471

**Heller, B. E.**

Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – 240

**Helleur, Chris**

Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227

**Hemez, F.**

Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86

**Hemm, Robert V**

Stochastic Lanchester Air-To-Air Campaign Model: Methods Used to Generate Model Outputs and a User's Guide: 2007 – 527

**Hemscheidt, Thomas K**

Semi-Synthesis and In-vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism – 401

**Henderson, Dale B**

A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – 478

**Henderson, Kyle**

Chamber Core Structures for Fairing Acoustic Mitigation – 50

**Hendrickson, C. L.**

High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – 71

**Hendrix, L**

Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398

**Henestroza, E.**

Overview of the Pulse Line Ion Accelerator – 577

**Henkins, Robert**

Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331

**Henning, Paul**

USNORTHCOM Integrated Architecture: A Means to an End – 494

**Henry, Paula P**

A Model for Predicting Intelligibility of Binaurally Perceived Speech – 153

**Henry, Paula**

Bone Conduction: Anatomy, Physiology, and Communication – 163

**Hensel, S. J.**

Type B Radioactive Material Package Failure Modes and Contents Compliance – 238

**Hensley, Lisa E**

Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331

Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330

**Hepburn, Matthew J**

Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332

**Hepner, Tom**

Modeling and Simulation in Support of Network Centric Warfare Analysis – 143

**Herberg, J. L.**

Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – 67

**Herbert, Steven**

Selection Process of a Non-Primary Power Source for a Combat Vehicle – 242

**Herbert, Tom**

Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144

**Herbst, Roy**

IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345

**Herceg, Paul M**

A Methodology for End-to-End Evaluation of Arabic Document Image Processing Software – 468

**Hering, Mark A**

Flexible Precision: Air Force's Answer to Army Transformation and Intratheater Airlift on the 21st Century Battlefield – 14

**Herm, Thomas S**

IEIST Technologies Enabling TCT Prosecution – 538

**Hermann, Brian**

Solutions Analysis for Helicopter Brownout – 33

**Hermenegildo, Ygor**

Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – 380

**Hermone, Ann R**

An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330

**Hernandez, Charles L**

Human Factors Evaluation of the High Mobility Artillery Rocket System (HIMARS) in the Combined HIMARS-Guided Multiple Launch Rocket System (GMLRS) Initial Operational Test – 423

Human Factors Evaluation of the XM30 Guided Multiple Launch Rocket System (GMLRS) in the Combined High Mobility Artillery Rocket System (HIMARS)-GMLRS Initial Operational Test – 423

**Hernandez, Edwin A**

Adaptive Sampling for Network Management – 485

**Hernandez, V. J.**

Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) – 177

**Herring, Thomas A.**

Analysis of ICESat Data Using Kalman Filter and Kriging to Study Height Changes in East Antarctica – 240

**Herron, Marissa**

Sonic Boom Assessment for the Crew Exploration Vehicle – 56

**Hess, David E**

A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 515

**Hess, Kathleen P**

Collaborative Critical Thinking – 148

- Heuze, F. E.**  
Review of the Stability Analysis for the LANL BSL-3 Building Foundation – 264
- Hibbs, Stephen**  
Murine Macrophages Kill the Vegetative Form of *Bacillus anthracis* – 394  
Role of Superoxide in the Germination of *Bacillus Anthracis* Endospores – 380
- Hickey, Thomas E**  
Intracellular Survival of *Campylobacter jejuni* in Human Monocytic Cells and Induction of Apoptotic Death by Cytolethal Distending Toxin – 394
- Hicks, Jeffrey D**  
Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627  
Intelligent Agent-Based Software Architecture for Tactical Decision Aid under Overwhelming Information Inflow and Uncertainty – 502
- Hicks, Jeffrey**  
Eyekon: Distributed Augmented Reality for Soldier Teams – 655
- Hiddessen, A. L.**  
Single-Cell Level Investigation of Cytoskeletal/Cellular Response to External Stimuli – 107
- Hieatt, J L**  
Application of the Simplified Phase Plane to the Analysis and Design of Missile Jet-Relay Control Systems – 2
- Hieb, Michael R**  
Data Alignment between Army C4I Databases and Army Simulations – 653  
Report Out of the C4I Study Group – 162
- Hill, Jonathan**  
Protection of Software-based Survivability Mechanisms – 447  
Willow System Demonstration – 449
- Hill-Harmon, Mary B**  
Weathering the Storm. Leading Your Organization Through a Pandemic – 368
- Hillman, Gilda**  
Intra-Prostate Cancer Vaccine Inducer – 316
- Hillman, Robert G**  
Modeling the Joint Battlespace Infosphere – 644
- Hilmas, Corey**  
Pulmonary Toxicity of Cholinesterase Inhibitors – 382
- Hilton, J L**  
Progress Report of the IAU Working Group on Precession and the Eclipse – 665
- Hinchman, Jacob**  
Automated Aerial Refueling Presentation to 2007 ARSAG Conference (Preprint) – 15
- Hindman, Charles**  
Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 597
- Hing, S.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Hiniker, Paul J**  
A Model of Command and Control Processes for JWARS: Test Results from Controlled Experiments and Simulation Runs – 151  
C3X: Correlation, Causation and Controlled Experimentation for C2 – 146
- Hitchcock, Jennifer**  
Joint Light Tactical Vehicle Power Requirements – 250
- Hjorthol, R. J.**  
How the Car Affects the Activity patterns of Children and Youth – 170
- Ho, Patience C**  
Adsorption and Desorption of Dinitrotoluene on Activated Carbon – 91
- Ho, Sean S**  
Integration of SATURN System and VGIS – 530
- Hocevar, Susan P**  
Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460  
Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489  
Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – 469  
When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141  
When Do Organizations Need to Change (Part II)? Incongruence in Action – 140
- Hochberg, M. J.**  
Integrated Plasmon and Dielectric Waveguides – 587
- Hodgkiss, William S**  
Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers – 272
- Hodgson, E.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415
- Hodgson, Ernest**  
Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – 384
- Hofer, D.**  
Database Manipulations Using Group Theory – 435
- Hoffman, Andrew R**  
Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287
- Hoffman, Kimberly A**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- Hoffman, Kimberly**  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503
- Hoffman, R. D.**  
Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106
- Hoffman, Stephen L**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Hoffman, Wesley P**  
Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – 100
- Hoffmeister, Chris W**  
An Evaluation Methodology for Protocol Analysis Systems – 490
- Hogan, Timothy**  
Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties – 189
- Hojjer, M.**  
Radiated Susceptibility Test in Reverberation Chamber – 202
- Holcomb, John B**  
Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354
- Holder, J. P.**  
Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – 601
- Holguin, Arturo**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631
- Holland, M J**  
Atomtronics: Ultracold Atom Analogs of Electronic Devices – 194
- Hollinger, Jeffrey O**  
Vulnerability Factors to Improve Bone Healing – 347
- Hollis, Brian R.**  
Nonequilibrium Stagnation-Line Radiative Heating for Fire II – 220

- Holman, Ryan**  
Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215  
Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551
- Holmes, Wesley W**  
Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110
- Holmgren, D. J.**  
National Software Infrastructure for Lattice Quantum Chromodynamics – 581
- Holt, Shawn**  
Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287
- Holtorf, Heidi**  
Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418
- Holzhauser, Douglas**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Homan, Paul B**  
Evaluation of High Density Surface Observations in Complex Terrain and Their Contribution to the MM5 Model – 268
- Honer zu Bentrup, Kerstin**  
Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development – 371
- Honeycutt, Kyle**  
Crack Growth and Stress Intensity Prediction Techniques. Delivery Order 0004: Implementing Models and Libraries – 31
- Hong, Seunghun**  
Surface-Templated Assembly for Mass-Production of ZnO Nanowire-Based Integrated Devices – 89
- Hong, Waun K**  
IMPACT (Imaging and Molecular Markers for Patients with Lung Cancer: Approaches with Molecular Targets and Complementary, Innovative and Therapeutic Modalities) – 345
- Hoogterp, Laura**  
Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120
- Hooker, Stanford B.**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Hoover, Brian G**  
Coherence and Polarization Properties of Far Fields Generated by Quasi-Homogeneous Planar Electromagnetic Sources (Postprint) – 602  
Coherence Solution for Bidirectional Reflectance of Surfaces with Wavelength-Scale Statistics (Postprint) – 528
- Hope-Tindall, Peter**  
Human Factors and Privacy – 476
- Horney, Matthew A**  
Seismic Response of a Half-Scale Masonry Building with Flexible Diaphragms – 239
- Hortin, G L**  
Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308
- Horvath, Thomas**  
Shuttle Entry Imaging Using Infrared Thermography – 57
- Hosmer, C. D.**  
Assessing Technology, Methods, and Information for Committing and Combating Cyber Crime – 428
- Hossack, John A**  
High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer – 350
- Hou, Jennifer C**  
Real-Time Communication and Coordination in Embedded Sensor Networks – 533
- Houck, T. L.**  
Electrostatic Modeling of Vacuum Insulator Triple Junctions – 205  
Flash X-ray (FXR) Linear Induction Accelerator(LIA) Optimization Upgrade of the OTR Emittance Diagnostic – 575  
Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses – 203
- Houghton, Peter**  
Potential System Vulnerabilities of a Network Enabled Force – 487
- Howe, R. T.**  
Damascene Process for Use in Fabricating Semiconductor Structures Having Micro/Nano Gaps – 213
- Howe, Roger T**  
Microsystems Research in Japan – 191
- Howells, Howard**  
Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 460
- Howson, J.**  
Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – 74  
System for the Evaluation of Moisture Damage Using Fundamental Material Properties – 74
- Hruby, Dennis E**  
Smallpox Antiviral Drug – 285
- Hruszkewycz, Stephan**  
Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114
- Hruza, Petr**  
The Synergic Integrated Concepts of C2S – 174
- Hsiung, L.**  
Sinodal Decomposition and Order Disorder Transformation in a Water Quenched U-6wtNb Alloy – 70
- Hsu, Chia-Jui**  
Dataflow Integration and Simulation Techniques for DSP System Design Tools – 467
- Hsu, J. S.**  
Motor Frame Cooling with Hot Liquid Refrigerant and Internal Liquid – 76
- Hu, J J**  
Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127
- Hu, S.**  
Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72
- Hu, W**  
A Review and Assessment of Current Airframe Lining Methodologies and Tools in Air Vehicles Division – 20
- Huang, Fengying**  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404
- Huang, Jingshu**  
Task Adaptable Display of Information for Training, Maintenance, and Emergency Response – 654
- Huang, Q.**  
Organic Light-Emitting Diodes and Related Hole Transport Compounds – 207
- Huang, Z P**  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92
- Hubbard, Paul**  
Managing Responsibility and Information Flow in Dynamic Team Decision-Making – 151
- Huber, M. E.**  
Large Synoptic Survey Telescope and Foundations for Data Exploitation of Petabyte Data Sets – 673
- Hubner, J P**  
Design and Validation of an Aeroacoustic Anechoic Test Facility – 587
- Hudock, David M**  
Biofiltration as a Viable Alternative for Air Pollution Control at Department of Defense Surface Coating Facilities – 64
- Huff, Janice**  
Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418  
Utility of DF-1 for Radioprotection in Lymphocytes – 420
- Hug, William F**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230

- Hughes, James R**  
A Weighted Consensus Approach to Tropical Cyclone 96-H and 120-H Track Forecasting – 268
- Hughes, Jeff**  
Advancing Software Security - The Software Protection Initiative – 626
- Hughes, T J**  
The Role of Continuity in Residual-Based Variational Multiscale Modeling of Turbulence – 514
- Hui, Elliot E**  
Microsystems Research in Japan – 191
- Hui, Xu**  
Enhancement of Tumor Immunotherapy by Blockade of a Prostate Tumor Derived Immunosuppressive Factor – 281
- Hulet, Michael W.**  
Learning from Past Experiences – 56
- Hulgan, M. C.**  
Object Detection in Electro-Optic Sensor Images – 208
- Hull, Anna K**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377
- Hull, Brett**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184
- Hull, R**  
Fabrication of Nanoscaled Systems – 229
- Hull, R.**  
Method of Forming Quantum Dots at Predetermined Positions on a Substrate – 201
- Hulshoff, S**  
The Role of Continuity in Residual-Based Variational Multiscale Modeling of Turbulence – 514
- Humiston, Todd**  
AFRL/IF Technology Transition to the Warfighter via the CAOC-X – 464  
The Combined Aerospace Operations Center (CAOC) of the Future – 160
- Hummel, Patrick**  
Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92
- Humphrey, Watts S**  
CASE Planning and the Software Process – 481
- Humphreys, Robert E**  
Intra-Prostate Cancer Vaccine Inducer – 354
- Humphreys, Robert**  
Intra-Prostate Cancer Vaccine Inducer – 316
- Hundhausen, J.**  
Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86
- Hung, Chih-Cheng**  
A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration – 510
- Hung, Chou**  
Ultra-fast Object Recognition from Few Spikes – 501
- Hunt, A.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Hunt, Carl W**  
Agent-Based Modeling for Testing and Designing Novel Decentralized Command and Control System Paradigms – 537  
Transforming Intra- and Interagency Processes through Advanced Models and Simulations: An Information Assurance Model – 487
- Hunt, Kenneth K**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Hunter, Christine**  
A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 332  
Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption – 337
- Hunter, Christopher**  
A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 332  
Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption – 337
- Hunter, J B**  
Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion – 622
- Hur-Diaz, Sun**  
Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667
- Hurezeanu, Vlad**  
Path Planning Software and Graphics Interface for an Autonomous Vehicle, Accounting for Terrain Features – 480
- Hurley, C K**  
Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles – 381  
Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394
- Hurst, Charles G**  
Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110
- Hurst, Victor**  
Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415
- Hurth, T.**  
First NNLL Prediction of  $B(\bar{B} \rightarrow X_s \gamma)$  – 567
- Husna, Fatima**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184
- Hussain, S.**  
Electronic Vehicle Identification: Industry Standards, Performance, and Privacy Issues – 178
- Hussain, Z.**  
New Strategic Plan Takes the ALS into the Future – 576
- Hutchins, Susan G**  
A New Perspective on Use of the Critical Decision Method with Intelligence Analysts – 609  
Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – 471  
Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460  
Network Aware Tactical Collaborative Environments – 165  
Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts) – 537  
Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489  
Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – 469  
When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141
- Hutton, John P**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631
- Huyse, Luc J.**  
Probabilistic Modeling of Space Shuttle Debris Impact – 58
- Huyser, Karen A**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665
- Hwang, Huey-Liang**  
Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196
- Hwang, J.**  
Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 070) – 206

- Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 378) – 206
- Hwang, Jung-Min**  
Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196
- Hwu, Y K**  
High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133
- Hyde, Clinton**  
Using Templates to Support Crisis Action Mission Planning – 455
- Hyett, Mark**  
Exploiting Data-Flow for Fault-Tolerance in a Wide-Area Parallel System – 447
- Hyink, Jeffrey F**  
Mobile Sensor Networks: A Discrete Event Simulation of WMD Threat Detection in Urban Traffic Schemes – 156
- Hyland, Matthew T**  
Performance Evaluation of Ad Hoc Routing Protocols in a Swarm of Autonomous Unmanned Aerial Vehicles – 38
- Hylin, E C**  
IHPRT Improvements to the Solid Performance Program (SPP) – 542
- Hysell, D L**  
Mission Support for the Communications/Navigation Outage Forecast Satellite – 49
- Iacono, Scott T**  
Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – 100
- Iarve, Endel**  
Image Reconstruction Based Modeling of 3D Textile Composite (Postprint) – 127
- Ibrahim, M S**  
Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331
- Iglesias, C. A.**  
Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry – 603
- Ihoshi, Naomi**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Ikegami, R**  
Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft – 583
- Ilevbare, G. O.**  
Crevice Repassivation Potentials for Alloy 22 in Simulated Concentrated Ground Waters – 119
- Immoos, Chad**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Inamdar, Amol**  
Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441
- Ingles, Sue Ann**  
Dietary Fat, Fat Metabolizing Genes, and Prostate Cancer Risk in African-Americans and Whites – 340
- Inglis, Timothy J**  
Environmental Survival, Military Relevance, and Persistence of Burkholderia Pseudomallei – 291
- Ingram, Brea R**  
Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53
- Ioerger, Thomas R**  
Distributed Command and Organizational Situation Awareness – 142  
Modeling Command and Control in Multi-Agent Systems – 452
- Isaacs, William B**  
Prostate Cancer Gene Discovery Using ROMA – 371
- Islam, Dilara**  
Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 396
- Istok, Jonathan**  
Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface – 102
- Itti, Laurent**  
Next-Generation Image and Sound Processing Strategies: Exploiting the Biological Model – 598
- Ivanchenko, Volodymyr G**  
Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99
- Ivasishin, Orest**  
Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99
- Ivins, Bruce E**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335  
Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340
- Iyengar, M. Sriram**  
Translational Research in Space Exploration – 413
- Iyer, Ram V**  
Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – 19
- Izumi, N.**  
Feasibility of Measuring 3He Bubble Diameter Populations in Deuterium-Tritium Ice Layers Using Mie Scattering – 573
- Jackson, Brian A**  
Sharing the Dragon's Teeth: Terrorist Groups and the Exchange of New Technologies – 643
- Jackson, J. A.**  
CCG-LCONE CT Reconstruction Code User and Programmers Guide – 570
- Jackson, P**  
A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division – 20
- Jackson, Vairzora**  
The Right Information....and Intelligent Nodes – 456
- Jacobs, Linda A**  
Hot Flashes and Quality of Life Among Breast Cancer Patients – 288
- Jacobsen, Kenneth O**  
The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (Chlorocebus aethiops) – 402
- Jacobson, Richard W**  
Experiences Linking Vehicle Motion Simulators to Distributed Simulation Experiments – 443
- Jacobson, Sheldon H**  
A Heuristic Design Information Sharing Framework for Hard Discrete Optimization Problems – 542
- Jahrling, Peter B**  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330
- Jain, Anil**  
Multimodal Biometric Systems – 472
- Jakubiak, Rachel**  
Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorenocarbonyl Methano[60]Fullerene Pentaads – 87
- Jalali, Bahram**  
Non-Electronic Radio Front-End (NERF) – 211
- Jalobeanu, Andre**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665
- James, D. L.**  
Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – 601
- James, William F**  
Experimental Effects of Lime Application on Aquatic Macrophytes: 4. Growth Response of Three Species – 89

**Jamison, Lewis**

Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144

**Jang, Y. I.**

Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – 246

**Jani, Dewal**

Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389

**Jannik, G. T.**

Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – 255

**Janowiak, Vincent**

Field Level Computer Exploitation Package – 464

**Janssen, Christoph S**

A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 388

**Jansson, D**

Design and Validation of an Aeroacoustic Anechoic Test Facility – 587

**Jarrard, David F**

Biological Impact of Senescence Induction in Prostate Cancer Therapy – 293

**Jarvis, E. A.**

Supported Metal Catalyst with Improved Thermal Stability – 64

**Jastrzembski, Tiffany S**

Knowledge Tracing and Prediction of Future Trainee Performance – 531

**Jata, Kumar V**

FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures – 29

Impact Location for a Multilayer Transversely Isotropic Plate – 604

**Javedani, J. B.**

Electrostatic Modeling of Vacuum Insulator Triple Junctions – 205

Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses – 203

**Jaw, Link**

PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498

**Jean, Buddy H**

A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration – 510

**Jeanloz, R.**

Creating the Core Conditions of Extrasolar and Solar Giant Planets – 672

**Jedrysik, Peter A**

The Interactive DataWall – 209

**Jeelani, Shaik**

Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113

**Jeevarajan, Anthony**

Effects of Lunar Dust Simulant (JSC-1A-vf) on WI-38 Human Embryonic Lung Cells – 417

**Jeevarajan, Antony**

A Study of the Attraction Forces of Lunar Dust Simulant – 664

Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418

Utility of DF-1 for Radioprotection in Lymphocytes – 420

**Jenkins, Letisha**

Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426

**Jenkins, Scott A**

Characterization of VSW Environment for UUV-N Operations – 214

**Jensen, Jens A**

Evolution of a Mission Plan – 646

**Jensen, Jerry G**

Effect of Atmospheric Background Aerosols on Biological Agent Detectors – 222

**Jensen, Robert**

Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121

Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89

**Jeun, Buddy H**

Multi-Sensor Information Fusion Technology Applied to the Development of Smart Aircraft – 8

**Jezirowski, Margaret**

Automated Information Extraction System (AIES) Capability Enhancement and Support – 614

**Ji, Wei**

Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorenocarbonyl Methano[60]Fullerene Pentaads – 87

**Ji, Zhengrong**

Optimizing Parallel Execution of Detailed Wireless Network Simulation – 624

**Jiang, Huabei**

Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314

**Jiang, Ju**

Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404

Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399

Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385

**Jiang, Shaoyi**

Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454

**Jimenez-Flores, Rafael**

The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193

**Jin, Xiaomin**

The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193

**Jiru, Michael**

Systems Engineering for Rapid Prototyping: Friendly Marking Device – 227

**Joeres, S.**

Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors – 600

**John, Esther M**

Human Leukocyte Antigen (HLA) Genotype as a Contributor to Racial/Ethnic Differences in Breast Cancer: A Population-Based Molecular Epidemiologic Study – 285

**John, J.**

A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414

**John, R**

Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122

Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91

**John, Reji**

Off-Axis Creep Behavior of Oxide/Oxide Nextel(Trademark)720/AS-0 (Preprint) – 122

**Johns, Kevin**

Joint Essential Tasks and a Framework for Evaluation – 136

**Johnsen, Terje**

Bi- and Multistatic Radar – 176

**Johnson, A. S.**

Operational Aspects of Space Radiation Analysis – 676

**Johnson, David E**

Medical Risk in the Future Force Unit of Employment. Results of the Army Medical Department Transformation Workshop V – 304



- Johnson, II, Douglas V**  
Global Climate Change: National Security Implications – [266](#)
- Johnson, Kevin**  
Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – [637](#)
- Johnson, M. B.**  
Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – [584](#)
- Johnson, M. S.**  
Final Task Report on NRF Measurements of Photon Scattering Resonances in Plutonium at the High Voltage Research Laboratory of MIT – [561](#)
- Johnson, Peter C**  
Tissue Engineering Research – [307](#)
- Johnson, R. P.**  
Studies of a Gas-Filled Helical Muon Beam Cooling Channel – [565](#)
- Johnson, Richard W**  
Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers – [272](#)
- Johnson, Rudy**  
Relaxed Fidelity CFD Methods Applied to Store Separation Problems – [5](#)
- Johnson, Todd**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – [395](#)
- Johnson, Wayne**  
A System Design Archetype for C4ISR Systems of the 21st Century – [159](#)
- Johnson-Throop, Kathy A.**  
MDS MIC Catalog Inputs – [416](#)  
Risk Assessment: Evidence Base – [529](#)  
Translational Research from an Informatics Perspective – [416](#)  
Translational Research in Space Exploration – [413](#)
- Johnson-Throop, Kathy**  
IMMR Phase 1 Prototyping Plan Inputs – [663](#)
- Johnston, Christopher O.**  
Nonequilibrium Stagnation-Line Radiative Heating for Fire II – [220](#)
- Johnston, D**  
Fort Holabird Defense Investigative Service (DIS), Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II – [422](#)
- Johnston, Joan H**  
Performance Measurement for Diagnosing and Debriefing Distributed Command and Control Teams – [150](#)
- Jones, B. A.**  
Perylene N-Type Semiconductors and Related Devices – [205](#)
- Jones, J. A.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – [415](#)
- Jones, J G**  
Oxygen Plasma Treatment and Deposition of CNx on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – [121](#)
- Jones, Jack**  
Software to Generate 3-Dimensional Displays of Inverse Synthetic aperture Radar Data – [455](#)
- Jones, Jeff**  
Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – [415](#)
- Jones, Jeffrey**  
Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – [675](#)
- Jones, Nancy L**  
Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – [398](#)
- Jones, Robert D**  
Study of the Utility of NWP Forecast Guidance and Simple Ocean Modeling as a Tool for Planning During Reactive Situations – [269](#)
- Jones, S. M.**  
Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors – [600](#)
- Jones, Steven M**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – [331](#)
- Jones, T.**  
HPC-Colony: Services and Interfaces to Support Systems with Very Large Numbers of Processors. (2006 Annual Report, January-December 2006) – [431](#)
- Jones, Tyrone L**  
Ballistic Evaluation of Magnesium Alloy AZ31B – [117](#)
- Jordan, Brett**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – [184](#)
- Jordan, Eric A**  
A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – [550](#)
- Jordan, Jennifer L**  
High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – [125](#)
- Jordan, Jeremy D**  
Updating Optimal Decisions Using Game Theory and Exploring Risk Behavior Through Response Surface Methodology – [534](#)
- Jordan, Mark L**  
Activation and Protection of Dendritic Cells in the Prostate Cancer Environment – [312](#)
- Joseph, Jeffrey I**  
Artificial Pancreas for Control of BG and Insulin Levels in Hospitalized Patients with Diabetes and Stress Hyperglycemia – [328](#)
- Joshi, L.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – [420](#)
- Jou, Jwo-huei**  
Nano-Dots Enhanced White Organic Light-Emitting Diodes – [90](#)
- Jouan, Alexandre**  
Land Use Mapping with Evidential Fusion of Polarimetric Synthetic Aperture Radar and Hyperspectral Imagery – [631](#)
- Judd, Greg**  
Optimising the Design of Land Force C2 Architectures – [152](#)
- Judge, P. G.**  
Hao Spectral Diagnostic Package for Emitted Radiation (Haos-Diper) Reference Guide. Version 1.0 – [558](#)
- Jurs, J. L.**  
Development and Testing of Flame Retardant Additives and Polymers – [67](#)
- Kaelbling, Leslie P**  
Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – [523](#)
- Kagan, Elliott**  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – [330](#)
- Kagumba, Lawino**  
Nanoengineered Additives for Active Coatings – [61](#)
- Kahler, S W**  
Acceleration and Propagation in the Heliosphere – [670](#)  
Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events – [668](#)  
Imaging Interplanetary Disturbances Causing Forbush Decreases – [670](#)  
Interplanetary CMEs Without Observed Coronagraph CMEs – [669](#)  
Observational Properties of Coronal Mass Ejections – [671](#)  
Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – [669](#)

- Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – 668
- Kahler, S**  
Near-Relativistic Electron c/v Onset Plots – 668
- Kahn, S M**  
Unique Approaches to Androgen Effects on Prostate Cancer – 334
- Kaiser, Ute**  
Pyroelectric AlGaIn/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – 96
- Kajfasz, E.**  
Some Searches for New Physics with the D0 Detector – 585
- Kale, L.**  
HPC-Colony: Services and Interfaces to Support Systems with Very Large Numbers of Processors. (2006 Annual Report, January-December 2006) – 431
- Kalinin, S. V.**  
Spatially Resolved Electromagnetic Property Measurement – 556
- Kalla, Elizabeth**  
Exploration Medical Capability (ExMC) Program – 417
- Kallemyn, Benjamin S**  
Prioritizing Satellite Payload Selection via Optimization – 46
- Kameoka, J.**  
Electrospray Emitter for Microfluidic Channel – 205
- Kammler, M.**  
Method of Forming Quantum Dots at Predetermined Positions on a Substrate – 201
- Kan, Robert K**  
In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents – 77
- Kan, Shirley A**  
China: Possible Missile Technology Transfers from U.S. Satellite Export Policy - Actions and Chronology – 637
- Kan, Shirley**  
China's Anti-Satellite Weapon Test – 53
- Kanatzidis, Mercouri G**  
Designing of Bulk Nano-Structures With Enhanced Thermoelectric Properties – 553
- Kanatzidis, Mercouri**  
Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties – 189
- Kandil, O. A.**  
Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4
- Kandirakis, Ioannis**  
Route Optimization for Mobile IPv6 Using the Return Routability Procedure: Test Bed Implementation and Security Analysis – 489
- Kang, Byeong Ho**  
Towards Next Generation WWW: Push, Reuse and Classification – 614
- Kang, Tae J**  
Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – 394
- Kanipes, Margaret I**  
Cell-surface Alpha-glucan in Campylobacter jejuni 81-176 – 401
- Kantz, Stephen M**  
Static Reachability Analysis and Validation Regarding Security Policies Implemented via Packet Filters – 489
- Kaplan, I. L.**  
Semantic Graph Query Language – 434
- Kara, K.**  
Effects of Nose Bluntness on Stability of Hypersonic Boundary Layers over Blunt Cone – 4
- Karikari, Afia**  
Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79
- Karr, Monette E**  
Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers – 272
- Karra, V. K.**  
Technology Review of Smart Sensors with Wireless Networks for Applications in Hazardous Work Environments – 168
- Karras, Marianna**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 388
- Karwacki, Christopher J**  
Novel Collective Protection Filters for Emerging TIC Requirements: Axial and Radial-Flow Filter Designs – 55
- Karypis, George**  
fRMSDPred: Predicting Local RMSD Between Structural Fragments Using Sequence Information – 369  
Methods for Effective Virtual Screening and Scaffold-Hopping in Chemical Compounds – 653
- Kashikhin, V.**  
AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605
- Kasyap, Anurag**  
Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551
- Kato, M.**  
Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214
- Katti, R. R.**  
Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438
- Katwyk, David W**  
Tension-Compression Fatigue Behavior of a Carbon Fiber/Epoxy (IM7/EPON 862) Composite Fabricated Using Vacuum Assisted Resin Transfer Molding Process – 85
- Katz, Joseph**  
Turbulence and Complex Flow Phenomena in Multi-Stage Axial Turbomachines – 582
- Katzman, Kenneth**  
The Iran Sanctions Act (ISA) – 593
- Kautz, D.**  
Microsystem Enclosure and Method of Hermetic Sealing – 71
- Kaydanov, V. I.**  
Studies of Basic Electronic Properties of CdTe-Based Solar Cells and Their Evolution During Processing and Stress. Final Technical Report October 16, 2001-August 31, 2005 – 246
- Kazman, Rick**  
Quality-Attribute-Based Economic Valuation of Architectural Patterns – 479
- Keckskemety, K**  
Acceleration and Propagation in the Heliosphere – 670
- Keckses, Laszlo J**  
Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114
- Kedl, Ross M**  
HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397
- Keenan, R.**  
High Efficiency Grazing Incidence Pumped X ray Laser – 601
- Kehring, Kathy L**  
Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – 153
- Keidar, M**  
Effect of Thermal Conductivity on the Knudsen Layer at Ablative Surfaces – 607
- Keller, Kirby**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184
- Kelley, K.**  
Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106

- Kellog, Keith**  
Defense Science Board 2006 Summer Study of Information Management for Net-Centric Operations. Volume 2. Operations Panel Report – 158
- Kelly, John D**  
Automated Run-Time Mission and Dialog Generation – 632
- Kelly, Richard T**  
Human Systems Integration Assessment of Network Centric Command and Control – 421
- Kelly, Scott**  
Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415
- Kelsey, Sheena**  
Methodology for Rapid Development of C2 Planning Systems – 173
- Kemp, R. A.**  
Chiral Multichromic Single Crystals for Optical Devices – 580
- Kempe, M. D.**  
Polymers for Orientation and Stability of Liquid Crystals – 75
- Kempe, Bill**  
A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492
- Kempe, W**  
Evolution of C4I Systems – 174
- Kempe, William G**  
Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – 471  
  
Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460  
  
Network Aware Tactical Collaborative Environments – 165  
  
Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts) – 537  
  
Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489  
  
Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – 469  
  
When Do Organizations Need to Change (Part II)? Incongruence in Action – 140
- Kempe, William**  
Quality of Service Behavioral Model From Event Trace Analysis – 166
- Kendall, Richard P**  
A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – 478
- Kennaway, David J**  
Disruption of the Circadian Rhythms of Gene Expression and the Development of Breast Cancer – 313
- Kennedy, Shawn P**  
Signal Event Detection System – 590
- Kennedy, V. S.**  
Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277
- Kennett, Brian L**  
Detection of Atmospheric Explosions at IMS Monitoring Stations using Infrared Techniques – 265
- Kerns, David A**  
Automatic Target Recognition User Interface Tool – 510
- Kerr, P.**  
Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570
- Key, M. H.**  
Status and Prospects of the Fast Ignition Inertial Fusion Concept – 571
- Keyes, D. E.**  
Implicit Solvers for Large Scale Nonlinear Problems – 433
- Khalek, I. A.**  
Diesel Particulate Measurement Research, 2007. Phase 3 – 238
- Khan, Sal**  
Digital Convergence Authenticated Video, Voice, & Text – 476
- Khodadoust, Abdollah**  
Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4
- Khovanova, Tanya**  
Decentralized Control Using Global Optimization (DCGO) (Preprint) – 495
- Kikuchi, A.**  
Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558
- Kilcoyne, M.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Killcrece, Georgia**  
Incident Management Capability Metrics Version 0.1 – 482
- Kim, Gyeong-Man**  
Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81
- Kim, Hyeonkyeong**  
Qualitative Reasoning about Fluids and Mechanics – 446
- Kim, Hyun-Kyung**  
Qualitative Kinematics of Linkages – 500
- Kim, Jerry**  
Through-the-Wall Imaging from Electromagnetic Scattered Field Measurements – 553
- Kim, Myung-Hee Y.**  
Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676
- Kim, Yang Sok**  
Towards Next Generation WWW: Push, Reuse and Classification – 614
- Kimberly, Jack L**  
A Bold 21st Century Strategy for U.S. Airborne ISR – 24
- Kimura, Y.**  
Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 255
- Kindler, Carrie**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- King, Jason M**  
A Detailed Study of Advection Sea Fog Formation to Reduce the Operational Impacts Along the Northern Gulf of Mexico – 268
- King, T. J.**  
Damascene Process for Use in Fabricating Semiconductor Structures Having Micro/Nano Gaps – 213  
  
Two Bit/Four Bit SONOS Flash Memory Cell – 200
- King, Thomas V**  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- King, Thomas**  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503
- King, V , Thomas S**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459
- King, W.**  
Ultrafast, In Situ Probing of Shocked Solids at the Mesoscale and Beyond: a New Paradigm for Materials Dynamics – 573
- Kingston, Gina**  
Degrees of Shared Awareness – 657  
  
Developing and Evolving a Joint Australian Task List – 155  
  
Evaluation of Organisational Interoperability in a Network Centric Warfare Environment – 146  
  
Joint Essential Tasks and a Framework for Evaluation – 136

**Kinkler, E S**

Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354

**Kinney, James**

Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360

**Kiraly, Laszlo**

The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314

**Kiraly, P**

Acceleration and Propagation in the Heliosphere – 670

**Kirby, Brendan**

Optimising the Design of Land Force C2 Architectures – 152

**Kirk, Allen**

Human Platelets Exhibit Chemotaxis using Functional N-Formyl Peptide Receptors – 386

**Kirker, K. R.**

Crosslinked Compounds and Methods of Making and Using Thereof – 72

**Kirshteyn, D**

Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140

**Kirton, Michael**

Software Agents as Facilitators of Coherent Coalition Operations – 459

**Kirz, J.**

New Strategic Plan Takes the ALS into the Future – 576

**Kish, F. A.**

Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214

**Kissin, Sidney**

Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461

**Kitano, Hiroaki**

Information Fusion for Hypothesis Generation under Uncertain and Partial Information Access Situation – 499

**Klapoetke, Thomas M**

Insensitive High-Performance Replacements for RDX in Explosive and Propellant Formulations – 59

**Klassen, A**

Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – 669

**Kleb, Bill**

Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – 437

**Klein, Mark**

Quality-Attribute-Based Economic Valuation of Architectural Patterns – 479

**Klein, R. I.**

FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere' – 672

**Kleinman, David L**

Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460

Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts) – 537

Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – 469

When Do Organizations Need to Change (Part II)? Incongruence in Action – 140

**Klemic, J F**

Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92

**Klemp, Jennifer R**

The Use of a Cognitive Protectant to Help Maintain Quality of Life and Cognition in Premenopausal Women with Breast Cancer Undergoing Adjuvant Chemotherapy – 361

**Kleypas, J. A.**

Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277

**Klibanov, A. M.**

Antimicrobial Polymeric Surfaces – 79

**Kline, K.**

Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86

**Klingbeil, Ralph**

Analysis of Network-Enabled ASW Concepts of Operation – 529

The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – 625

Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – 590

**Klingenburg, Daniel**

A Pragmatic C4ISR Approach From the US Army CECOM Security Assistance Perspective – 614

**Klonoff, David D**

Third Annual Clinical Diabetes Technology Meeting – 647

**Klose, Dirk**

Experimenting with C2 Applications and Federated Infrastructures for Integrated Full-Spectrum Operational Environments in Support of Collaborative Planning and Interoperable Execution – 143

Multinational C2 Experiments Supported by C2 Systems and Modeling and Simulations Addressing Army Transformation of Collaborative Planning and Interoperable Execution in a Coalition Environment – 615

**Knauss, K. G.**

Controls of Fluid Chemistry on Fracture Growth – 105

**Knechtges, Paul L**

Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335

**Knezo, Genevieve J**

'Sensitive But Unclassified' Information and Other Controls: Policy and Options for Scientific and Technical Information – 635

**Knight, Doyle**

Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – 216

**Knight, John C**

Efficient Hierarchic Management for Reconfiguration of Networked Information Systems – 485

Willow System Demonstration – 449

**Knight, John**

Protection of Software-based Survivability Mechanisms – 447

**Knize, M. G.**

Single Cell Chromatography, LDRD, Feasibility Study – 105

**Knopp, Jeremy S**

Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Postprint) – 534

The Joy of Computing with Volume-Integrals – 19

**Knudsen, Beatrice S**

Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis – 344

**Knuth, Kevin H**

An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665

**Knutson, Richard D**

Portfolio Management Decision Support Tools Analysis Relating to Management Value Metrics – 635

**Kobsar, Joseph**

Battle Command on the Move – 145

**Kobzik, Lester**

Scavenger Receptors and Resistance to Inhaled Allergens – 328

- Koch, Wolfgang**  
Advanced Target Tracking Techniques – 175  
Tracking and Data Fusion Applications – 177
- Kochel, Tadeusz J**  
Cross-Serotype Neutralization of Dengue Virus in *Aotus nancymae* Monkeys – 387
- Kocher, David C**  
Screening Doses for Induction of Cancers Calculated With the Interactive Radio Epidemiological Program (IREP) – 306  
Screening Doses for Induction of Cancers Calculated with the Interactive RadioEpidemiological Program (IREP) – 348
- Kochler, U.**  
Battery System – 246
- Koh, B**  
Scale-Independent Biomechanical Optimization – 521
- Koh, Byung-II**  
Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – 511
- Kolacinski, Richard M**  
Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18
- Kolaczyk, Eric D**  
Analysis of Origin Destination Flows (Raw Data) – 521
- Kolakowski, Michael W**  
Access to Government Information in the USA – 650
- Kolarczyk, T. C.**  
Unattended Ground Sensor Assembly – 436
- Kolda, T. G.**  
Pattern Analysis of Directed Graphs Using DEDICOM: An Application to Enroll Email – 439
- Kolesik, M**  
Computational Nonlinear Optics: Femtosecond Atmospheric Light String Applications – 266
- Kolev, T. V.**  
Parallel Auxiliary Space AMG for Definite Maxwell Problems – 436  
Parallel Eigensolver for H (curl) Problems using H1 Auxiliary Space AMG Preconditioning – 434  
Some Experience with a H1 Based Auxiliary Space AMG for H (curl) Problems – 437
- Kolisnyk, John**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375
- Kolka, M A**  
Skin Temperature Feedback Optimizes Microclimate Cooling – 272
- Kollman, Peter A**  
Applications of Molecular and Materials Modeling – 94
- Koltenbah, Benjamin**  
Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193
- Konduri, R. K.**  
Storage, Generation, and Use of Hydrogen – 69
- Kone, Abdoulaye**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated *Plasmodium falciparum* Malaria and Healthy Controls – 400
- Kong, Der-Hung**  
Simulation of Coherent Signals with Forward Error Correction Coding – 540
- Konidaris, N. P.**  
All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets – 674
- Koo, Justin W**  
Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52
- Kooij, Taco W**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 388
- Koplovitz, Irwin**  
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77
- Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – 372
- Kopp, S. E.**  
Long Baseline Neutrino Physics in the U.S – 578
- Korenyi-Both, A**  
Oxygen Plasma Treatment and Deposition of CN<sub>x</sub> on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121
- Kornfield, J. A.**  
Polymers for Orientation and Stability of Liquid Crystals – 75
- Korotkova, Olga**  
Coherence and Polarization Properties of Far Fields Generated by Quasi-Homogeneous Planar Electromagnetic Sources (Postprint) – 602
- Kosasih, Herman**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Kosik, Wendy E**  
Nanoengineered Additives for Active Coatings – 61
- Kott, Alexander**  
AI on the Battlefield: An Experimental Exploration (Preprint) – 501  
Managing Responsibility and Information Flow in Dynamic Team Decision-Making – 151
- Koup, Richard A**  
HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397
- Koutcher, Jason A**  
Non-Invasive Markers of Tumor Growth, Metastases, and Sensitivity to Anti-Neoplastic Therapy – 363
- Koutsourelakis, P. S.**  
Survey of Probabilistic Models for Relational Data – 435
- Kovar, R F**  
Fretting Wear-Resistant, Micro-Arc Oxidation Coatings for Aluminum and Titanium Alloy Bearings (Preprint) – 44
- Kowal, J J**  
Army Science Conference 2006 TECHNOLOGY ASSESSMENT of SOLDIER and MAN PORTABLE FUEL CELL POWER – 249
- Kowalik, Robert W**  
Elevated-Temperature Life Limiting Behavior of Hi-Nicalon SiC/SiC Ceramic Matrix Composite in Interlaminar Shear – 80
- Kozanecki, W.**  
Closed Orbit Distortion and the Beam-Beam Interaction – 556
- Kraemer, M**  
Atomtronics: Ultracold Atom Analogs of Electronic Devices – 194
- Kraft, Andrew S**  
Pim Protein Kinase-Levels Correlate with Prostate Tumor Growth and Chemo-Resistance - Potential Mechanism of PIM Action – 282
- Kramer, Franklin D**  
Defense Horizons. I-Power: The Information Revolution and Stability Operations. Number 55 – 619
- Krasnykh, A.**  
Coreless Approaches for On/Off Marx Type Modulators – 579  
e-/e+ Accelerating Structure with Cyclic Variation of Azimuth Asymmetry – 578  
Employment of Second Order Ruled Surfaces in Design of Sheet Beam Guns – 579  
Topology of On/Off Marx Modulator with Protection of Load and Solid State Switches – 579
- Krasnykh, Victor**  
Vasculature-Specific Adenovirus Vectors for Gene Therapy of Prostate Cancer – 352

- Kraus, J. A.**  
Measurements of the B Production Cross Section in Proton-Antiproton Collisions at  $s^{1/2} = 1.96$  TeV using Semileptonic Decays of b Hadrons – 586
- Krebs, G. F.**  
New Strategic Plan Takes the ALS into the Future – 576
- Kreiman, Gabriel**  
Ultra-fast Object Recognition from Few Spikes – 501
- Krengel, Maxine**  
Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350
- Kreps, M.**  
New Results on X(3872) from CDF – 585
- Krestik, Fred**  
Servicing Hawker Vehicle Batteries with Standard Battery Charging and Test Equipment – 248
- Kribs, G. D.**  
Predicting the Cosmological Constant from the Causal Entropic Principle – 671
- Krishna, Sanjay**  
Polarimeter in a Pixel – 195
- Krishnamurthy, Sudha**  
An Adaptive Quality of Service Aware Middleware for Replicated Services – 521
- Krishnan, G. N.**  
Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.) – 126
- Krishnaswami, Sumi**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184
- Kristiansen, Rene E**  
Photonic Crystal Fibers – 232
- Krout, Timothy**  
Network-Centric Applications and Tactical Networks – 173
- Kruger, Lennard G**  
Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – 497
- Kruse, John**  
Network Centric Warfare in the U.S. Navy's Fifth Fleet. Network-Supported Operational Level Command and Control in Operation Enduring Freedom – 143
- Krymskaya, Vera P**  
The Role of TSC Proteins in Regulating Cell Adhesion and Motility – 281
- Krzych, Urszula**  
The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites – 404
- Kuang, J. B.**  
Self Limiting Gate Leakage Driver – 200
- Kuempers, J. A.**  
Battery System – 246
- Kugler, Jacek**  
Forecasting Complex Political and Military Events: The Application of Expected Utility to Crisis Situations – 653
- Kuhr, Samuel J**  
Impact Location for a Multilayer Transversely Isotropic Plate – 604  
Quantification of Impact Damage in CMC Thermal Protection Systems Using Thin-Film Piezoelectric Sensors (Preprint) – 211
- Kukreja, Sunil L.**  
F-15B QuietSpike(TradeMark) Aeroseervoelastic Flight Test Data Analysis – 35
- Kumar, A P**  
Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 336
- Kumar, Sanjai**  
Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389
- Kumar, Satish**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- Kumar, V.**  
Post-Coupling Synthetic Approach for Polymeric Antioxidants – 65
- Kuniansky, Eve L**  
Database Dictionary for Ethiopian National Ground-Water Database (ENGDA) Data Fields – 631
- Kuo, M H**  
An Agent-Based Dynamic Information Security Model in Information Warfare – 643
- Kuper, Samuel R**  
Using Work-Centered Support System Technology to Enhance Command and Control – 488
- Kurfess, James D**  
Naval Research Laboratory Space Science Division Newsletter: 01/2007 – 669
- Kurtz, H A**  
Role of Bond Coordination and Molecular Volume on the Dielectric Constant of Mixed-Oxide Compounds – 90
- Kuzmenko, P. J.**  
Materials and Fabrication Issues for Large Machined Germanium Immersion Gratings – 575
- Kvaternik, Raymond G.**  
Development of Aeroseervoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 3
- Kwakernaak, M. H.**  
Photonic Device and Method for Making Same – 209
- Kwon, Eugene D**  
A Phase II Immunotherapeutic Trial: Combination Androgen Ablative Therapy and CTLA-4 Blockade as a Treatment for Advanced Prostate Cancer – 297
- Kwon, K. C.**  
Conversion of Hydrogen Sulfide in Coal Gases to Liquid Elemental Sulfur with Monolithic Catalysts. (Annual Report, October 1, 2005-September 30, 2006) – 107
- Kysor, Kragg P**  
Case Study of a Prototype Set of Behaviorally Anchored Rating Scales (BARS) for C2 Assessment – 135
- La Scala, John J**  
Nanoengineered Additives for Active Coatings – 61
- Labbe', Paul**  
Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457
- Lacetera, Joseph**  
Report Out of the C4I Study Group – 162
- Lacy, J**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Lacy, Seth**  
Multi-Cumulant and Non-Inferior Strategies for Multi-Player Pursuit-Evasion (PREPRINT) – 544  
Wavefront Aberration Correction Using Zernike Polynomial Parameterizations of Optical Phased Arrays (PRE-PRINT) – 597
- Laczniaik, R. J.**  
Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – 273
- Laguna-Torres, Alberto**  
Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393
- Laguna-Torres, V A**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403

- Laguna-Torres, Victor A**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- Lahiani, Limor**  
Self-Stabilizing Mobile Node Location Management and Message – 511  
Virtual Stationary Automata for Mobile Networks – 536
- Laker, Travis S**  
Development of Subscale Fast Cookoff Test – 134
- Lakhina, Anukool**  
Analysis of Origin Destination Flows (Raw Data) – 521
- Lal, Anita**  
Role of Merlin in the Growth and Transformation of Arachnoidal Cells – 370
- Lalain /Iain /McVey, Theresa A**  
Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31
- Lam, M N**  
Workforce Configuration of a Canadian Forces Gematics Division – 539
- Lam, Y H**  
Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140
- Lamm, M.**  
AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605
- Lamont, A.**  
AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – 254
- Lamont, S**  
Radon Screening of Buildings at the Umatilla Depot Activity, Hermiston, Oregon – 94
- Lanar, David E**  
Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379
- Land, III, H B**  
SparkJet Actuators for Flow Control – 235
- Landau, U.**  
Modeling the Effects of Crevice Former, Particulates, and the Evolving Surface Profile In Crevice Corrosion – 119
- Landry, Trela**  
Johnson Space Center Flight Medicine Clinic Experience – 413
- Lane, Kim**  
Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – 597
- Lane, Steven A**  
Chamber Core Structures for Fairing Acoustic Mitigation – 50
- Laney, D. E.**  
Application of Morse Theory to Analysis of Rayleigh Taylor Topology – 569
- Lang, Nann C**  
Investigation of the Effect of Fuselage Dents on Compressive Failure Load – 23
- Langdon, A. B.**  
Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions – 603
- Lange, Douglas S**  
Boot Camp for Cognitive Systems: A Model for Preparing Systems with Machine Learning for Deployment – 463
- Langenberg, Jan P**  
A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 374
- Langer, R. S.**  
pH Triggerable Polymeric Particles – 66
- Langley, M.**  
Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States – 439
- Langston, Jeffrey L**  
Effects of Sarin on the Operant Behavior of Guinea Pigs – 382
- Langston, John**  
Intelligent Nodes in Coalition Warfare – 630
- Lappe, Joan M**  
Efficacy of Calcium and Vitamin D Supplementation for the Prevention of Stress Fractures in Female Naval Recruits – 288
- Larbalestier, David C**  
Report on the Wisconsin-Stanford-Kansas-Davis-Florida State MURI on Scientific Challenges of Coated Conductors – 555
- Larios-Sanz, Maia**  
Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – 675
- Larkin, J.**  
Adaptive Optics Views of the Hubble Deep Fields Final Report on LLNL LDRD Project 03-ERD-002 – 672
- Larsen, C. A.**  
Storage, Generation, and Use of Hydrogen – 69
- Larsen, Curtis E.**  
Probabilistic Modeling of Space Shuttle Debris Impact – 58
- Larson, Christopher**  
China's Energy Security and Its Military Modernization Efforts: How China Plans to Dominate the World – 248
- Larsson, Erik G**  
Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509
- Lasinski, B. F.**  
Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions – 603
- Lasnier, C. J.**  
Visible and Infrared Optical Design for the ITER Upper Ports – 599
- Latini, M.**  
Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing – 568
- Latkowski, J. F.**  
Particle Splitting for Monte-Carlo Simulation of the National Ignition Facility – 561
- Latz, Michael**  
Optical, Biochemical, and Molecular Characterization of New Bioluminescence Systems – 354
- Lau, K. H.**  
Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.) – 126
- Lauer, E. J.**  
Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses – 203
- Lawler, James V**  
Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340
- Lawless, D.**  
Global Local Dynamic Models – 572
- Lawless, W F**  
A Quantum Approach to Multi-Agent Systems (MAS), Organizations, and Control – 534  
The Control of Multi-Agent Systems (MAS) – 609
- Layman, Gene**  
C4I Tactical Applications Utilizing Embedded Simulations – 150  
C4I-Simulation Interoperability Using the DII COE and HLA – 468  
New Navy Solutions: Developing Simulation Based C4I Applications – 445
- Lazaro, A M**  
Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394

- Le May, Francois**  
The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective – [623](#)
- Le Roch, Karine G**  
The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – [401](#)
- Leake, Charles R**  
Industrial Base Model Data Requirements (IBMDR) – [650](#)
- Leammukda, W**  
Skin Temperature Feedback Optimizes Microclimate Cooling – [272](#)
- Lean, Judith L**  
Naval Research Laboratory Space Science Division Newsletter: 01/2007 – [669](#)
- Lebedev, Vadim**  
Pyroelectric AlGaIn/GaN HEMTs for ion-, gas- and Polar-Liquid Sensors – [96](#)
- Lebedev, V.**  
8 GeV Beam Line Optics Optimization for the Rapid Antiproton Transfers at Fermilab – [557](#)
- Lebensohn, R A**  
Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Text – [117](#)
- LeCarpentier, Gerald L**  
Characterization of Breast Masses Using a new Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – [391](#)  
Characterization of Breast Masses Using a New Method of Ultrasound Contrast Agent Imaging in 3D Mapping of Vascular Anomalies – [391](#)
- Lee, Andre**  
Molecular Structure Analysis of Aminophenyl Silsesquioxane (Preprint) – [97](#)
- Lee, B. C.**  
Regression Strategies for Parameter Space Exploration. A Case Study in Semicorensing Multigrid and R – [435](#)
- Lee, C.**  
Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – [130](#)
- Lee, David A**  
Stochastic Lanchester Air-To-Air Campaign Model: Methods Used to Generate Model Outputs and a User's Guide: 2007 – [527](#)
- Lee, F C**  
Standard-Cell, Open-Architecture Power Conversion Systems – [247](#)
- Lee, Haiwon**  
Vertical Alignment of Single-Walled Carbon Nanotubes on Nanostructure Fabricated by Atomic Force Microscope – [88](#)
- Lee, Juhnyoung**  
Using Dynamic Adjustment of Serialization Order for Real-Time Database Systems – [613](#)
- Lee, Justin**  
Video Enabling the Combatant Commander's Headquarters – [48](#)
- Lee, Kuan-Feng**  
Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – [196](#)
- Lee, Laura A**  
Challenges for Vertical Collaboration Among Warfighters for Missile Defense C2 – [443](#)
- Lee, Michael S**  
Assessment of Detection and Refinement Strategies for de novo Protein Structures using Force Field and Statistical Potentials – [353](#)
- Lee, P. L.**  
Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – [255](#)
- Lee, P.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – [415](#)
- Lee, Peter P**  
Immunology, Systems Biology, and Immunotherapy of Breast Cancer – [360](#)
- Lee, Richard**  
Flexible UAV Mission Management Using Emerging Technologies – [23](#)
- Lee, Robyn B**  
Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – [383](#)  
Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – [110](#)
- Lee, Stephanie J**  
National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – [397](#)
- Lee, Woo Il**  
Permeability Prediction of Three-Dimensional Woven Fabrics – [89](#)
- Lee, Yung-Chun**  
A Hybrid Nano-Imprinting Lithography Method for Nano-Patterning Based on Infrared Pulsed Laser Heating – [232](#)
- Leeds, Chris**  
Time-Base Tree Graphs for Stabilized Force Structure Representations – [539](#)
- Leffel, Elizabeth K**  
Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – [340](#)  
The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (Chlorocebus aethiops) – [402](#)
- Leffler, P.**  
Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Acute Toxic Releases to Air – [256](#)
- Legaspi, Albert**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – [143](#)
- Legutki, Bart**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – [377](#)
- LeHouillier, Frank**  
Automated Information Extraction System (AIES) Capability Enhancement and Support – [614](#)
- Lei, X.**  
Electronic and Optoelectronic Devices and Methods for Preparing Same – [213](#)
- Leibfritz, J.**  
Survey and Alignment of the Fermilab Electron Cooling System – [585](#)
- Leibowitz, Lawrence M**  
RF Design for Tactical Ultra-Light Unmanned Aerial Vehicle Radar System – [27](#)
- Leichner, Aaron**  
Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – [97](#)
- Leidy, Andy**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – [143](#)
- Lein, Ed**  
High-Throughput Analysis of Dynamic Gene Expression Associated with Sleep Deprivation and Recovery Sleep in the Mouse Brain – [409](#)
- Lekstrom-Himes, Julie**  
Human Platelets Exhibit Chemotaxis using Functional N-Formyl Peptide Receptors – [386](#)
- Lenhart, Martha**  
Voice Recognition Interface in the Rehabilitation of Combat Amputees – [307](#)
- Lenski, Joseph W.**  
High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction – [35](#)
- Lenz, D E**  
Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – [374](#)



- Leon, L R**  
Hypothermia Induction and Recovery in Free-Ranging Rats – 409
- Leowattana, Wattana**  
Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385
- LePort, F.**  
Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – 582
- Lerner, S. A.**  
Compact Imaging Spectrometer Utilizing Immersed Gratings – 602
- Lerner-Lam, Arthur**  
Regionalization of Crustal and Upper Mantle Q Structure in Eastern Eurasia Using Multiple Regional Waves – 262
- Leslie, J. C.**  
Development and Manufacture of Cost Effective Composite Drill Pipe. 2006 Annual Technical Progress Report – 84
- Letourneau, Francois**  
Different Approaches for the Creation and Exploitation of 3D Urban Models – 159
- Letowski, Tomasz R**  
Bone Conduction: Anatomy, Physiology, and Communication – 163  
Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSs) on Speech Communication: Talk-Through Systems – 630
- Levchuck, Georgiy M**  
Scenario Design for the Empirical Testing of Organizational Congruence (Briefing Charts) – 537
- Levchuk, Georgiy M**  
A Systematic Approach to Optimize Organizations Operating in Uncertain Environments: Design Methodology and Applications – 169
- Levchuk, Yuri N**  
A Systematic Approach to Optimize Organizations Operating in Uncertain Environments: Design Methodology and Applications – 169
- Leverich, K**  
Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192
- Leverich, W K**  
Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95
- Leveton, Lauren B.**  
Behavioral Health Program Element – 417
- Levidow, Bjorn B**  
Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666
- Levine, Alice C**  
Effect of COX-2 (PGE2) and IL-6 on Prostate Cancer Bone Mets – 294
- Levine, L S**  
Interaction of Intense Electron Beams with Plasma – 582
- Levis, Alexander H**  
Course of Action Analysis for Coalition Operations – 458  
Levels of Interoperability in Coalition Systems – 646
- Levis, Alexander**  
An Approximation Technique for Belief Revision in Timed Influence Nets – 520
- Levy, R. J.**  
Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof – 72
- Lewis, James**  
Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – 99
- Lewis, John A**  
Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335
- Lewis, K.**  
Antimicrobial Polymeric Surfaces – 79
- Lewis, Lance**  
Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113
- Lewis, Matthew**  
Biometric Security Issues – 474
- Lewis, Michael D**  
Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 396
- Leyva, Ivett A**  
Dark Core Analysis of Coaxial Injectors at Sub-, Near-, and Supercritical Conditions in a Transverse Acoustic Field – 589
- Li, Andrew**  
Cloning and Sequence Analysis of the 22-kDa Antigen Genes of Orientia tsutsugamushi Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – 399
- Li, Bin**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Li, Fei**  
Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 43
- Li, G. P.**  
Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72
- Li, Jian**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – 588  
Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314  
Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509
- Li, Jia-Yi**  
Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease – 343
- Li, Joachim J**  
DNA Damage and Genomic Instability Induced by Inappropriate DNA Replication – 336
- Li, Ran**  
10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 190
- Li, Rong**  
BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – 406
- Li, Shaoguang**  
A BCR-ABL Kinase Activity-Independent Signaling Pathway in Chronic Myelogenous Leukemia – 351
- Li, Tianfang**  
Automated Patient Positioning Guided by Cone-Beam CT for Prostate Radiotherapy – 286  
Multiple Aperture Radiation Therapy (MART) for Breast Cancer – 292
- Li, X**  
Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388
- Li, Xi**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – 588  
Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509
- Li, Zhenjiang**  
A Distributed Approach for Multi-Constrained Path Selection and Routing Optimization – 640
- Lian, T.**  
Corrosion Resistance of Structural Amorphous Metal – 104  
Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – 69  
Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – 107

- High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe<sub>49.7</sub>Cr<sub>17.7</sub>Mn<sub>1.9</sub>Mo<sub>7.4</sub>W<sub>1.6</sub>B<sub>15.2</sub>C<sub>3.8</sub>Si<sub>2.4</sub> – 107
- X ray Diffraction Techniques for Structural Determination of Amorphous Materials – 69
- Liang, M**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Liao, C. J.**  
Antimicrobial Polymeric Surfaces – 79
- Lichtblau, Dale E**  
The Critical Role of Intelligent Software Agents in Enabling Net-Centric Command and Control – 444
- Liew, Kim M**  
Atomistic Calculation of Elastic Moduli in Strained Silicon – 187
- Lightfoot, M D**  
A Method to Predict Atomization Performance in Gas-Centered Swirl-Coaxial Injectors – 218
- Lightfoot, Malissa D**  
Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors – 216
- Liles, Christian F**  
Military Helicopter Modernization: Background and Issues for Congress – 28
- Liljedahl, B.**  
Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Aqute Toxic Releases to Air – 256
- Lilly, Jeffrey**  
Automated Information Extraction System (AIES) Capability Enhancement and Support – 614
- Lim, Matthew L**  
History of U.S. Military Contributions to the Study of Diarrheal Diseases – 408
- Lim, Peter**  
Analytical and Characterization Studies of Organic Chemicals, Drugs and Drug Formulations – 60
- Lin, Deng-Sung**  
Dynamics of Epitaxy on the Nano-sized Semiconductor Surfaces – 188
- Lin, Jane**  
Automatic Author Profiling of Online Chat Logs – 503
- Lin, Jau-Jr**  
10x Improvement of Power Transmission over Free Space Using Integrated Antennas on Silicon Substrates – 190
- Lin, Lihwa**  
WABED Model in the SMS: Part 2. Graphical Interface – 470
- Lin, R.**  
Reconfigurable Matrix Multiplier Architecture and Extended Borrow Parallel Counter and Small-Multiplier Circuits – 208
- Lin, Sharron X**  
Investigating the Functional Role of Prostate-Specific Membrane Antigen and its Enzymatic Activity in Prostate Cancer Metastasis – 344
- Lin, T.**  
Operational Aspects of Space Radiation Analysis – 676
- Lin, Tzu-Chau**  
Novel Two- and Three-Photon Pumped Lasing Dyes: Design, Synthesis, and Characterization – 232
- Lin, Y.**  
Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83
- Lind, M. A.**  
Tag Device, Luggage Tag, and Method of Manufacturing a Tag Device – 200
- Linderman, Mark**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Linderman, Richard E**  
A Distributed Parallel Processing System for Command and Control Imagery – 466  
Rapid C4I High Performance Computing for Hyperspectral Imaging Exploitation – 598
- Lindgren, Eric A**  
The Joy of Computing with Volume-Integrals – 19
- Lindgren, Eric**  
Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint) – 80  
Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 81
- Lindsey, Changhong Y**  
Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353
- Liotta, C L**  
Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- Lippert, Thomas K**  
Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites – 123
- Lippmann, R P**  
Making Network Intrusion Detection Work With IPsec – 505
- Lis, J. T.**  
Liquid Mixing Reactor for Biochemical Assays – 71
- Litke, David W**  
Database Dictionary for Ethiopian National Ground-Water Database (ENGDA) Data Fields – 631
- Litt, Jonathan S.**  
Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – 39
- Little, S. L.**  
Materials and Fabrication Issues for Large Machined Germanium Immersion Gratings – 575
- Little, S. R.**  
pH Triggerable Polymeric Particles – 66
- Litz, Marc**  
Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode – 212
- Liu, Jianwei**  
Multi-Wall Carbon Nanotubes for Flow-Induced Voltage Generation (Preprint) – 95
- Liu, Junwei**  
Apoptosis-Dependent and Apoptosis-Independent Functions of Bim in Prostate Cancer Cells – 307
- Liu, M**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226
- Liu, P. K. T.**  
Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor. Semi-Annual Technical Progress Report for April 1, 2006 to September 30, 2006 – 68
- Liu, V. S. Y.**  
Immobilized Iminophosphatranes Useful for Transesterification – 70
- Liu, Wanderley**  
Risk Advised Course of Action (COA) Analysis – 532
- Liu, Wenbin**  
Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411
- Liu, Xin**  
Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Postprint) – 534
- Liu, Y.**  
Crosslinked Compounds and Methods of Making and Using Thereof – 72
- Liu, Yingjie**  
L2 Stability Analysis of the Central Discontinuous Galerkin Method and a Comparison between the Central and Regular Discontinuous Galerkin Methods – 523
- Liu, Yuming**  
Studies on Three-Dimensional Slamming on Slender Ships – 221

- Livergood, Brian K**  
Joint Space Forces in Theater: Coordination is No Longer Sufficient – 47
- Llanos-Cuentas, Alejandro**  
Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386
- Llewellyn, Il, Larry C**  
Distributed Fault-Tolerant Quality Of Service Routing in Hybrid Directional Wireless Networks – 182
- Lloyd, John P**  
Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31
- Lock Pin, Chew**  
Command Control and Information Systems in the Age of Knowledge-Centricity – 143
- Loeber, Gary J**  
Aircraft Battery Design Concept for Improved Ultra Low Temperature Performance (Postprint) – 17
- Loebl, Andy**  
Suitability of Agent Technology for Military Command and Control in the Future Combat System Environment – 457
- Loffredo, C A**  
Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308
- Logan, Ryan C**  
The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8
- Logan, Thomas P**  
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77
- Logman, H.**  
Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178  
Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183
- Logue, Brian A**  
Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110
- Long, Diane W**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Long, Duncan**  
Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 21
- Long, Tim**  
Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79
- Longe, Timothy**  
Fort Holabird Defense Investigative Service (DIS), Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II – 422
- Loo, Fook L**  
Polarimetric Thermal Imaging – 540
- Looareesuwan, Sornchai**  
Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385
- Looney, B.**  
Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report – 109
- Looney, Michael J**  
The Quest for Effective Interoperability - Issues in Achieving a Naval Coalition Force Virtual Combat System – 645
- Lopez, Adam**  
A Survey of Statistical Machine Translation – 509
- Lopez, Juan L**  
A Comparison of Trajectory Determination Approaches for Small UAVs – 11
- Lor, Karin**  
HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397
- Loredo, Elvira N**  
Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability – 33
- Lorenzana, H.**  
Ultrafast, In Situ Probing of Shocked Solids at the Mesoscale and Beyond: a New Paradigm for Materials Dynamics – 573
- Losser, Kevin**  
Simulation and Analysis of Dart Dispense Events with Collisions – 235
- Loughran, Julia**  
Using Gaming and Agent Technology to Explore C2 – 537
- Louis, Francis**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Lu, Chenyang**  
Real-Time Communication and Coordination in Embedded Sensor Networks – 533
- Lu, Junxuan**  
Methylselenium and Prostate Cancer Apoptosis – 339
- Lu, Mei**  
Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289
- Lu, Xueqing**  
Intra-Prostate Cancer Vaccine Inducer – 316
- Lu, Yadong**  
The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515
- Lu, Zi**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Lucas, Carmen**  
Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392  
White Blood Cell Counts and Malaria – 400
- Lucero, J.**  
Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86
- Lucia, M S**  
Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 337
- Lucier, A.**  
Ecosystems and Climate Change: Research Priorities for the U.S. Climate Change Science Program. Recommendations from the Scientific Community – 278
- Luckyk, Paul W**  
Vertical Variation of Dust and Its Impact on the Top of the Atmosphere Brightness Temperature in the Midwave Infrared – 271
- Lueders, Kathryn**  
Developing Metrics in Systems Integration (ISS Program COTS Integration Model) – 608
- Lukas, Ludek**  
The Synergic Integrated Concepts of C2S – 174
- Luke, Thomas**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Luks, E. M.**  
Database Manipulations Using Group Theory – 435
- Lumpkin, Horace L**  
Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- Lund, S. M.**  
Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions – 603
- Lundquist, K. A.**  
Implementation of the Immersed Boundary Method in the Weather Research and Forecasting Model – 275

- Luo, Jianhui**  
PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498
- Luo, Y.**  
Crosslinked Compounds and Methods of Making and Using Thereof – 72
- Luqi,**  
Evolution of C4I Systems – 174
- Luscombe, James H**  
Non-Equilibrium Quantum Dots: Transport – 185  
Semiconductor Quantum Dot Resonant Tunnelling Spectroscopy – 185
- Luther, Linda**  
Environmental Impacts of Airport Operations: Maintenance, and Expansion – 44
- Lutz, R. N.**  
Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – 59
- Luu, T.**  
Description of ALARMA. The Alarm Algorithm Developed for the Nuclear Car Wash – 580  
Neutron Production by Muon Spallation I: Theory – 571
- Luz-Cjuno, Maria**  
Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386
- Luzwick, Perry**  
Applying the Concept of Minimal Essential to Maintain Operational Continuity and Attain Mission Assurance During Internal and External Attacks on the Information Environment – 495
- Lyke, Kirsten E**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Lynch, Nancy**  
Motion Coordination Using Virtual Nodes – 454  
Proving Atomicity: An Assertional Approach – 487  
Self-Stabilizing Mobile Node Location Management and Message – 511  
Virtual Stationary Automata for Mobile Networks – 536
- Lynn, D. M.**  
pH Triggerable Polymeric Particles – 66
- Lyons, John W**  
Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 21
- Lytton, R.**  
Application of Surface Energy Measurements to Evaluate Moisture Susceptibility of Asphalt and Aggregates – 74
- Lyu, H Y**  
Experimental and Numerical Investigations of RP-2 Under High Heat Fluxes – 130
- Ma, Norman K**  
Distributed Command and Organizational Situation Awareness – 142
- Ma, Ou**  
On-Orbit Identification of Inertia Properties of Spacecraft using Robotics Technology – 49
- Maamar, Zakaria**  
Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457
- Mabry, J**  
Processing of Multifunctional Epoxy Resins Modified with Silicon Based Nanomaterials (POSTPRINT) – 124
- Mabry, Joseph M**  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- MacArthur, Erica Z**  
Compliant Formation Control of an Autonomous Multiple Vehicle System – 507
- MacGillivray, A R**  
Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture – 93
- MacIver, Brian K**  
Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31
- Mack, Thomas J**  
Implementation of a High-Speed Numeric Function Generator on a COTS Reconfigurable Computer – 513
- Macker, Joseph P**  
Cooperative Multi-Agent Systems in Mobile Ad Hoc Networks – 495  
Multi-Agent Systems in Mobile Ad hoc Networks – 626
- MacKinnon, A.**  
FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere' – 672
- MacLaren, S. A.**  
Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601
- MacMillan, Jean**  
When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141
- MacNulty, Christine A**  
NDIA FORCEnet Study - Overview of the Human Element Group's Findings: Implications for C2 and other Aspects of NCW – 172
- Macon, Jr , W A**  
Emerging Energy Requirements for Future C4ISR – 244
- MacPherson, Douglas A**  
Optical and Radio Frequency Refractivity Fluctuations from High Resolution Point Sensors: Sea Breezes and Other Observations – 554
- Macri, R. A.**  
Progress on the Europium Neutron-Capture Study Using DANCE – 673
- Magaslaev, V.**  
8 GeV Beam Line Optics Optimization for the Rapid Antiproton Transfers at Fermilab – 557
- Magill, Alan J**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387  
Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392  
White Blood Cell Counts and Malaria – 400
- Magness, Lee S**  
Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114
- Magnus, Amy**  
New Metrics for Blog Mining – 622
- Mahadevan, Sankaran**  
PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498
- Mahadevan, Sridhar**  
Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – 523
- Mahaffey, D W**  
Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint) – 118
- Mahajan, Babita**  
Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389
- Mahmud, M**  
Relativistic Jets in the Radio Reference Frame Image Database. 1. Apparent Speeds From the First 5 Years of Data – 670
- Majam, Gary**  
Intracellular Survival of Campylobacter jejuni in Human Monocytic Cells and Induction of Apoptotic Death by Cytolethal Distending Toxin – 394

- Majam, Victoria**  
Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389
- Majunder, Uttam K**  
Point Spread Function Characterization of a Radially Displaced Scatterer Using Circular Synthetic Aperture Radar – 230
- Makowski, Armand M**  
A Strong Zero-One Law for Connectivity in One-Dimensional Geometric Random Graphs With Non-Vanishing Densities – 527
- Makrigiorgos, G M**  
Expression and Genomic Profiling of Minute Breast Cancer Samples – 281
- Maldonado, H.**  
Evaluation of Portable Emissions Measurement Systems (PEMS) for Inventory Purposes and the Not-to-Exceed Heavy-Duty Diesel Engine Regulation – 236
- Malhotra, R.**  
Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.) – 126
- Malik, Mujeeb R.**  
Analysis of Crossflow Transition Flight Experiment aboard the Pegasus Launch Vehicle – 43
- Maliner, Beverly I**  
Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110
- Malmuth, Norman D**  
Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – 518
- Malone, Shala**  
Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – 453  
Distributed Simulation Run Automation Capability for the Navy PRA Testbed – 453
- Man, Yang-gao**  
The Significance of Focal Basal Cell Layer Disruption-Induced Immuno-Cell Infiltration in Prostate Cancer Invasion – 364
- Managan, R. A.**  
Improved Charged Particle Model in CA-LEICF – 569
- Manfredi, James J**  
Restoration of Wild-Type Activity to Mutant p53 in Prostate Cancer: A Novel Therapeutic Approach – 365
- Manini, H. A.**  
Simulated Performance of a Second Generation Compact Compton Imaging Detector – 569
- Mann, G**  
Solar Radio Burst and Solar Wind Associations With Inferred Near-Relativistic Electron Injections – 669
- Mann, Travis A**  
Grout Impregnation of Pre-Placed Recycled Concrete Pavement (RCP) for Rapid Repair of Deteriorated Portland Cement Concrete Airfield Pavement – 45
- Mannikoff, A.**  
Studies on Electrical Safety, When Using ESD Protective Equipment, Especially ESD Protective Garments – 205
- Manning, Carol A.**  
Prediction and Classification of Operational Errors and Routine Operations Using Sector Characteristics Variables – 12
- Manning, Carol A**  
Relationship of Complexity Factor Ratings With Operational Errors – 513
- Maranda-Verastegui, Cesar**  
Comparison of Meglumine Antimoniate and Pentamidine for Peruvian Cutaneous Leishmaniasis – 386
- Marceau, C.**  
Secure Peer-to-Peer Object Storage System – 439
- Marchant, Darrell**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125
- Marchant, D**  
Processing of Multifunctional Epoxy Resins Modified with Silicon Based Nanomaterials (POSTPRINT) – 124
- Marchukov, Mark**  
Using Formal Methods to Reason about Architectural Standards – 472
- Marcus, Sherry E**  
Link Analysis for Dynamic Planning and Scheduling – 502
- Marian, J.**  
Collaborations in Nuclear Reactors – 559
- Marino, Lisa**  
Executive Overview of SEI MOSAIC: Managing for Success Using a Risk-Based Approach – 545
- Marinovic, Baldo**  
Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407
- Markman, Arthur B**  
Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666
- Marks, Peter J**  
Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305
- Marks, T. J.**  
Organic Light-Emitting Diodes and Related Hole Transport Compounds – 207  
Perylene N-Type Semiconductors and Related Devices – 205
- Markwell, Jeff**  
Real-Time Sonar Beamforming on High-Performance Distributed Computers – 596
- Marland, Peter**  
The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – 625
- Marlborough, S. J.**  
Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78
- Marlin, Michael J**  
Wide Area Search and Engagement Simulation Validation – 32
- Marmelstein, Robert E**  
The Outlook Y-JBI: An E-Mail Based Approach to Prototyping the Joint Battlespace Infosphere – 152
- Marmorstein, Ronen**  
Structure-Based Design of Cdk4/6-Specific Inhibitors – 290
- Ma'Roef, Chairin**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Marovich, Mary A**  
Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378
- Marozkina, N V**  
The Impact of Tyrosine Kinase Signaling on Breast Cancer Development – 289
- Marquino, Wilmer**  
Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – 380
- Marras, Giovanni**  
Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapotic Self-complementary Tecton Tailored to Halogen Bonding – 98
- Marshall, A. G.**  
High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – 71
- Marshall, II, Tommy V**  
A Comparative Assessment of Knowledge Management Leadership Approaches within the Department of Defense – 638
- Martel, Francois**  
Generic Organisation Data Integration Solution: The Fast and Convenient Way to Integrate Data – 644

- Martell, Craig**  
Degrees of Shared Awareness – 657
- Martemucci, Matteo G**  
Regaining the High Ground: The Challenges of Perception Management in National Strategy and Military Operations – 661
- Martenson, Christian**  
Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – 450
- Martin, Jay**  
Optimizing Parallel Execution of Detailed Wireless Network Simulation – 624
- Martin, L. P.**  
Impedance Analysis of Electrochemical NOx Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247
- Martin, Michael**  
Managing Responsibility and Information Flow in Dynamic Team Decision-Making – 151
- Martin, Paul**  
National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397
- Martin, Steve A**  
FEM Modeling of Guided Wave Behavior in Integrally Stiffened Plate Structures – 29
- Martin, Steven A**  
Impact Location for a Multilayer Transversely Isotropic Plate – 604
- Martinez, J. G.**  
Mesostructured Zeolitic Materials, and Methods of Making and Using the Same – 76
- Martovetsky, N. N.**  
Summary Report--FY2006 ITER Work Accomplished – 575
- Marzik, J. V.**  
Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 83
- Masad, E. A.**  
System for the Evaluation of Moisture Damage Using Fundamental Material Properties – 74
- Mascarenhas, A.**  
Time varying Reeb Graphs. A Topological Framework Supporting the Analysis of Continuous Time varying Data – 438
- Masel, Richard I**  
A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 112  
Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – 230  
New Column Designs for MicroGC (Preprint) – 197
- Masiello, Paul**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Maslen, Cheryl L**  
The Role of CRELD1 Isoform 9B in the Pathogenesis of Breast Cancer – 280
- Mason, Carl J**  
Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 396  
Mosaic Structure of a Multiple-Drug-Resistant, Conjugative Plasmid from Campylobacter jejuni – 407
- Mason, Jonathan D**  
Meteorological Factors That Lead to Separation of the California Coastal Jet from the Central Coast – 270
- Mastorides, T.**  
Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 580
- Mateczun, Alfred**  
Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – 386
- Mather, Patrick T**  
Hyperbranched Polymers for Resin Transfer Molding – 126  
Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81
- Matheson, Gordon**  
Do Capacity Coupled Electric Fields Accelerate Tibial Stress Fracture Healing – 287
- Mathew, J**  
Design and Validation of an Aeroacoustic Anechoic Test Facility – 587
- Mathew, Jose**  
Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551
- Mathews, Bruce**  
An Ultra High Resolution, Electro-Optical Framing Camera for Reconnaissance and Other Applications Using a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222  
Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – 222
- Mathews, P**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – 665
- Mathieson, Graham**  
From Simple Prescriptive to Complex Descriptive Models: An Example from a Recent Command Decision Experiment – 147
- Mattapallil, Joseph J**  
HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397
- Matthews, Christopher**  
An Expose of Autonomous Agents in Command and Control Planning – 498
- Matuska, M.**  
Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – 65
- Matyi, Richard J**  
Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186
- Maughon, B. R.**  
Telechelic Alkadiene Polymers with Crosslinkable End Groups and Methods for Making the Same – 73
- Mavrikakis, M.**  
Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – 105
- Mawhinney, R. D.**  
National Software Infrastructure for Lattice Quantum Chromodynamics – 581
- Max, C. E.**  
Adaptive Optics Views of the Hubble Deep Fields Final Report on LLNL LDRD Project 03-ERD-002 – 672
- Maxwell, Donald M**  
A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 374  
Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – 372
- May, M. J.**  
Second Preliminary Report on X-Ray Yields from OMEGA II Targets – 601
- Mayes, J S**  
2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – 82
- Mayhall, D. J.**  
Preliminary Low Frequency Electromagnetic Analysis of a Flux Concentrator – 569
- Mayk, Israel**  
C2 Product-Centric Approach to Transforming Current C4ISR Information Architectures – 612  
Experimenting with C2 Applications and Federated Infrastructures for Integrated Full-Spectrum Operational Environments in Support of Collaborative Planning and Interoperable Execution – 143

- Multinational C2 Experiments Supported by C2 Systems and Modeling and Simulations Addressing Army Transformation of Collaborative Planning and Interoperable Execution in a Coalition Environment – [615](#)
- Using a Combination of UML, C2RM, XML, and Metadata Registries to Support Long-Term Development/Engineering – [452](#)
- Mazaheri, Ali R.**  
Exploring Hypersonic, Unstructured-Grid Issues through Structured Grids – [437](#)  
Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – [58](#)
- McAfee, Farrell**  
Microarray-based Resequencing of Multiple *Bacillus anthracis* Isolates – [386](#)
- McArdle, M**  
Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – [251](#)
- McBeth, Michael S**  
A Theory of Interoperability Failures – [651](#)
- McBride, William H**  
Radiation-Induced Immune Modulation in Prostate Cancer – [325](#)
- McCall, S. K.**  
Radiation Damage Effects on the Magnetic Properties of  $\text{Pu}(1-x)\text{Am}(x)$  ( $x=0.224$ ) – [562](#)
- McCallam, Dennis H**  
Applying the Concept of Minimal Essential to Maintain Operational Continuity and Attain Mission Assurance During Internal and External Attacks on the Information Environment – [495](#)
- McCann, Carol**  
Using the Command and Control Framework to Analyse Command Challenges – [151](#)
- McCarron, Richard**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – [395](#)  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – [385](#)
- McCarthy, Anna**  
Developing and Evolving a Joint Australian Task List – [155](#)
- McCarthy, Dennis D**  
Evolution of Time Scales – [666](#)
- McCarthy, Jim**  
Defense Science Board 2006 Summer Study of Information Management for Net-Centric Operations. Volume 2. Operations Panel Report – [158](#)
- McCarthy, Karen**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – [387](#)
- McClaine, A. W.**  
Storage, Generation, and Use of Hydrogen – [69](#)
- McClellan, M.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – [420](#)
- McClintock, Kevin**  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – [330](#)
- McConkey, David J**  
Cell Cycle Dependence of TRAIL Sensitivity in Prostate Cancer Cells – [303](#)
- McConnell, Gregory**  
Today's Biometric Projects Need Mobile & Handheld Readers - Why? Applications and Readers – [476](#)
- McCormack, John P**  
On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – [263](#)
- McCormick, Ed**  
Experimentation with Evolving C2 Operation Centers - Implications for the Human Element – [137](#)
- McCourt, Michael J**  
A Decision Model for Selecting Energy Efficient Technologies for Low-Sloping Roof Tops Using Value-Focused Thinking – [242](#)
- McDaniel, David**  
A Roadmap for Developing Architectures in a Net-Centric World – [609](#)
- McDonough, John H**  
Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – [110](#)  
Atropine and Other Anticholinergic Drugs – [372](#)  
In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents – [77](#)
- McDougall, Ian**  
Application of NCO Conceptual Framework to US/UK Coalition Combat Operations during Operation Iraqi Freedom – [494](#)
- McEneaney, Julie**  
Exploring the High Energy Universe: GLAST Mission and Science – [667](#)
- McFarland, Blair J**  
Solving Wireless Communications Interoperability Problems among Emergency First Responders Depends on Greater National Guard Involvement – [181](#)
- McGaha, Christopher C**  
Filtered Rayleigh Scattering Measurements in a Buoyant Flowfield – [544](#)
- McGee, Steve**  
Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – [273](#)
- McGillis, W R**  
Microphysics of Air-Sea Exchanges – [274](#)
- McGinley, Catherine B**  
MEMS Shear Stress Sensors: Promise and Progress – [190](#)
- McGrath, Connor**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – [330](#)
- McGuinness, Barry**  
Assessing Human Factors in Command and Control: Workload and Situational Awareness Metrics – [422](#)  
Quantitative Analysis of Situational Awareness (QUASA): Applying Signal Detection Theory to True/False Probes and Self-Ratings – [132](#)
- McGuire, Michele**  
Agile Coalition Environment (ACE) – [613](#)
- McGwin, Gerald**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – [395](#)
- McHale, James**  
Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI – [481](#)
- McHugh, Kevin P**  
Skeletal Complications in Neurofibromatosis Type 1: The Role of Neurofibromin Haploinsufficiency in Defective Skeletal Remodeling and Bone Healing in NF1 – [377](#)
- McIlvain, Jason**  
Integrated Information Management (IIM) – [484](#)
- McIntire, Larry V**  
Tissue Engineering Research – [307](#)
- McIntosh, Dawn**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – [665](#)
- McIver, Rene**  
ISO/IEC JTC1 SC37 Overview – [474](#)
- McKay, David S.**  
Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – [675](#)

- McKenna, J**  
Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – [192](#)
- McKenzie, F E**  
Sources of Variability in Determining Malaria Parasite Density by Microscopy – [392](#)  
White Blood Cell Counts and Malaria – [400](#)
- McKeon, William**  
Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – [130](#)
- McKinley, Richard A**  
A Model of the Effects of Acceleration on a Pursuit Tracking Task – [37](#)
- McKnight, Steven H**  
Nanoengineered Additives for Active Coatings – [61](#)
- McKnight, Steven**  
Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – [121](#)
- McKown, Gary**  
Fort Holabird Defense Investigative Service (DIS), Base Realignment and Closure (BRAC) Cleanup Plan (BCP), Version II – [422](#)
- McLain, C D**  
Making Network Intrusion Detection Work With IPsec – [505](#)
- McLaughlin, Daniel**  
Assured Reference Technology Research (ARTHRR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – [596](#)
- McLoughlin, Glenn J**  
Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – [497](#)
- McMahan, M. A.**  
Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – [584](#)
- McMahon, Margaret M**  
Network Centric Warfare for Coalition Integrated Defense Against Terrorism – [165](#)
- McMillen, John D**  
Theoretical Characterization of the Radiative Properties of Dust Aerosol for the Air Force Combat Climatology Center Point Analysis Intelligence System – [271](#)
- McNabb, D. P.**  
Final Task Report on NRF Measurements of Photon Scattering Resonances in Plutonium at the High Voltage Research Laboratory of MIT – [561](#)
- McNally, Richard E**  
Aircraft Downwind Hazard Distance After a Chemical Attack – [34](#)
- McNeely, Rachelle L**  
Tour Planning for an Unmanned Air Vehicle Under Wind Conditions (Preprint) – [19](#)
- McNeill, Helen**  
Genetic and Molecular Analysis of the Mechanisms by Which TSC Regulates Neuronal Differentiation – [321](#)
- McNiel, Charles M**  
Demonstration of Clean Particle Seeding for Particle Image Velocimetry in a Closed Circuit Supersonic Wind Tunnel – [15](#)
- Meagher, Michael M**  
Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – [369](#)
- Meagher, Michael**  
Process Research and Development of Antibodies as Countermeasures for C. Botulinum – [308](#)
- Medalia, Jonathan**  
Terrorist 'Dirty Bombs': A Brief Primer – [250](#)
- Medina, Enrique A**  
Impact Location for a Multilayer Transversely Isotropic Plate – [604](#)
- Megretski, Alexandre**  
New Tools for Hybrid Systems – [517](#)
- Mehrotra, Sharad**  
An Approach to Integrating Query Refinement in SQL – [530](#)  
Integration of SATURN System and VGIS – [530](#)  
Locally Dimensionality Reduction: A New Approach to Indexing High Dimensional Spaces (Preprint) – [612](#)  
The Hybrid Tree: An Index Structure for High Dimensional Feature Spaces (Preprint) – [529](#)
- Mehta, Rajan**  
Cloning and Sequence Analysis of the 22-kDa Antigen Genes of *Orientia tsutsugamushi* Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – [399](#)
- Meirina, Candra**  
Effects-Based Design of Robust Organizations – [520](#)
- Meitzler, Tom**  
Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – [597](#)
- Mel, Bartlett W**  
Next-Generation Image and Sound Processing Strategies: Exploiting the Biological Model – [598](#)
- Melear, John**  
Bilateral Interoperability through Enterprise Architecture – [493](#)  
C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security – [629](#)
- C2 Interoperability: Simulation, Architecture and Information Security – [642](#)
- Melosh, N. A.**  
Superlattice Nanopatterning of Wires and Complex Patterns – [207](#)
- Meltz, Robert**  
The Supreme Court's Climate Change Decision: Massachusetts v. EPA – [263](#)
- Memon, Nasir**  
Source Camera Identification and Blind Tamper Detections for Images – [504](#)
- Menard, J. E.**  
Recent Physics Results from NSTX – [571](#)
- Mendez, A. J.**  
Design and Evaluation of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/OCDMA) – [177](#)
- Mendoza, S**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – [403](#)
- Meneveau, Charles**  
Turbulence and Complex Flow Phenomena in Multi-Stage Axial Turbomachines – [582](#)
- Mercadante, R.**  
Cooled Turbine Airfoil – [42](#)
- Merced, Norma**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – [375](#)
- Mercier, C. W.**  
Double Near-Net Forging of Article – [41](#)
- Meric-Bernstam, Funda**  
Translational Research from an Informatics Perspective – [416](#)  
Translational Research in Space Exploration – [413](#)
- Messina, A.**  
W + Jet Production at CDF – [585](#)
- Metrangolo, Pierangelo**  
Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapotic Self-complementary Tecton Tailored to Halogen Bonding – [98](#)
- Mett, Vadim**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – [377](#)
- Metzer, N**  
Novel Technology Evaluation for Volatile Organic Compounds Emission Control – [60](#)
- Meulen, D. V.**  
8 GeV Beam Line Optics Optimization for the Rapid Antiproton Transfers at Fermilab – [557](#)



- Meyer, April N**  
FGFR4 Downregulation of Cell Adhesion in Prostate Cancer – 376
- Meyer, Franck**  
Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapotic Self-complementary Tecton Tailored to Halogen Bonding – 98
- Meyers, B C**  
Conditions for Achieving Network-Centric Operations in Systems of Systems – 465
- Meyers, Michael A**  
Can GWOT Primary Prevention Strategy More Effectively Impede Religious Extremism? – 390
- Michael, James B**  
Experiments with the Sun Java Real-Time System -- Part 2 – 466
- Michala, Travis E**  
Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint) – 55
- Michalak, Travis E**  
Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint) – 55
- Michalski, Sydney C**  
Determining Logistics Ground Support Manpower Requirements for a Reusable Military Launch Vehicle – 57
- Michisaki, Reiko**  
Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407
- Michlin, Alex**  
Incident, Action, Recovery, and Recommissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – 202
- Miga, Michael I**  
Development of an Automated Modality-Independent Elastographic Image Analysis System for Tumor Screening – 357
- Mikhael, D**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339
- Mikhail, Auguston**  
Quality of Service Behavioral Model From Event Trace Analysis – 166
- Miles, Donald E**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7
- Miles, Donald**  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503
- Miles, R. C.**  
Battery System – 246
- Millar, Richard**  
A Feasibility Study of Life-Extending Controls for Aircraft Turbine Engines Using a Generic Air Force Model (Preprint) – 550
- Miller, Charles**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Miller, J O**  
Modeling the U.S. Military Intelligence Process – 448
- Miller, J. W.**  
Evaluation of Portable Emissions Measurement Systems (PEMS) for Inventory Purposes and the Not-to-Exceed Heavy-Duty Diesel Engine Regulation – 236
- Miller, James C**  
Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – 166  
Modeling Performance in C4ISR Sustained Operations: A Multi-Level Approach (Briefing Charts) – 411
- Miller, Janet E**  
Critiquing: A Methodology to Extract C2 Expertise – 166
- Miller, Joseph P**  
Incorporating New Technology to Create a Comprehensive Realistic Training Environment for the 91W – 343
- Miller, L D**  
Military Information Networks as Complex Adaptive Systems – 512
- Miller, Leo**  
NAC Off-Vehicle Brake Testing Project – 139
- Miller, Lynda**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335
- Miller, Michael K**  
Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114
- Miller, Nita L**  
A Process Model of Situated Cognition in Military Command and Control – 421
- Miller, P. L.**  
Application of Morse Theory to Analysis of Rayleigh Taylor Topology – 569
- Miller, R**  
Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122  
Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91
- Millhorn, David E**  
Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – 338
- Millhouse, Scott**  
Evaluation of airborne Electromagnetic Systems for Detection and Characterization of unexploded ordnance (uXo) – 12
- Mills, James N**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Mills, Patrick**  
Sustaining Air Force Space Systems: A Model for the Global Positioning System – 26
- Min, Byung G**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- Minagel, Todd C**  
Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114
- Minaie, Bob**  
Advanced Polymer Composite Molding Through Intelligent Process Analysis and Control – 85
- Minich, M.**  
Infiniband Performance Comparisons of SDR, DDR and Infinipath – 204
- Miniewicz, Andrzej**  
New Materials, Techniques and Device Concepts for Organic NLO Chromophore-based Electrooptic Devices. Part 1 – 291
- Minken, H.**  
Appraising Policies to Reduce Freight Transport Time and Its Variability-A New Method – 430
- Minnett, P J**  
Microphysics of Air-Sea Exchanges – 274
- Minor, Christian**  
Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – 637
- Minsavage, Gary D**  
Bifunctional Alkylating Agent-Induced p53 and Nonclassical Nuclear Factor kB Responses and Cell Death are Altered by Caffeic Acid Phenethyl Ester: A Potential Role for Antioxidant/Electrophilic Response-Element Signaling – 388
- Minton, Timothy K**  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- Miracle, Daniel B**  
Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99
- Miracle, Daniel**  
Nanoscience and Technology at the Air Force Research Laboratory (AFRL) – 54

- Mitchell, Brian J**  
Continent-Wide Maps of 5-50 S Rayleigh-Wave Attenuation for Eurasia Inferred from Maps of 1-Hz Lg Coda Q and its Frequency Dependence – 265
- Mitchell, Jr, Robert H**  
Real Options as a Strategic Management Framework: A Case Study of the Operationally Responsive Space Initiative – 51
- Mitchell, Roy**  
Workforce Configuration of a Canadian Forces Gematics Division – 539
- Mitcheltree, Larry W**  
Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383  
Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- Mithaiwala, Manish**  
Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere – 261
- Mitra, Sayan**  
Motion Coordination Using Virtual Nodes – 454  
Proving Atomicity: An Assertional Approach – 487
- Mittal, Rajat**  
Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215
- Mittu, Ranjeev**  
A Case Study for the Naval Training Meta-FOM (NTMF): Analyzing the Requirements from MAGTF FOM – 629  
Multi-Agent Systems in Mobile Ad hoc Networks – 626  
Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452  
Training Coordination Proxy Agents – 616
- MoberlyChan, W. J.**  
Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 83
- Moch, J K**  
Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379
- Modine, N. A.**  
Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems – 204
- Moffat, James**  
Modelling Information Age Warfare: Work In Progress – 654
- Moffat, Jim**  
From Simple Prescriptive to Complex Descriptive Models: An Example from a Recent Command Decision Experiment – 147  
Modelling a Network of Decision Makers – 610
- Mohan, Subburaman**  
Molecular Mechanisms of Soft Tissue Regeneration and Bone Formation in Mice: Implications in Fracture Repair and Wound Healing in Humans – 298
- Mohney, Suzanne E**  
Ohmic Contacts for Technology for Frequency Agile Digitally Synthesized Transmitters – 113
- Mokole, Eric L**  
RF Design for Tactical Ultra-Light Unmanned Aerial Vehicle Radar System – 27
- Mollenhauer, David**  
Image Reconstruction Based Modeling of 3D Textile Composite (Post-print) – 127
- Moloney Figliola, Patricia**  
Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – 497
- Moloney, Jerome V**  
Computational Nonlinear Optics: Femto-second Atmospheric Light String Applications – 266
- Molvik, A. W.**  
Quantitative Experiments with Electrons in a Positively Charged Beam – 606
- Mommsen, R. K.**  
Performance Measurement of the Upgraded D0 Central Track Trigger – 558
- Mones, C.**  
Removal of Elemental Mercury from a Gas Stream Facilitated by a Non-Thermal Plasma Device. Final Report – 258
- Mongillo, D. J.**  
Cooled Turbine Airfoil – 42
- Mongru, D**  
A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division – 20
- Monk, David J**  
Microsystems Research in Japan – 191
- Monroe, J. R.**  
Combined muon-neutrino and electron-neutrino Oscillation Search at Mini-BooNE – 557
- Montano, Silvia M**  
Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- Monteiro, Mario A**  
Cell-surface Alpha-glucan in Campylobacter jejuni 81-176 – 401
- Monteville, Marshall R**  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396
- Montgomery, Joel M**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Montgomery, John**  
Metrics for Command in an NEC Era: Operational Analysis of Way of Command in the Era of Network Enabled Capability – 170
- Montgomery, Vicki A**  
Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – 369
- Monty, Chelsea**  
Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – 230
- Moon, S.**  
FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere' – 672
- Mooney, David J**  
Tissue Engineering Research – 307
- Mooney, H.**  
Ecosystems and Climate Change: Research Priorities for the U.S. Climate Change Science Program. Recommendations from the Scientific Community – 278
- Moorcroft, David**  
Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10
- Moore, Andrew P**  
Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497  
Modeling and Analysis of Information Technology Change and Access Controls in the Business Context – 478
- Moore, David P**  
The Independent Readiness Team (IRRT) of SMC – 49
- Moore, III, Louis R**  
Measuring the Value of High Level Fusion – 608
- Moore, Jason**  
The Interactive DataWall – 209
- Moore, Ronald A**  
Communication of Context in Multi-Echelon Information Exchange Environments – 656  
Understanding and Improving Knowledge Transactions in Command and Control – 624

- Moore, Sandra**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631
- Moore, Valerie**  
Toxicity and Radioprotective Effects of DF-1 and Carbon Nanotubes in Human Lung and Liver Cell Lines – 418  
Utility of DF-1 for Radioprotection in Lymphocytes – 420
- Moraes, J R**  
Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394
- Moraes, M E**  
Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394
- Moran, Anita V**  
Effects of Sarin on the Operant Behavior of Guinea Pigs – 382
- Moran, T S**  
Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379
- Morehouse, D H**  
Hypothermia Induction and Recovery in Free-Ranging Rats – 409
- Moreira, J.**  
HPC-Colony: Services and Interfaces to Support Systems with Very Large Numbers of Processors. (2006 Annual Report, January-December 2006) – 431
- Morel, Andre**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Morrell, Morris**  
Simulation and Analysis of Dart Dispense Events with Collisions – 235
- Morgan, Daniel**  
Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – 10
- Morgan, G. B.**  
Tag Device, Luggage Tag, and Method of Manufacturing a Tag Device – 200
- Morgan, J.**  
8 GeV Beam Line Optics Optimization for the Rapid Antiproton Transfers at Fermilab – 557
- Morgan, Roger J**  
Characterization of the Structure-Processing-Performance Relations of Phenylethynyl Phthalic Anhydride Crosslinked Fluorinated Polyimides (AFR-PEPA-N) and Their Carbon Fiber Composites – 84
- Morgenstern, H.**  
Microsystem Enclosure and Method of Hermetic Sealing – 71
- Morita, T.**  
Telechelic Alkadiene Polymers with Crosslinkable End Groups and Methods for Making the Same – 73
- Morley, Rebecca**  
Battle Command on the Move – 145
- Morokuma, Keiji**  
Applications of Molecular and Materials Modeling – 94
- Moron, Cecilia**  
Human Spotted Fever Rickettsial Infections – 386  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404
- Morris, Ed**  
System-of-Systems Governance: New Patterns of Thought – 465
- Morris, Jr, Gerald W**  
The Chaos of Katrina – 267
- Morris, K.**  
Visible and Infrared Optical Design for the ITER Upper Ports – 599
- Morris, M. C.**  
Gas Turbine Engine Including a Low Pressure Sump Seal Buffer Source and Thermally Isolated Sump – 41
- Morris, Scott C**  
Tip Clearance Control Using Plasma Actuators – 16
- Morrisett, Greg**  
Next Generation Systems Languages – 455
- Morrison, Jeffrey G**  
Communication of Context in Multi-Echelon Information Exchange Environments – 656  
Understanding and Improving Knowledge Transactions in Command and Control – 624
- Morrissey, James F**  
Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers – 312
- Morse, Katherine L**  
Web Enabling HLA Compliant Simulations to Support Network Centric Applications – 444
- Moses, Clifford A**  
Fuel Property Effects on T700 Exhaust Particulates – 132
- Moshkina, Lilia**  
Lethality and Autonomous Robots: An Ethical Stance – 504
- Moss, Sarah M**  
Long-Range Operational Military Forecasts for Afghanistan – 271
- Mossman, Jason**  
Investigation of Advanced Propellants to Enable Single Stage to Orbit Launch Vehicles – 51
- Mostert, P. S.**  
Methods and Computer-Readable Medium for Navigating between a Plurality of Discrete Images – 432
- Moteff, John D**  
Critical Infrastructure Information Disclosure and Homeland Security – 656  
Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – 497
- Motoda, Hiroshi**  
Towards Next Generation WWW: Push, Reuse and Classification – 614
- Moulin, Bernard**  
Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457
- Mount, D. B.**  
Cloning and Characterization of SLC26A7 and SLC26A9 Anion Exchangers – 68
- Moustakas, T**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230
- Movit, Steven M**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665
- Moxley, Rayment E**  
A Multipurpose Projectile for Penetrating Urban Targets – 519
- Moynihan, Richard**  
Army Fire Support Investment Framework – 472
- Mracek, Curtis P**  
Control of Spinning Symmetric Airframes – 552
- Mrksich, Milan**  
Tissue Engineering Research – 307
- Mross, Klaus G**  
Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model – 375
- Mueschke, N.**  
Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing – 568  
Rayleigh Taylor Instability induced Mixing. Initial Conditions Modeling, Three Dimensional Simulations and Comparisons with Experiment – 570
- Mukhtar, Hasan**  
Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer – 320
- Muller, C J**  
Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186
- Muller, Patrick**  
The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314
- Mulvehill, Alice**  
Using Templates to Support Crisis Action Mission Planning – 455

- Mun, Seong K**  
Medical Vanguard Diabetes Management – 390
- Munsch, George F**  
The Mitigation of Radio Noise from External Sources at Receiving Sites – 163
- Munson, Michael J**  
High-Speed-/Hypersonic-Weapon-Development-Tool Integration – 22
- Muratore, C**  
Oxygen Plasma Treatment and Deposition of CNx on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121
- Murphey, Thomas W**  
A Test Method to Assess the Foldability of Flexible Structural Materials – 125
- Murphy, Jim**  
Case Study of a Prototype Set of Behaviorally Anchored Rating Scales (BARS) for C2 Assessment – 135
- Murphy, R K**  
The Joy of Computing with Volume-Integrals – 19
- Murphy, William J**  
Chemokine Blockade in Combination with Cytoreductive Conditioning in Metastatic Breast Cancer – 290
- Murray, Chris**  
Designing of Bulk Nano-Structures with Enhanced Thermoelectric Properties – 189
- Murray, Mark A**  
Post Traumatic Stress Disorder: The Facts – 369
- Mustafa, M.**  
Neutron Induced Cross Sections for Radiochemistry Isotopes of Nickel, Copper and Zinc – 106
- Mutumanje, E**  
Proteomic Analysis of Rickettsia prowazekii – 395
- Muzzell, Patsy**  
In the Midst of a Fuels Evolution - An Army Perspective – 38
- Myer, Charles R**  
C4ISR Architectural Frameworks in Coalition Environments – 153
- Myers, W. R.**  
Potential Applications of Microtesla Resonance Imaging Detected Using a Superconducting Quantum Interference Device – 560
- Myles, Kimberly**  
The Tactile Modality: A Review of Tactile Sensitivity and Human Tactile Interfaces – 423
- Myrick, M L**  
Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121
- Myslinski, Mike**  
Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667
- Nabar, R. P.**  
Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – 105
- Naber, N.**  
Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – 65
- Nace, William A**  
Development of a Charged-particle Accumulator Using an RF Confinement Method II – 591
- Nadeau, John**  
Improving the Resiliency of the Natural Gas Supply and Distribution Network – 129
- Nadelhoffer, K.**  
Ecosystems and Climate Change: Research Priorities for the U.S. Climate Change Science Program. Recommendations from the Scientific Community – 278
- Naff, Jeffrey E**  
Quick-Turn Finite Element Analysis for Plug-and-Play Satellite Structures – 520
- Naficy, Abdollah**  
Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379
- Nafziger, J. C.**  
Method and Apparatus for Providing an Asymmetric Watermark Carrier – 430
- Nagarajan, R. L.**  
Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214
- Nagarkatti, Rana**  
Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389
- Naimuddin, M.**  
Some Aspects of Hadron-Hadron Collisions in High Energy Interactions (B(O)(s) Mixing Oscillations in Semileptonic Decay at D0 Experiment) – 557
- Najafi, Khalil**  
Microsystems Research in Japan – 191
- Najita, J**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226
- Nakagawa, Arthur**  
Video Enabling the Combatant Commander's Headquarters – 48
- Nandi, Satyabrata**  
A Rat Model for Human Ductal Carcinoma In Situ – 392
- Naninaparampil, Jose**  
Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – 591
- Nantista, C. D.**  
Variable Directional Coupler for an Alternate ILC High-Power RF Distribution Scheme – 605
- Nanus, David**  
Anti-Angiogenic Action of Neutral Endopeptidase – 285
- Narayanan, Shri**  
Next-Generation Image and Sound Processing Strategies: Exploiting the Biological Model – 598
- Naseem, H. A.**  
Investigation of Low Temperature Metal Induced Crystallization and Doping of Silicon Using Various Excitation Sources for Solar Cells and other Microelectronic Applications. – 604
- Natelson, Douglas**  
Strategic Partnership for Research in Nanotechnology – 210
- Nathan, V**  
Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – 102
- Naulleau, P.**  
Lithographic Characterization of Low-Order Aberrations in a 0.3-NA EUV Microfield Exposure Tool – 600
- Naulty, Cheryl M**  
Children's Hospice – 293
- Navarra, Kelly R**  
PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498
- Nedd, Steven**  
Can a Self-Diagnostic Digitally Controlled Pacemaker/Defibrillator Device be Used for Alerting Military Personnel When a Soldier Health Condition Becomes Compromised Out in the Field – 426
- Neiderer, Wayne**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Nelman-Gonzalez, M.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Nelson, Brad H**  
Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms. Addendum – 357
- Nelson, Brian W**  
Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – 471

- Nelson, W**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230
- Nesthus, T.**  
Flight Attendant Fatigue – 412
- Neta, Beny**  
High-Order Higdon Non-Reflecting Boundary Conditions for the Linearized Euler Equations – 526
- Neu, Annette L**  
Building Collaborative Capacity for Biosecurity at the Georgia Seaports – 638
- Neumann, John**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631
- Neurock, Matthew**  
Applications of Molecular and Materials Modeling – 94
- Nevins, W. M.**  
Characterizing Electron Temperature Gradient Turbulence Via Numerical Simulation – 603
- Nevis, A. J.**  
Object Detection in Electro-Optic Sensor Images – 208
- Newlon, Thomas M**  
Mathematical Programming Model for Fighter Training Squadron Pilot Scheduling – 32
- Newman, J. A.**  
All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets – 674
- Newmark, Jonathan**  
Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – 110
- Ng, B.**  
Global Local Dynamic Models – 572  
Survey of Bayesian Models for Modelling of Stochastic Temporal Processes – 434
- Ng, J**  
Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394
- Ng, Kevin Y**  
Workforce Configuration of a Canadian Forces Gematics Division – 539
- Ng, Laurel**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Ng, T T**  
Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18
- Ngo, H. C.**  
Self Limiting Gate Leakage Driver – 200
- Nguy, Yves**  
Model of Energy Storage Circuit for Iso-otope Battery Based on SiC Schottky Diode – 212
- Nguyen, C. T. C.**  
Micromechanical Resonator Device Having a Desired Mode Shape – 201
- Nguyen, Huu H**  
Using Cyclic Memory Allocation to Eliminate Memory Leaks – 442
- Nguyen, Tam L**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330
- Nguyen-Tuong, Anh**  
Exploiting Data-Flow for Fault-Tolerance in a Wide-Area Parallel System – 447
- Nichol, Stuart T**  
Hantavirus Pulmonary Syndrome in Central Bolivia: Relationships Between Reservoir Hosts, Habitats, and Viral Genotypes – 378
- Nichols, Richard**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX (Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- Nicholson, Carol**  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385
- Nickel, Ulrich**  
Fundamentals of Signal Processing for Phased Array Radar – 176  
Principles of Adaptive Array Processing – 176
- Nickerson, C. A.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Nickerson, Cheryl A.**  
Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development – 371
- Nickol, Robert G**  
Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306
- Nielson, Paul E**  
A Qualitative Approach to Rigid Body Mechanics – 501
- Niemoeller, Ben**  
ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual – 469
- Nikkel, D.**  
Ultrafast, In Situ Probing of Shocked Solids at the Mesoscale and Beyond: a New Paradigm for Materials Dynamics – 573
- Nikolaev, S.**  
Large Synoptic Survey Telescope and Foundations for Data Exploitation of Petabyte Data Sets – 673
- Niles, Christopher**  
A Study of Autonomous Micro-Robots and Their Application to Complex Environments, Volume 1 – 543
- Niles, Steve**  
Incident, Action, Recovery, and Recommissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – 202
- Nilsen, J.**  
Looking for Anomalous Dispersion in Weakly Ionized Plasmas Using X ray Laser Interferometry – 603
- Nilsson, C.**  
Kapillaerelektrofores i Tva Dimensioner. Slutrapport Fran Innovationsprojekt 14215 (Two-Dimensional Capillary Electrophoresis Final Report of the Innovative Project 14215) – 68
- Nimnual, Anjaruwee**  
Characterization of the Role of Breast Tumor Kinase (BRK) in Breast Cancer Cells Non-responsive to EGFR-targeted Agents – 329
- Nirdnoy, Warawadee**  
Mosaic Structure of a Multiple-Drug-Resistant, Conjugative Plasmid from *Campylobacter jejuni* – 407
- Nishida, Toshi**  
MEMS Shear Stress Sensors: Promise and Progress – 190
- Nishida, Toshikazu**  
Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – 133  
Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551
- Nissen, Mark E**  
Computational Experimentation in C2 – 140  
Computational Experimentation with the Virtual Design Team: Bridging the Chasm between Laboratory and Field Research in C2 – 445
- Nitayaphan, Sorachai**  
Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army – 282
- Nithyanantham, T.**  
Oxygen Transport Ceramic Membranes. Quarterly Report from October 2006 through December 2006 – 126
- Niu, Eugene**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297

- Nixon, W E**  
Development and Assessment of a Complete ATR Algorithm Based on ISAR Euler Imagery – 468
- Nobithai, Anont**  
Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army – 282
- Noga, Andrew J**  
The Matrix Pencil and its Applications to Speech Processing – 589
- Nolte, Tina**  
Motion Coordination Using Virtual Nodes – 454  
Self-Stabilizing Mobile Node Location Management and Message – 511  
Virtual Stationary Automata for Mobile Networks – 536
- Nookala, Munichandraiah**  
Electrochemical Investigations of the Interface at Li/Li+ Ion Conducting Channel – 90
- Noort, Daan**  
Feasibility of Biomonitoring of Exposure to Permethrin Through Analysis of Long-Lived (Metabolite) Adducts to Proteins – 320  
Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model – 375
- Nordeen, Steven K**  
HOXC5 as a Biomarker of Disease Presence in Tumor-Associated Normal Prostate – 290
- Norman, E. B.**  
Final Task Report on NRF Measurements of Photon Scattering Resonances in Plutonium at the High Voltage Research Laboratory of MIT – 561
- Norman, Jon**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Norris, Sarah L**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335
- Norris, S**  
Development of In Vitro Correlate Assays of Immunity to Infection with Yersinia Pestis – 327
- Norwood, K.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Nothwang, William D**  
Electromechanics of Dielectric and Piezoelectric Crystals With Point, Line, and Surface Defects – 187
- Nounu, Hatem N.**  
Minimizing Astronauts' Risk from Space Radiation during Future Lunar Missions – 676
- Novak, Mark J**  
NMR Analysis of Thiodiglycol Oxidation by Mammalian Alcohol Dehydrogenases – 371  
Thiodiglycol, the Hydrolysis Product of Sulfur Mustard: Analysis of In Vitro Biotransformation by Mammalian Alcohol Dehydrogenases using Nuclear Magnetic Resonance – 384
- Novick, David**  
A Modular, Scalable, Architecture for Unmanned Vehicles – 547
- Nowka, K. J.**  
Method and System for Interactive Modeling of High-Level Network Performance with Low-Level Link Design – 436  
Self Limiting Gate Leakage Driver – 200
- Nullmeyer, Robert T**  
The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8
- Nunyuie, Mensa**  
Quarterly Groundwater Monitoring First Quarter Sampling Results fort Dix, New Jersey – 61
- Nurhayati,**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Nuss-Warren, S. R.**  
Phase 1 Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines – 237  
Report 17: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines. (Technical Report, October 1, 2006-December 31, 2006) – 237
- Nwogu, Okey G**  
Infra-Gravity Wave Input Toolbox (IGWT): User's Guide – 470
- Nykaza, Edward T**  
ERDC-CERL LD-870 Download Program Developed for Aberdeen Test Center: User's Manual – 469
- Nylund, W. E.**  
Micrometeorological and Soil Data for Calculating Evapotranspiration for Rainier Mesa, Nevada Test Site, Nevada, 2002-05 – 273
- Nyman, David W**  
Dynamic Tissue Culture from Prostate Biopsy Specimens as a Model for Predicting Tumor Radiosensitivity to Ionizing Radiation Treatment – 381
- Nyquist, Judith K**  
Support for the Resident Research Associateship Program with the U.S. Army Medical Research and Materiel Command – 338
- Nysether, Nathan E**  
Classifying Failing States – 528
- Obeidat, Baha**  
Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224
- Oberer, R. B.**  
Far Field Approximation in the Generalized Geometry Holdup (GGH) Model – 581  
Self Attenuation Correction for Holdup Measurements. An Historical Perspective – 581
- O'Brien, Catherine**  
Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water – 409
- O'Brien, Fergus**  
Models of Jointness: Infrastructure Issues for Inter-Organisational Working – 642
- O'Connell, Cynthia A**  
Observation on the Joint Service Military Medical Facility What Does the Future Hold – 398
- Odendaal, W G**  
Standard-Cell, Open-Architecture Power Conversion Systems – 247
- Odgers, Kenton M**  
Testing and Evaluation of Dynasig Biometric Pen in Support of Tactical Military and Law Enforcement Missions – 422
- Oelke, Mathias**  
Development of Antigen Presenting Cells for Adoptive Immunotherapy in Prostate Cancer – 286
- Oestin, A.**  
Kapillaerelektrofores i Tva Dimensioner. Slutrapport Fran Innovationsprojekt 14215 (Two-Dimensional Capillary Electrophoresis Final Report of the Innovative Project 14215) – 68
- Ogata, Naoya**  
Self Assembled Nano-Photonic Devices Derived from Marine DNA for Opto-Electronic Applications – 292
- Oh, Ilwhan**  
Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – 230
- Ohno, T. R.**  
Studies of Basic Electronic Properties of CdTe-Based Solar Cells and Their Evolution DURING Processing and Stress. Final Technical Report October 16, 2001-August 31, 2005 – 246
- Oilvier, S.**  
Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors – 600
- Ojard, G**  
Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122  
Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91

- Ojima, D.**  
Ecosystems and Climate Change: Research Priorities for the U.S. Climate Change Science Program. Recommendations from the Scientific Community – 278
- Okada, Hiroshi**  
Numerical Investigation for the Microstructural Effects on the Crack Growth Behavior of Particulate Composite Materials – 79
- Okrasinski, Richard**  
Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273
- Oleski, P. J.**  
T/R Module for Satellite TT&C Ground Link – 200
- Olsen, Karl Erik**  
Bi- and Multistatic Radar – 176
- Olson, James G**  
Human Spotted Fever Rickettsial Infections – 386  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- Olson, Mark A**  
Assessment of Detection and Refinement Strategies for de novo Protein Structures using Force Field and Statistical Potentials – 353
- O'Mahony, Orla A**  
Differential Mechanisms of Androgen Resistance – 313
- O'May, Janet**  
Data Mining Techniques Applied to Urban Terrain Command and Control Experimentation – 615  
Identifying Battlefield Metrics Through Experimentation – 158
- O'Meara, Wendy P**  
Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392
- ONeil, D. C.**  
t-bar Production at the Tevatron. Event Selection and Cross Section Measurement – 586
- O'Neill, John**  
Models of Jointness: Infrastructure Issues for Inter-Organisational Working – 642
- Ong, Hwa-Tung**  
Application of the Unscented Transformation to Obtain Target Range, Bearing, Elevation, Range Rate, Speed and Course Estimates and Errors From Tracks Given in Cartesian Coordinates – 517
- Ono, Noboru**  
A New Synthesis of Porphyrins with Extended Conjugation and their Photophysics – 62
- Oonk, Heather M**  
Communication of Context in Multi-Echelon Information Exchange Environments – 656  
Understanding and Improving Knowledge Transactions in Command and Control – 624
- Oordt, Mark**  
A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 332
- Opava, Susan C**  
The California Central Coast Research Partnership: Building Relationships, Partnerships and Paradigms for University-Industry Research Collaboration – 193
- Oppenheimer, Michael W**  
A Method for Including Control Effector Interactions in the Control Allocation Problem (Preprint) – 461  
Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48
- Oral, S**  
Multicast Performance Analysis for High-Speed Torus Networks – 484
- Oren, Alex**  
Handheld Broadband Electromagnetic UXO Sensor – 198
- Orgonek, Danielle**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
- Oristian, Thomas**  
Air Force Information Workflow Automation through Synchronized Air Power Management (SAPM) – 610
- Orlicki, Joshua A**  
Nanoengineered Additives for Active Coatings – 61  
Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79
- Orlowsky, Brian**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Oros, Carl**  
A Model of Tactical Battle Rhythm – 170
- O'Rourke, Ronald**  
Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress – 593  
Navy Ship Propulsion Technologies: Options for Reducing Oil Use - Background for Congress – 244  
Navy-Marine Corps Tactical Air Integration Plan: Background and Issues for Congress – 9
- Ortega-Binderberger, Michael**  
An Approach to Integrating Query Refinement in SQL – 530  
Content Based Retrieval Database Management System with Support for Similarity Searching and Query Refinement – 622
- Orth, David F**  
An Infrared Camera Simulation for Estimating Spatial Temperature Profiles and Signal-to-Noise Ratios of an Airborne Laser-Illuminated Target – 234
- Orton, Sarah L**  
Seismic Response of a Half-Scale Masonry Building with Flexible Diaphragms – 239
- Orvisky, E**  
Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308
- Osborne, J K**  
The Costs of Not Using Green Design in the USAF: Would Using Green Building Design Have Resulted in Life Cycle Cost – 212
- ose C**  
Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393
- Osga, Glenn**  
Human Factors Engineering: An Enabler for Military Transformation Through Effective Integration of Technology and Personnel – 424
- Oshinowo, B. O.**  
Survey and Alignment of the Fermilab Electron Cooling System – 585
- Ostberg, Donald T**  
Lightweight and Advanced Materials for Defense: Materials for Military Ground Vehicles – 85
- Otani, Thomas W**  
Experiments with the Sun Java Real-Time System -- Part 2 – 466
- Ott, C. Mark**  
Three-Dimensional Cell Culture Models for Infectious Disease and Drug Development – 371
- Ott, C. M.**  
A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Ou, Jao J**  
Development of an Automated Modality-Independent Elastographic Image Analysis System for Tumor Screening – 357
- Overholt, Jim**  
Establishment of a Center for Defense Robotics – 508

- Owen, Lyn**  
An Open Architecture Approach to Network Enabled Capability – 656
- Owens, Sarah M**  
Aircraft Battery Design Concept for Improved Ultra Low Temperature Performance (Postprint) – 17
- Oxgaard, Jonas**  
Ligand Field Strengths of Carbon Monoxide and Cyanide in Octahedral Coordination – 92
- Ozkaya, Ipek**  
Quality-Attribute-Based Economic Valuation of Architectural Patterns – 479
- Paddock, R.**  
Technology Review of Smart Sensors with Wireless Networks for Applications in Hazardous Work Environments – 168
- Paeaejaervi, L.**  
Demonstratore Foer Stoerskydd av GNSS-Mottagare (Demonstrator for Anti-Jamming of GNSS Receivers) – 204
- Pain, Arnab**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 388
- Palacios, Ana M**  
Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – 380
- Palmer, Dupeh R**  
Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378
- Palmer, Matthew R**  
Bisphosphonate-Based Contrast Agents for Radiological Imaging of Microcalcifications – 362
- Palmer, M.**  
Ecosystems and Climate Change: Research Priorities for the U.S. Climate Change Science Program. Recommendations from the Scientific Community – 278
- Palmieri, Tina L**  
State of the Science Meeting: Burn Care: Goals for Treatment and Research – 370
- Palmour, John**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184
- Palombo, F.**  
Measurements of CP-Violating Asymmetries in B0 to a1+(1260) pi+ Decays – 578
- Paloski, William H.**  
Artificial Gravity: Will it Preserve Bone Health on Long-Duration Missions? – 411
- Multi-System Effects of Daily Artificial Gravity Exposures in Humans Deconditioned by Bed Rest – 418
- Pan, Ernian**  
Atomistic Calculation of Elastic Moduli in Strained Silicon – 187  
On the Correlation Between the Self-Organized Island Pattern and Substrate Elastic Anisotropy – 552
- Pan, L.**  
CLMT2 User's Guide: A Coupled Model for Simulation of Hydraulic Processes from Canopy to Aquifer – 276
- Panchal, Rekha G**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330
- Panetta, C J**  
Materials on the International Space Station Experiment (MISSE): Optical Analysis of Molecular Contamination on PEC1 Tray 2 – 54
- Pang, Shen**  
Identification of a Protein for Prostate-Specific Infection – 301
- Pang, Somnang**  
Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378
- Pangilinan, Harold**  
Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120
- Pankove, J**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230
- Pantschenko, Alexander G**  
The Distribution, Levels, and Relevance of the Interleukin-1 Family of Cytokines and Receptors in Human Breast Carcinoma-Induced Osteolysis – 300
- Papadopoulos, Konstantinos**  
Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere – 261
- Papadopoulos, Themistoklis**  
Probability Modeling of Multi-Type Autonomous Unmanned Combat Aerial Vehicles Engaging Non-Homogeneous Targets Under Imperfect Information – 26
- Papagiannaki, Konstantina**  
Analysis of Origin Destination Flows (Raw Data) – 521
- Papila, Melih**  
Optimization of Synthetic Jet Actuators – 235
- Pappas, Daphne**  
Wettability Tests of Polymer Films and Fabrics and Determination of Their Surface Energy by Contact-Angle Methods – 89
- Papp-Szabo, Erzsebet**  
Cell-surface Alpha-glucan in Campylobacter jejuni 81-176 – 401
- Paradiso, Rick**  
Developing an Information Superiority-Command and Control Joint Experimentation Strategy – 648
- Paragi, Robert**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Paranthaman, M. P.**  
Superconductors on Iridium Substrates and Buffer Layers – 606
- Parazyński, Scott**  
Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415
- Parenteau, Nancy L**  
Tissue Engineering Research – 307
- Parfomak, Paul W**  
Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety and Regulation – 129
- Parisi, F. B.**  
Double Near-Net Forging of Article – 41
- Park, Adrian E**  
Advanced Technologies in Safe and Efficient Operating Rooms – 309
- Park, Cheol**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- Park, Heungsoon**  
Effective Mobile Routing Through Dynamic Addressing – 182
- Park, Sung Sik**  
Towards Next Generation WWW: Push, Reuse and Classification – 614
- Park, Tae**  
Numerical Analysis of Chamber Wall Heat Transfer in a GH2/GO2 Sub-Scale Combustor – 98
- Parker, Andrew A**  
Signal Population in the License-Exempt Wireless-Radio Bands at the MOUT Site – 152  
The Mitigation of Radio Noise from External Sources at Receiving Sites – 163
- Parker, James**  
Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – 130
- Parker, KathyIn A**  
Novel and Efficient Synthesis of the Promising Drug Candidate Discodermolide – 355
- Parker, W.**  
Progress on the Europium Neutron-Capture Study Using DANCE – 673
- Parra, M.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420



- Parrish, P**  
Fabrication of Nanoscaled Systems – 229
- Parviz, Babak A**  
Meso-Scale Self-Assembly Pilot Study – 199
- Pascoe, Celina**  
Yet Another Role for Team Building and Work Motivation -Enabler of Knowledge Creation and Knowledge Sharing – 457
- Pastor-Cauna, Giovanna**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- Patchan, M. W.**  
Determination of Metal Ions in Solution by Photoluminescence Anisotropy – 115
- Patel, Mamta J.**  
Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411
- Patel, Mehul P**  
Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18
- Patel, P. K.**  
High Efficiency Grazing Incidence Pumped X ray Laser – 601
- Patel, P.**  
FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere' – 672
- Patara, Anthony T**  
Parameter Space: The Final Frontier. Certified Reduced Basis Methods for Real-Time Reliable Solution of Parametrized Partial Differential Equations – 512
- Patil, S K**  
Distributed Mechanical Actuators for Design of a Closed-Loop Flow-Control System (Postprint) – 18
- Patrick, Andrew S.**  
Usability and Acceptability of Biometric Security Systems – 473
- Patrick, Scott**  
AFRL/IF Technology Transition to the Warfighter via the CAOC-X – 464
- Patriotis, Christos**  
Mechanisms and Chemoprevention of Ovarian Carcinogenesis – 358
- Patterson, Robert**  
Helmet-Mounted Displays for Use in Air Force Training and Simulation – 6
- Pattipati, Krishna R**  
A Systematic Approach to Optimize Organizations Operating in Uncertain Environments: Design Methodology and Applications – 169
- Effects-Based Design of Robust Organizations – 520
- Patton, Kenneth E**  
Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426
- Paugh, Francesca**  
Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488
- Paul, Gesine**  
Developing Human Embryonic Stem Cells for Grafting in Parkinson's Disease – 343
- Paul, Raymond**  
Performance Measurement in C2 Systems – 496
- Paul, U.**  
Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – 105
- Paulini, M.**  
Spectroscopy and Decay of B Hadrons at the Tevatron – 576
- Pavletic, Steven**  
National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397
- Pawar, Sangita C**  
Effects of Modifications in the Laminin-10 Basal Laminina on Prostate Cancer Invasion – 376
- Pawling, Carl R**  
Modeling the U.S. Military Intelligence Process – 448
- Pawlowski, Tom**  
Applying Executable Architectures to Support Dynamic Analysis of C2 Systems – 482
- Pax, P.**  
Gas Detector LCLS Engineering Specifications Document – 573
- Payer, J. H.**  
Modeling the Effects of Crevice Former, Particulates, and the Evolving Surface Profile In Crevice Corrosion – 119
- Pearce, Bruce**  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385
- Pearce, L B**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395
- Pearson, Jeffrey P**  
The Effect of Graduate Education on the Performance of Air Force Officers – 526
- Peehl, Donna M**  
Development of Methodology to Maintain Primary Cultures of Normal and Malignant Human Prostatic Epithelial Cells in Vivo – 342
- Pekker, L**  
Effect of Thermal Conductivity on the Knudsen Layer at Ablative Surfaces – 607
- Pellerin, Karine**  
The Accuracy of a Fingerprint/Voice Multimodal Verification System – 473
- Pelletier, Paul**  
Facial Recognition Evaluation Project Passport Office of Canada - The Methodology and Findings – 228
- Pelton, M. A.**  
Concepts Associated with Transferring Temporal and Spatial Boundary Conditions Between Modules in the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) – 431
- Pennington, D.**  
Adaptive Optics Views of the Hubble Deep Fields Final Report on LLNL LDRD Project 03-ERD-002 – 672
- Penta, Heather L**  
Collaboration Tool Suites Developed to Support Joint Command and Control Planning and Decisionmaking – 471
- Perala, Chuck H**  
Galvanic Skin Response as a Measure of Soldier Stress – 410  
Workload, Stress, and Situation Awareness of Soldiers Who are Controlling Unmanned Vehicles in Future Urban Operations – 408
- Perez, G.**  
Predicting the Cosmological Constant from the Causal Entropic Principle – 671
- Perez-Bao, J**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403
- Perina, Jan**  
Nonclassical Properties of Pulsed Second-Subharmonic Generation in Photonic-Band-Gap Structures – 196
- Perkins, D. D.**  
Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – 214
- Perla, Peter P**  
Using Gaming and Agent Technology to Explore C2 – 537
- Perlin, M. W.**  
Automated STR Analysis for DNA Databases – 429

- Perlmutter, David H**  
Pharmacological and Nonpharmacological Methods of Treatment for Fragile – 410
- Permpanich, Barnyen**  
Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392  
White Blood Cell Counts and Malaria – 400
- Pernin, Chris**  
Modelling a Network of Decision Makers – 610
- Perpall, Mark W**  
Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – 100
- Persad, K.**  
Electronic Vehicle Identification: Industry Standards, Performance, and Privacy Issues – 178  
Impacts of Traveler Information on Transportation Network Operations and Potential Deployment Technologies – 178
- Pervin, Farhana**  
Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113
- Peskin, M.**  
Gravi-Leptogenesis: Leptogenesis from Gravity Waves in Pseudo-Scalar Driven Inflation Models – 673
- Peters, K.**  
Proposal to Upgrade the MIPP Experiment – 563
- Peterson, Alan**  
A Randomized Trial of Musculoskeletal Pain Treatment in a Military Population – 332  
Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption – 337
- Peterson, Gregory W**  
Novel Collective Protection Filters for Emerging TIC Requirements: Axial and Radial-Flow Filter Designs – 55
- Peterson, Michael C**  
From the Battlefield to the Homeland: Building the Case for Network-Centric Response – 636
- Peterson, R. J.**  
Proposal to Upgrade the MIPP Experiment – 563
- Peterson, Scott N**  
Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – 335
- Petitt, Patricia L**  
Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332
- Petricovics, Ilona**  
Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110
- Petroff, P. M.**  
Superlattice Nanopatterning of Wires and Complex Patterns – 207
- Petrov, Plamen V**  
Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627  
Intelligent Agent-Based Software Architecture for Tactical Decision Aid under Overwhelming Information Inflow and Uncertainty – 502
- Petrov, Plamen**  
Distributed Command and Control Research: Networking Multiple Simulation Platforms – 495  
Eyekon: Distributed Augmented Reality for Soldier Teams – 655
- Petteys, Brian J**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- Pfarr, Jerry W**  
Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31
- Pfeffer, A.**  
Global Local Dynamic Models – 572
- Pfeffer, R A**  
Emerging Energy Requirements for Future C4ISR – 244
- Pfeffer, Robert A**  
A Rationale for Establishing Survivability Requirements for Objective Force Unmanned Army Platforms and Systems – 191
- Pfeffer, Robert**  
Digital C4I Interoperability: The EM Protection Issue – 163
- Pfeiderer, Elaine M.**  
Prediction and Classification of Operational Errors and Routine Operations Using Sector Characteristics Variables – 12
- Pfleiderer, Elaine M**  
Relationship of Complexity Factor Ratings With Operational Errors – 513
- Pham, Khan D**  
Multi-Cumulant and Non-Inferior Strategies for Multi-Player Pursuit-Evasion (PREPRINT) – 544
- Pham, Khanh D**  
Cooperative Solutions in Multi-Person Quadratic Decision Problems: Finite-Horizon and State-Feedback Cost-Cumulant Control Paradigm – 516
- Phelps, Janet R**  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330
- Philbin, Nora**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385
- Philippens, Ingrid H**  
Monitoring and Counteracting Functional Deterioration in Parkinson's Disease: A Multilevel Integrative Approach in a Primate Model System – 319
- Philippens, M M**  
Assessment of Injury Potential in Aircraft Side-Facing Seats Using the ES-2 Anthropomorphic Test Dummy – 10
- Phillabaum, II, Robert A**  
A Multipurpose Projectile for Penetrating Urban Targets – 519
- Phillips, C S**  
Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379
- Phillips, Charles**  
The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314
- Phillips, Laurence**  
Suitability of Agent Technology for Military Command and Control in the Future Combat System Environment – 457
- Phillips, T. J.**  
Environmental Consequences of Large-Scale Deployment of New Energy Systems – 253
- Philp, Chris**  
The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – 625
- Phipps, W A**  
A Multiservice Switch for Advanced Avionics Data Networks – 42
- Phister, Jr , Paul W**  
AFRL/IF Technology Transition to the Warfighter via the CAOC-X – 464  
Joint Synthetic Battlespace: Cornerstone for Predictive Battlespace Awareness – 455
- Phister, Paul W**  
Data Fusion 'Cube': A Multi-Dimensional Perspective – 628
- Phister, Paul**  
The Combined Aerospace Operations Center (CAOC) of the Future – 160

- Photinos, William**  
Distributed Simulation Run Automation Capability for the Navy PRA Test-bed – 453
- Pickett, Lynn K.**  
Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425
- Piebler, Lars T**  
Nanoengineered Additives for Active Coatings – 61
- Piekarz, H.**  
Preliminary Study of Using ‘Pipetron’-Type Magnets for a Pre-Accelerator for the LHC – 566
- Pierce, Byron J**  
Helmet-Mounted Displays for Use in Air Force Training and Simulation – 6  
Visual Simulation S&T: Summary of Accomplishments – 7
- Pierce, David**  
Automated Information Extraction System (AIES) Capability Enhancement and Support – 614
- Pierce, N A**  
Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127
- Pierson, D. L.**  
A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment – 414
- Pigeau, Ross**  
Using the Command and Control Framework to Analyse Command Challenges – 151
- Pigeon, Luc**  
Concept of C4I Data Fusion Command Center for Urban Operations – 155  
HUMINT Communication Information Systems for Complex Warfare – 642
- Pilati, Tullio**  
Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapic Self-complementary Tecton Tailored to Halogen Bonding – 98
- Pillariseti, Aravind**  
Adaptive Identification of Fluid-Dynamic Systems – 215
- Pimentia, Ian S**  
Pentazole-Based Energetic Ionic Liquids: A Computational Study (Preprint) – 97
- Pineda, A**  
On the Importance of Atomic Packing in Determining Dielectric Permittivities – 553
- Piner, B G**  
Relativistic Jets in the Radio Reference Frame Image Database. 1. Apparent Speeds From the First 5 Years of Data – 670
- Piranian, A**  
Advances in Modeling and Simulation Capabilities for Predicting Store Trajectories - Past Success and Future Challenges – 5  
Use of Statistical Tools to Improve Modeling and Simulation of Store Separation – 4
- Pirkil, Daniel**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Pirolli, Peter L**  
A New Perspective on Use of the Critical Decision Method with Intelligence Analysts – 609
- Pitt, M L**  
Determination of Antibiotic Efficacy Against Bacillus Anthracis in a Mouse Aerosol Challenge Model – 335  
The Use of a Low-Concentration Heparin Solution to Extend the Life of Central Venous Catheters in the African Green Monkeys (*Chlorocebus aethiops*) – 402
- Pittman, Phillip R**  
Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) Francisella Tularensis Vaccination – 332
- Pizzul, L.**  
Degradation of Polycyclic Aromatic Hydrocarbons by Actinomycetes – 104
- Place, Pat**  
Conditions for Achieving Network-Centric Operations in Systems of Systems – 465  
System-of-Systems Governance: New Patterns of Thought – 465
- Platoff, Gennady E**  
Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110
- Plonisch, Igor G**  
AFRL/IF Technology Transition to the Warfighter via the CAOC-X – 464  
Joint Synthetic Battlespace: Cornerstone for Predictive Battlespace Awareness – 455
- Plonisch, Igor**  
Data Fusion ‘Cube’: A Multi-Dimensional Perspective – 628  
The Combined Aerospace Operations Center (CAOC) of the Future – 160
- Plowe, Christopher V**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Plunkett, B**  
Elastic-Viscoplastic an Isotropic Modeling of Textured Metals and Validation using the Taylor Cylinder Impact Test – 117
- Pocar, A.**  
Liquid Xenon Ionization Chamber in an All-Fluoropolymer Vessel – 582
- Poggio, Tomaso**  
Ultra-fast Object Recognition from Few Spikes – 501
- Poirier, John A**  
‘How Much is a Pound of C4ISR Worth?’ An Assessment methodology to Evolve Network Centric Measures and Metrics for Application to FORCEnet – 173  
NDIA FORCEnet Study - Overview of the Human Element Group’s Findings: Implications for C2 and other Aspects of NCW – 172  
Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000 – 489
- Poirier, John**  
Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – 469
- Polk, J. D.**  
Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – 415
- Pollak, Thomas M**  
Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP2 – 233
- Pollet, P**  
Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- Pollock, Robert**  
Suitability of Agent Technology for Military Command and Control in the Future Combat System Environment – 457
- Polsen, Erik S**  
Analysis of the Thermal Shielding Properties of Camouflage Materials Brief – 192  
Analysis of the Thermal Shielding Properties of Camouflage Materials – 191
- Pomeroy-Huff, Marsha**  
Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI – 481
- Poon, K.**  
Gas Turbine Engine Including a Low Pressure Sump Seal Buffer Source and Thermally Isolated Sump – 41
- Porche, Isaac**  
Framework for Measuring the Impact of C4ISR Technologies and Concepts on Warfighter Effectiveness Using High Resolution Simulation – 144
- Porter, Gary R**  
Enablers of Self-Synchronization for Network-Centric Operations: Design of a Complex Command and Control Experiment – 460

**Porter, Kevin R**

Cross-Serotype Neutralization of Dengue Virus in *Aotus nancymae* Monkeys – 387

**Porter, Mark W**

Transcriptome Analysis of Human Immune Responses Following Live Vaccine Strain (LVS) *Francisella Tularensis* Vaccination – 332

**Porwollik, S.**

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

**Post, Douglass E**

A Proposed Taxonomy for Software Development Risks for High-Performance Computing (HPC) Scientific/Engineering Applications – 478

**Potikasikorn, Jinnapa**

Behavioral Responses to DDT and Pyrethroids Between *Anopheles Minimus* Species A and C Malaria Vectors in Thailand – 393

**Potok, Thomas**

Suitability of Agent Technology for Military Command and Control in the Future Combat System Environment – 457

**Potter, John K**

Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99

**Poulton, M J**

GaN Wide Band Power Integrated Circuits (Preprint) – 95

Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95

Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192

**Powell, Allison L**

Comparing the Performance of Collection Selection Algorithms – 613

**Powell, Gerald M**

Army Intelligence Analysis and Interpretation: Assessing the Utility and Limitations of Computational Diagnostic Reasoning – 652

**Poynter, Kennon R**

Mechanism of Telomerase Inhibition Using Small Inhibitory RNAs and Induction of Breast Tumor Cell Sensitivity – 287

**Pozgay, Angela**

Systems and Capability Relation Management in Defence Systems-of-System Context – 616

**Prabaripai, Atchariya**

Behavioral Responses to DDT and Pyrethroids Between *Anopheles Minimus* Species A and C Malaria Vectors in Thailand – 393

**Prasad, Paras N**

New Generation Photonics Materials: Design, Development, Characterization, and Applications – 210

**Pravecek, Tasha L**

Bio-Defense Now: 56 Suggestions for Immediate Improvements – 427

**Prekop, Paul**

Sense Making - Underpinning Concepts and Relation to Military Decision-Making – 617

**Prendergast, George C**

IDO Inhibitors for Combination Therapy of Prostate Cancer – 317

**Prestwich, G. D.**

Crosslinked Compounds and Methods of Making and Using Thereof – 72

**Price, D. F.**

High Efficiency Grazing Incidence Pumped X ray Laser – 601

**Price, D W**

Molecular Random Access Memory Cell – 441

Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions – 187

**Price, Richard**

Impact of Information Technology-For Strategic Leaders – 181

**Price, Roseanne**

Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321

**Prieto, L. M.**

USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling – 277

**Prior, Stephen**

Weathering the Storm. Leading Your Organization Through a Pandemic – 368

**Prokurat-Franks, Lisa**

Tank Automotive Research, Development, and Engineering Center – 129

**Proulx, Rene**

Recommendations for Network-and Internet-based Synchronized E-activities for Location- and Time-dependent Information – 457

**Prouty, Ray C**

Challenges for Vertical Collaboration Among Warfighters for Missile Defense C2 – 443

**Prudhomme, Wendy A**

White Blood Cell Counts and Malaria – 400

**Pruet, J.**

Test Suite for Nuclear Data I. Deterministic Calculations for Critical Assemblies and Replacement Coefficients – 574

**Przedborski, Serge**

Program Project on the Pathogenesis and Treatment of Parkinson's Disease – 334

**Przepiorka, Donna**

National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397

**Puglionesi, P S**

Novel Technology Evaluation for Volatile Organic Compounds Emission Control – 60

**Puigserver, Pere**

Maintenance of Glucose Homeostasis through Acetylation of the Metabolic Transcriptional Coactivator PGC-1alpha – 343

**Puntel, Robert**

Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360

**Purcell, Bret K**

Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340

**Purkitt, Helen E**

Problem representation and variation in the forecasts of 'political experts' – 543

**Purvis, Keith B**

A Review of Recent Algorithms and a New and Improved Cooperative Control Design for Generating a Phantom Track (Preprint) – 26

**Puterbaugh, Rebekah L**

Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint) – 55

**Puterbaugh, Rebekah**

Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint) – 55

**Putnam, Cheryl D**

Distributed Computing and Collaboration Framework (DCCF) – 466

**Putnam, Shannon D**

Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375

Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396

Posttreatment Changes in *Escherichia coli* Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385

**Pyles, Raymond A**

Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability – 33

**Qerushi, A.**

Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma – 574

- Qian, Wei**  
Integration of Anatomic and Pathogenic Bases for Early Lung Cancer Diagnosis – 506
- Qiu, Jing-Mei**  
Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – 515
- Qu, Liangti**  
Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81
- Quake, S. R.**  
High Throughput Screening of Crystallization of Materials – 71
- Quashnock, Dee**  
Human Systems Integration Assessment of Network Centric Command and Control – 421
- Quevy, E. P.**  
Damascene Process for Use in Fabricating Semiconductor Structures Having Micro/Nano Gaps – 213
- Quick, L.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Quigley, Jason**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Quinkert, Kathleen A**  
Performance Analysis and Training for Digital Command Staff: Training for the Battle Command Reengineering III – 650
- Quinn, J. P.**  
High Resolution Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometry Methods and Apparatus – 71
- Quinn, Michael L**  
Evolution of a Mission Plan – 646
- Quintana, Roxanne**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125
- Radabaugh, T.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Radadia, Adarsh D**  
A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 112  
New Column Designs for MicroGC (Preprint) – 197
- Radice, Richard A**  
Dominating Cyberspace – 660
- Radojevic, Antonije**  
Terahertz Fiber Laser for Explosives Detection – 229
- Radousky, H. B.**  
Science & Technology Review January/February 2007 – 575
- Rafiq, A.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415
- Rago, Thomas A**  
Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – 407
- Ragot, B R**  
Near-Relativistic Electron c/v Onset Plots – 668
- Rahaman, M N**  
Microstructure of Dense Thin Sheets of gamma-TiAl Fabricated by Hot Isostatic Pressing of Tape-Cast Monotapes (Preprint) – 92
- Rahardjo, Nancy**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Rahimi, Ali**  
Simultaneous Localization, Calibration, and Tracking in an ad Hoc Sensor Network – 536
- Raine, J D**  
A Comprehensive Survey of the Plasmodium Life Cycle by Genomic, Transcriptomic, and Proteomic Analyses – 388
- Rajca, Andrzej**  
Organic Polymers with Magneto-Dielectric Properties – 124
- Raju, Reni**  
Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215
- Raju, Usha**  
Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289
- Rajulu, Sudhakar**  
Anthropometric Accommodation in Space Suit Design – 424
- Rakho, I.**  
Radiation Shielding Issues for Superconducting RF Cavity Test Facility at Fermilab – 564
- Ramachandran, Hariharan**  
Background Modeling and Algorithm Fusion for Airborne Landmine Detection – 517
- Ramamurthy R.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Ramdat, Upendra**  
Software Communications Architecture (SCA) Compliant Software Defined Radio Design for Interim Standard 95B (IS-95B) Transceiver – 463
- Ramesh, Govindarajan T.**  
Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416
- Ramesh, Kaliat T**  
Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114
- Ramesh, Sivarajan**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- Ramseyer, George O**  
A Distributed Parallel Processing System for Command and Control Imagery – 466  
Rapid C4I High Performance Computing for Hyperspectral Imaging Exploitation – 598
- Randall, Cora E**  
On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263
- Randall, John N**  
Non-Equilibrium Quantum Dots: Transport – 185  
Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186  
Semiconductor Quantum Dot Resonant Tunneling Spectroscopy – 185
- Ranganathan, Srinivasa**  
Topological Close Packing in Structurally Complex Intermetallics (Crystalline, Quasicrystalline and Noncrystalline) – 116
- Rangwala, Huzefa**  
fRMSDPred: Predicting Local RMSD Between Structural Fragments Using Sequence Information – 369
- Rao, A. M.**  
Novel Synthesis of Branched Carbon Nanotubes – 207
- Rao, K M**  
Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335
- Rao, Malla R**  
Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379
- Rao, Mohan D**  
A Model for Predicting Intelligibility of Binaurally Perceived Speech – 153
- Rao, P S**  
Field Demonstration and Validation of a New Device for Measuring Groundwater and Perchlorate Fluxes at IHDIV-NSWC, Indian Head, MD – 139

- Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes at Naval Base Ventura County (NBVC), Port Hueneme, CA – [138](#)
- Field Demonstration and Validation of a New Device for Measuring Water and Solute Fluxes NASA LC-34 SITE – [138](#)
- Ras, Josephine**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – [279](#)
- Rasch, Robert**  
AI on the Battlefield: An Experimental Exploration (Preprint) – [501](#)
- Rasmi, Srihari**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – [588](#)
- Rasmuson, A.**  
Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – [109](#)
- Rasmussen, Suzanne L**  
Microarray Analysis of Transposon Insertion Mutants in Bacillus Anthracis: Global Identification of Genes Required for Sporulation and Germination – [335](#)
- Ratanatharathorn, Voravit**  
Cord Blood Stem Cell Procurement in Minority Donors – [302](#)
- Rathore, Dharmendar**  
Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – [389](#)
- Ratti, A.**  
Fermi Timing and Synchronization System – [605](#)
- Rauch, Travis M**  
Savage Modeling and Analysis Language (SMAL): Metadata for Tactical Simulations and X3D Visualizations – [640](#)
- Ravel, Jacques**  
Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – [386](#)
- Rawlett, A M**  
Molecular Random Access Memory Cell – [441](#)
- Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – [121](#)
- Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions – [187](#)
- Rawlett, Adam M**  
Nanoengineered Additives for Active Coatings – [61](#)
- Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – [79](#)
- Ray, Indrajit**  
A Model of Trust for Developing Trustworthy Systems From Untrustworthy Actors – [660](#)
- Ray, Indrakshi**  
A Model of Trust for Developing Trustworthy Systems From Untrustworthy Actors – [660](#)
- Ray, Radharaman**  
DNA Ligase I is an In Vivo Substrate of DNA-Dependent Protein Kinase and is Activated by Phosphorylation in Response to DNA Double-Strand Breaks – [383](#)
- Raymond, J C**  
Ultraviolet Properties of Halo Coronal Mass Ejections: Doppler Shifts, Angles, Shocks, and Bulk Morphology – [668](#)
- Read, Timothy D**  
Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – [386](#)
- Reading, Richard**  
Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – [453](#)
- Distributed Simulation Run Automation Capability for the Navy PRA Testbed – [453](#)
- Rebak, R. B.**  
Crevice Repassivation Potentials for Alloy 22 in Simulated Concentrated Ground Waters – [119](#)
- Rebollo, Jerome**  
Implementing a Low-Cost Long-Range Unmanned Underwater Vehicle: The SeaDiver Glider – [505](#)
- Rebovich, D.**  
Assessing Technology, Methods, and Information for Committing and Combating Cyber Crime – [428](#)
- Reda, Daniel C.**  
Boundary Layer Transition Experiments in Support of the Hypersonics Program – [1](#)
- Redden, Elizabeth S**  
Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – [225](#)
- Redmond, Patrick**  
A System of Systems Interface Hazard Analysis Technique – [541](#)
- Reed, M A**  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – [92](#)
- Microfabrication of a Mechanically Controllable Break Junction in Silicon – [186](#)
- Molecular Random Access Memory Cell – [441](#)
- Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – [121](#)
- Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions – [187](#)
- Reed, Mark A**  
Non-Equilibrium Quantum Dots: Transport – [185](#)
- Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – [186](#)
- Semiconductor Quantum Dot Resonant Tunneling Spectroscopy – [185](#)
- Reed, Patricia D**  
Integrating Local Public Health Agencies into the Homeland Security Community – [311](#)
- Rees, Leanne M**  
System Instantiation Comparison Method: A Technique for Comparing Military Headquarters – [542](#)
- Rege, K.**  
High Throughput Screening of Potential Displacer Molecules – [73](#)
- Reichard, G D**  
COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care – [368](#)
- Reid, Darryn J**  
A Woven Web of Guesses – [538](#)
- Reid, Darryn**  
A System Design Archetype for C4ISR Systems of the 21st Century – [159](#)
- Reid, R**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – [230](#)
- Reid, Tom**  
Course of Action Analysis for Coalition Operations – [458](#)
- Reiff, R.**  
In-Track Demonstration of Laser-Treated Rail to Reduce Friction and Wear – [74](#)
- Reigonen, J.**  
Neutron Generators Developed at LBNL for Homeland Security and Imaging Applications – [566](#)
- Reinach, S.**  
Human Error Investigation Software Tool (HEIST) – [427](#)
- Reinbolt, J A**  
Parallel Global Optimization with the Particle Swarm Algorithm (Preprint) – [533](#)
- Scale-Independent Biomechanical Optimization – [521](#)
- Reinbolt, Jeffrey A**  
Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – [511](#)
- Reindal, E.**  
Development and Implementation of Noise Analysis Standards for ACSA Airports – [255](#)
- Reisfeld, Ralph A**  
Immunotherapy Targeting Tumor Stromal Fibroblasts Improves Chemotherapy of Breast Cancer – [301](#)

- Reiter, Robert**  
Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – 351
- Relyea, Harold C**  
Access to Government Information in the USA – 650  
Security Classification Policy and Procedure: E.O. 12958, as Amended – 650  
Security Classified and Controlled Information: History, Status, and Emerging Management Issues – 658
- Remington, B. A.**  
Hypothesis of the Magnetostatic Turbulence and its Implications for Astrophysics – 671
- Remington, B.**  
FY06 LDRD Final Report 'The Creation of a Neutron Star Atmosphere' – 672
- Rempt, Raymond D**  
Nondestructive Evaluation (NDE) Technology Initiatives II Delivery Order 0001: Multi-Layer Cracks and Multi-site Damage NDE – 193
- Ren, Z F**  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92
- Renner, Scott**  
A Reference Architecture for Network-Centric Information Systems – 619  
Building Information Systems for Network-Centric Warfare – 615
- Rentmeister-Bryant, H.**  
Flight Attendant Fatigue – 412
- Resnati, Giuseppe**  
Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapotic Self-complementary Tecton Tailored to Halogen Bonding – 98
- Ressler, M**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Ressom, H W**  
Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308
- Retamal, A**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – 403
- Reuter, M. C.**  
Method of Forming Quantum Dots at Predetermined Positions on a Substrate – 201
- Reyes, Kevin B**  
Hyperspectral Imagery Target Detection Using Principal Component Analysis – 522
- Reynolds, D.**  
Implicit Solvers for Large Scale Nonlinear Problems – 433
- Reynolds, Julia**  
Utility of DF-1 for Radioprotection in Lymphocytes – 420
- Rhee, In-Sik**  
Decomposition Kinetic of Greases by Thermal Analysis – 127  
Development of ASTM Precision Bearing Grease Guide – 64
- Rhodes, Carl**  
A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – 620
- Ribeiro, Jose M**  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404
- Riccardi, Luisa**  
Technical and Non-Technical Problems in Biometric Physical Access Control Systems – 473
- Rice, D.**  
AB 1007 Full /Fuel Cycle Analysis (FFCA) Peer Review – 254
- Rice, James R**  
A Novel Approach to Calibrating Wavemakers and Generating Wavemaker Transfer Functions – 515
- Rice, Jennifer**  
A Hemoglobin-based Oxygen Carrier, Bovine Polymerized Hemoglobin (HBOC-201) Versus Hetastarch (HEX) in a Moderate Severity Hemorrhagic Shock Swine Model with Delayed Evacuation – 395  
Effects of Bovine Polymerized Hemoglobin in Coagulation in Controlled Hemorrhagic Shock in Swine – 385
- Rice, Norman**  
Nanoengineered Additives for Active Coatings – 61
- Rich, F J**  
On the Relationship of SAPS to Storm-Enhanced Density – 263
- Richards, Allen L**  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404  
Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399  
Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385
- Richards, Allen**  
Human Spotted Fever Rickettsial Infections – 386
- Richards, Russell**  
Developing an Information Superiority-Command and Control Joint Experimentation Strategy – 648
- Richards, Wayne**  
High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – 125
- Richards, Whitman**  
Collective Choice with Uncertain Domain Models – 535
- Richer, Warren**  
Evaluation of Organisational Interoperability in a Network Centric Warfare Environment – 146
- Richie, Thomas L**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Richman, K W**  
Investigation of Ignition Delay: Novel Beta-Substituted Ethylazide Derivatives as Potential New Liquid Propellant Fuels (Preprint) – 100
- Richmond, James**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184
- Richter, E.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Richter, M J**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226
- Richter, M**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Rico, Helen M**  
Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488
- Rico, Pedro**  
Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340
- Riddle, Dawn L**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – 459  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – 503
- Riddle, Dawn**  
Weapons Director Intelligent-Agent-Assist Task: Procedure and Findings for a Validation Study – 7

- Riddle, Mark S**  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396  
Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385
- Rideout, W**  
On the Relationship of SAPS to Storm-Enhanced Density – 263
- Riel, Gordon K**  
Correcting the Response of an Albedo Neutron Dosimeter for Energy – 219
- Riepenhoff, Cameron A**  
Aircraft Battery Design Concept for Improved Ultra Low Temperature Performance (Postprint) – 17
- Rieser, Christian J**  
Wireless Intrusion Detection – 483
- Rigney, D. A.**  
Micro and Nano-structure Development and Multiscale Physics at Sliding Metal Interfaces. Final Report May 2006 – 78
- Riha, B.**  
Studies to Support Deployment of Edible Oils as the Final cVOC Remediation in T-Area. Summary Report – 109
- Riha, David S.**  
Probabilistic Modeling of Space Shuttle Debris Impact – 58
- Rinard, Martin**  
Using Cyclic Memory Allocation to Eliminate Memory Leaks – 442
- Ring, Steven J**  
Applying Executable Architectures to Support Dynamic Analysis of C2 Systems – 482
- Rininger, Michael**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Ripberger, Erik**  
Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint) – 80  
Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 81
- Rishel, J. P.**  
Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274  
Using DUSTAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – 253
- Risin, Diana**  
Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416  
Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411
- Risin, Semyon A.**  
Effects of Hind Limb Unloading on Pharmacokinetics of Procainamide in Mice – 416  
Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411
- Ritchie, Christina**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
- Rivas, Paul**  
Antioxidant Prophylaxis in the Prevention of Prostatic Epithelial Neoplasia – 337
- Rivetta, C.**  
Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 580
- Rizki, Aylin**  
Effects of Extracellular Matrix on DNA Repair in Vivo – 363
- Roach, J. L.**  
Area Factor Determinations for an Industrial Worker Exposed to a Concrete Slab End State – 255
- Roach, Jeffrey**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184
- Robards, T.**  
Climate Change Impact on Forest Resources. White Paper – 277
- Robbins, Paul D**  
Protein Transduction Based Therapies for Breast Cancer – 315
- Robbins, William W.**  
Changing the Cultural Paradigm to Meet Emerging Requirements – 56
- Roberts, Joel E**  
Winning the Battle of Ideas in the War on Terrorism – 181
- Roberts, Jr, Charles T**  
A Novel Mechanism of Androgen Receptor Action – 288
- Robertson, III, Lawrence M**  
Study of Free-Free Beam Structural Dynamics Perturbations due to Mounted Cable Harnesses – 53
- Robertson, Lawrence**  
Multi-Cumulant and Non-Inferior Strategies for Multi-Player Pursuit-Evasion (PREPRINT) – 544
- Robinette, Jason**  
Nanosilica Modification of Elastomer-Modified VARTM Epoxy Resins for Improved Resin and Composite Toughness – 121
- Robinson, II, Paul D**  
Patterns of War Termination: A Statistical Approach – 528
- Robinson, Judith**  
Baylor College of Medicine Saturday Morning Science Workshop – 608
- Robinson, M.**  
Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR) – 276
- Robuck, Mark J.**  
High Ratio, Reduced Size Epicyclic Gear Transmission for Rotary Wing Aircraft with Improved Safety and Noise Reduction – 35
- Rockabrand, David M**  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396
- Rockabrand, David R**  
Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385
- Rockwood, Gary A**  
Effects of Sarin on the Operant Behavior of Guinea Pigs – 382  
Spectrophotometric Analysis of the Cyanide Metabolite 1-Aminothiazoline-6-Carboxylic Acid – 110
- Rodi, William**  
Grid-Search Techniques for Seismic Event Location and Phase Association – 261
- Rodney, S**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339
- Roederer, Mario**  
HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397
- Roehl, John M**  
Internet Protocol Geolocation: Development of a Delay-Based Hybrid Methodology for Locating the Geographic Location of a Network Node – 641
- Roesch, M. F.**  
Intrusion and Misuse Deterrence System Employing a Virtual Network – 432
- Rogacki, John R**  
Research Institute for Autonomous Precision Guided Systems – 31
- Rogers, Lynn**  
Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft – 583



- Rogers, Paul**  
FCS Technology Insertion and Transition – 508
- Rogers, Robert L**  
Development and Testing of a Multiple Frequency Continuous Wave Radar for Target Detection and Classification – 223
- Rohl, Peter J**  
Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52
- Rolek, Evan**  
Experimentation with Evolving C2 Operation Centers - Implications for the Human Element – 137
- Rolfe, J. L.**  
Storage, Generation, and Use of Hydrogen – 69
- Roll, Jr, Charles R**  
Sustaining Air Force Space Systems: A Model for the Global Positioning System – 26
- Rollett, A D**  
Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint) – 118
- Roman, Jesse**  
Prenatal Exposure to Nicotine and Childhood Asthma: Role of Nicotine Acetylcholine Receptors, Neuropeptides and Fibronectin Expression in Lung – 333
- Romano, Brian C**  
Rapid C4I High Performance Computing for Hyperspectral Imaging Exploitation – 598
- Romero, M. F.**  
Cloning and Characterization of SLC26A7 and SLC26A9 Anion Exchangers – 68
- Rosander, Michael**  
Alkene- and Alkyne- Substituted Methyylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – 100
- Rosasco, Lorenzo**  
Empirical Effective Dimension and Optimal Rates for Regularized Least Squares Algorithm – 524
- Rose, Robert W**  
Defending Electrical Power Grids – 243
- Rosen, Gerald M**  
Role of Superoxide in the Germination of Bacillus Anthracis Endospores – 380
- Rosen, J D**  
Bilateral Interoperability through Enterprise Architecture – 493
- Rosen, W A**  
A Distributed Parallel Embedded System for Autonomous Sonar Arrays – 450  
A Multiservice Switch for Advanced Avionics Data Networks – 42
- Rosen, Warren A**  
Fault Tolerance in Autonomous Acoustic Arrays – 185
- Rosenberg, Jonathan**  
Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases – 329
- Rosenwaks, Zamik**  
Improving COIL Efficiency By Iodine Pre-Dissociation Via Corona Discharge In The Transonic Section Of The Secondary Flow – 234
- Rose-Pehrsson, Susan L**  
Intelligent Data Fusion for Wide-Area Assessment of UXO Contamination. SERDP Project MM-1510. 2006 Annual Report – 637
- Rosner, W**  
Unique Approaches to Androgen Effects on Prostate Cancer – 334
- Ross, F. M.**  
Method of Forming Quantum Dots at Predetermined Positions on a Substrate – 201
- Ross, I M**  
Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – 48
- Ross, Joseph**  
The Coalition Aerial Surveillance and Reconnaissance (CAESAR) Approach to Enhancing the Interoperability of Coalition Ground Surveillance Systems – 224
- Ross, Martin**  
Shuttle Entry Imaging Using Infrared Thermography – 57
- Ross, Robert**  
Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452
- Ross, T.**  
Uncertainty Quantification of Composite Laminate Damage with the Generalized Information Theory – 86
- Ross, Virginia W**  
Grid Computing for High Performance Computing (HPC) Data Centers – 451
- Rossi, L.**  
Preliminary Study of Using 'Pipetron'-Type Magnets for a Pre-Accelerator for the LHC – 566
- Rossin, Joseph A**  
Novel Collective Protection Filters for Emerging TIC Requirements: Axial and Radial-Flow Filter Designs – 55
- Rostoker, N.**  
Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma – 574
- Roth, Robert M**  
Foreign Policy Effects on Strategic Communications and the Ability to Influence – 180
- Rough, Jill**  
Hurricane Katrina: Lessons for Army Planning and Operations – 163
- Roukes, Michael L**  
Spin Electronics – 189
- Rouseel, M. C.**  
Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – 276
- Roussier, Emmanuel**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Rowan, Ford**  
Weathering the Storm. Leading Your Organization Through a Pandemic – 368
- Rowanhill, Jonathan C**  
Efficient Hierarchic Management for Reconfiguration of Networked Information Systems – 485
- Rowe, Neil C**  
Automatic Generation of Best Emergency Routes and Procedures on a Brazilian Frigate – 467
- Rowe, Thomas W**  
Testing the Effectiveness of the North Shore - LIJ Health System's Bioterrorism Response Program to Identified Surveillance Data – 345
- Rowland, M.**  
Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570
- Rowland, Tami C**  
Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – 110
- Rowley, David R**  
Role of Reactive Stroma in Prostate Cancer Progression – 317
- Roy, Ajit K**  
Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81
- Roy, Gabriel D**  
Confined Detonations and Pulse Detonation Engines – 42
- Rozmajzl, Patrick J**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375  
Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385
- Ruan, Sui**  
Effects-Based Design of Robust Organizations – 520

- Rubel, Robert C**  
Using Wargames for Command and Control Experimentation – 145
- Rubineau, Brian**  
When Do Organizations Need to Change (Part I)? Coping with Incongruence – 141  
When Do Organizations Need to Change (Part II)? Incongruence in Action – 140
- Ruchansky, Dora**  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- Rudakov, Leonid**  
Possibility for Artificially Inducing Strong Pitch Angle Diffusion in the Magnetosphere – 261
- Ruebush, II, Trenton K**  
Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – 380
- Ruefle, Robin**  
Incident Management Capability Metrics Version 0.1 – 482
- Rufa, Justin R**  
Development of an Experimental Platform for Testing Autonomous UAV Guidance and Control Algorithms – 38
- Rufolo, D M**  
Hypothermia Induction and Recovery in Free-Ranging Rats – 409
- Ruggles, A.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Rupert, J**  
Use of Statistical Tools to Improve Modeling and Simulation of Store Separation – 4
- Rusjan, Edmond**  
Eigenvector Analysis for Multipath – 549
- Rusnak, B.**  
High-Energy Neutron Imaging Development at LLNL – 567
- Russ, Jose C**  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- Russell, Joshua A**  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404
- Russell, Kevin L**  
Cross-Serotype Neutralization of Dengue Virus in Aotus nancymae Monkeys – 387
- Russi, Jose Vinales**  
Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393
- Russo, Dane**  
Revitalization of Space-Related Human Factors, Environmental and Habitability Data – 425
- Rutledge, R.**  
Operational Aspects of Space Radiation Analysis – 676
- Rutz, F. C.**  
Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274  
Using DUSTRAN to Simulate Fog-Oil Dispersion and Its Impacts on Local Insect Populations at Ft. Hood: Final Report – 253
- Ryan, Donna**  
Military Nutrition Research: Four Tasks to Address Personnel Readiness and Warfighter Performance – 366
- Ryba, Stuart**  
Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune – 321
- Rylov, Sergey**  
Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441
- Ryu, Sei-Hyung**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184
- Ryutov, D. D.**  
Hypothesis of the Magnetostatic Turbulence and its Implications for Astrophysics – 671
- Saavedra, S. S.**  
Biomimetic Energy Transduction: Artificial Photosynthesis in a Stabilized Lipid Membrane Coupled to a Semiconductor – 204
- Sabatino, Daniel**  
High Temperature Heat Exchanger Development – 215
- Sabbagh, Elias H**  
The Joy of Computing with Volume-Integrals – 19
- Sabbagh, Harold A**  
The Joy of Computing with Volume-Integrals – 19
- Sacci, Jr, John B**  
Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404
- Sadda, S.**  
Adaptive Optics Ophthalmologic Systems Using Dual Deformable Mirrors – 600
- Sadoway, D. R.**  
Polymer Electrolyte, Intercalation Compounds and Electrodes for Batteries – 246
- Safavi-Naini, Rei**  
Key Establishment in Heterogeneous Self-Organized Networks – 484
- Saffron, Christopher**  
Large Scale Green Synthesis of 1,2,4-Butanetriol – 66
- Sagripanti, Jose-Luis**  
Environmental Survival, Military Relevance, and Persistence of Burkholderia Pseudomallei – 291
- Sahn, David J**  
Telemedicine Based Ultrasound for Detecting Neonatal Heart Disease in Babies at Remote Military or Native American Health Care Facilities – 360
- Sahu, Anubhav**  
Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441
- Saladin, Julie E**  
Shakedown & Determination of Tunnel Control Settings for Refurbished Trisonic Gasdynamic Facility (TGF) – 134
- Salari, K.**  
Code Verification Results of an LLNL ASC Code on Some Tri-Lab Verification Test Suite Problems – 562
- Salazar, Maxsimo**  
A Geometric Investigation of Acoustical Wavefront Scattering and Healing Induced by Ocean Internal Waves – 588
- Sale, Tom**  
Electronically Induced Redox Barriers for Treatment of Groundwater – 198
- Salinas, Jose**  
Continuous Pre-hospital Data as a Predictor of Outcome Following Major Trauma: A Study Using Improved and Expanded Data – 354
- Saltzman, G. M.**  
Truck Driver Occupational Safety and Health. 2003 Conference Report and Selective Literature Review – 238
- Samad, Fahumiya**  
Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin – 357
- Samame, Billey K**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX- (Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- Samareh, Jamshid A.**  
Discrete Data Transfer Technique for Fluid-Structure Interaction – 478

- Sammarco, J. J.**  
Technology Review of Smart Sensors with Wireless Networks for Applications in Hazardous Work Environments – 168
- Samoc, Anna**  
New Materials, Techniques and Device Concepts for Organic NLO Chromophore-based Electrooptic Devices. Part 1 – 291
- Samoc, Marek**  
New Materials, Techniques and Device Concepts for Organic NLO Chromophore-based Electrooptic Devices. Part 1 – 291
- Samstad, H.**  
Appraising Policies to Reduce Freight Transport Time and Its Variability-A New Method – 430
- Sanborn, Harold R**  
TARDEC National Automotive Center - Selfridge Air National Guard Base – 132
- Sanchez, Joel L**  
Randomized Double-Blind Phase III Pivotal Field Trial of the Comparative Immunogenicity Safety and Tolerability of Two Yellow Fever 17D Vaccines (ARILVAX-(Trademark) and YF-VAX(Trademark)) in Healthy Infants and Children in Peru – 387
- Sanchez, Jose L**  
Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – 393
- Sanchez-Ramos, Juan**  
Brain's DNA Repair Response to Neurotoxicants – 317
- Sanda, Arthur T**  
Discovery of Therapeutics for Ricin Toxicosis – 299
- Sandel, B**  
On the Relationship of SAPS to Storm-Enhanced Density – 263
- Sanders, Jeffrey H**  
Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – 591
- Sanders, John W**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – 375  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396  
Knowledge, Attitudes, and Practices Regarding Epidemiology and Management of Travelers' Diarrhea: A Survey of Front-Line Providers in Iraq and Afghanistan – 375  
Posttreatment Changes in Escherichia coli Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385
- Sanders, Pamela A**  
C2 Interoperability. A Force Multiplier for Joint/Combined Operations and Homeland Security – 629
- Sanders, William H**  
An Adaptive Quality of Service Aware Middleware for Replicated Services – 521
- Sands, Timothy A**  
Fine Pointing of Military Spacecraft – 51
- Sandvol, Eric**  
Collaborative Research: Ground Truth of African and Eastern Mediterranean Shallow Seismicity Using SAR Interferometry and Gibbs Sampling Inversion – 261
- SanFilipo, Bill**  
Handheld Broadband Electromagnetic UXO Sensor – 198
- Sanford, Allen E**  
Effects of Using NATEC Services within E-2C and FA-18 Operational Squadrons – 24
- Sanford, Gregory E**  
A Test Method to Assess the Foldability of Flexible Structural Materials – 125
- Sangare, Lansana**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Sanghvi, N. T.**  
Ultrasound Phased Arrays – 208
- Sanjurjo, A.**  
Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. (Quarterly Technical Report 14, October 1, 2006-December 31, 2006.) – 126
- Santhosh, U**  
Time-Dependent Response of MI SiC/SiC Composites Part 1: Standard Samples (Preprint) – 122  
Time-Dependent Response of MI SiC/SiC Composites. Part 2: Samples with Holes – 91
- Santoro, Robert J**  
Confined Detonations and Pulse Detonation Engines – 42
- Sarafanov, Andrey**  
Cadmium, Zinc, and Selenium Levels in Carcinoma of the Human Prostate – 356
- Sardar, Dhiraj K**  
Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597
- Sarfraz, Sami**  
Cannabinoid Receptors: A Novel Target for Therapy of Prostate Cancer – 320
- Sarkar, A.**  
Immobilized Iminophosphatranes Useful for Transesterification – 70
- Sarkar, Fazlul H**  
Molecular Effects of 13C/DIM in Prostate Cancer – 406
- Sarkar, Sudipta**  
Grid-Search Techniques for Seismic Event Location and Phase Association – 261
- Sarwana, Saad**  
Quarter-Rate Superconducting Modulator for Improved High Resolution Analog-to-Digital Converter – 441
- Sarwate, Anand D**  
Observation Uncertainty in Gaussian Sensor Networks – 162
- Sathish, Shamachary**  
Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint) – 80  
Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – 81
- Satterthwaite, Charles P**  
Space Surveillance and Early Warning Radars: Buried Treasure for the Information Grid – 165
- Satterwaite, Charles P**  
IEIST Technologies Enabling TCT Prosecution – 538
- Sauter, David**  
Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – 273
- Savarino, Stephen J**  
Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379
- Savastano, Mario**  
Technical and Non-Technical Problems in Biometric Physical Access Control Systems – 473
- Savoie, Matthew J**  
A Device for the In-Situ Measurement of Acoustically Stimulated Bioluminescence – 309
- Saw, C. K.**  
Changes in Delta-Plutonium Due to Self-Irradiation Aging Observed by Continuous In-Situ X-ray Scattering – 120  
X ray Diffraction Techniques for Structural Determination of Amorphous Materials – 69
- Saw, C.**  
Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 130

- Corrosion Resistances of Iron Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine & Natural Seawater. Fe48Mo14Cr15Y2C15B6 and W-Containing Variants – [69](#)
- Corrosion Resistances of Iron-Based Amorphous Metals with Yttrium and Tungsten Additions in Hot Calcium Chloride Brine and Natural Seawater. Fe48Mo14Cr15Y2C15B6 and Variants – [107](#)
- High-Performance Corrosion Resistant Iron Based Amorphous Metals. The Effects of Composition, Structure and Environment. Fe49.7Cr17.7Mn1.9Mo7.4W1.6B15.2C3.8Si2.4 – [107](#)
- Sawin, R.**  
Electro-Optic Array Interface – [213](#)
- Sawvel, A. M.**  
Magnetic Resonance Based Diagnostics for Polymer Production and Surveillance – [67](#)
- Scalora, Michael**  
Nonclassical Properties of Pulsed Second-Subharmonic Generation in Photonic-Band-Gap Structures – [196](#)
- Schaab, A E**  
Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint) – [118](#)
- Schaefer, Ronald**  
A Reference Architecture for Network-Centric Information Systems – [619](#)
- Schafer, Zachary**  
Regulation of Apoptosis by AFG3L2, a Potential Oncogene – [293](#)
- Schaff, W. J.**  
Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 070) – [206](#)  
Highly Doped III-Nitride Semiconductors (PAT-APPL-11-082 378) – [206](#)
- Scharine, Angelique A**  
A Model for Predicting Intelligibility of Binaurally Perceived Speech – [153](#)
- Schechter, Shelly**  
Medical Reserve Corps Volunteers' Ability and Willingness to Report to Work for the Department of Health During Catastrophic Disasters – [312](#)
- Scherer, A.**  
Integrated Plasmon and Dielectric Waveguides – [587](#)
- Schermerhorn, Janel H**  
Understanding and Improving Knowledge Transactions in Command and Control – [624](#)
- Scherrer, Michael**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – [184](#)
- Scheuring, R. A.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – [415](#)
- Scheuring, Richard A.**  
Space Medicine Issues and Healthcare Systems for Space Exploration Medicine – [415](#)
- Schifflett, Samuel**  
Issues Related to Experience & Automated Agent Technology in Synthetic Task Performance – [503](#)
- Schifflett, Samuel G**  
Classifying C2 Decision Making Jobs Using Cognitive Task Analyses and Verbal Protocol Analysis – [459](#)
- Schihl, Peter**  
Modeling JP-8 Fuel Effects on Diesel Combustion Systems – [120](#)
- Schiller, Elad**  
Autonomous Virtual Mobile Nodes – [535](#)
- Schilling, O.**  
Assessment of Gradient Diffusion Closures for Modeling Rayleigh Taylor and Richtmyer Meshkov Instability Induced Mixing – [568](#)  
Rayleigh Taylor Instability induced Mixing. Initial Conditions Modeling, Three Dimensional Simulations and Comparisons with Experiment – [570](#)  
Summary of LLNL Russian Projects – [573](#)
- Schlager, John J**  
Biomarkers for Amyotrophic Lateral Sclerosis in Active Duty Military – [338](#)
- Schlorff, John**  
A Link Scheduling and Ad Hoc Networking Approach Using Directional Antennas – [189](#)
- Schmid, Josef**  
Integrated Clinical Training for Space Flight Using a High-Fidelity Patient Simulator in a Simulated Microgravity Environment – [415](#)
- Schmid, Robert**  
Model of Energy Storage Circuit for Isotope Battery Based on SiC Schottky Diode – [212](#)
- Schmitt, David R**  
Development of a 3-D Defocusing Liquid Crystal Particle Thermometry and Velocimetry (3DDLCTV) System – [111](#)
- Schmitt, Harry A**  
Integrated Sensing and Processing (ISP) Phase 2: Demonstration and Evaluation for Distributed Sensor Networks and Missile Seeker Systems – [514](#)
- Schneider, Jr, William**  
Defense Science Board 2006 Summer Study on Information Management for Net-Centric Operations. Volume 1: Main Report – [158](#)
- Schneider, M. B.**  
Time Resolved Soft X-Ray Imaging (SXRI) Diagnostic for Use at the NIF and OMEGA Laser (version 2) – [601](#)
- Schneider, Stefan**  
Alkene- and Alkyne- Substituted Methylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – [100](#)
- Schock, S**  
Center for Coastline Security Technology, Year-2 – [228](#)
- Schoehn, Guy**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – [330](#)
- Schoeler, George B**  
Human Spotted Fever Rickettsial Infections – [386](#)  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – [404](#)
- Schokman, Rowena D**  
Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – [353](#)
- Schraml, Stephen J**  
A Multipurpose Projectile for Penetrating Urban Targets – [519](#)
- Schreiber, Craig**  
Information Technology and Knowledge Distribution in C3I teams – [627](#)
- Schreiber, Martin A**  
The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – [314](#)
- Schreiter, Daniel**  
Automated Aerial Refueling Presentation to 2007 ARSAG Conference (Preprint) – [15](#)
- Schroeder, D.**  
Flight Attendant Fatigue – [412](#)
- Schubert, Johan**  
Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – [450](#)
- Schuck, Peter W**  
Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates – [513](#)
- Schuck, Tod M**  
Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion – [622](#)

- Schuhart, II, Russell G**  
Hacking Social Networks: Examining the Viability of Using Computer Network Attack Against Social Networks – 491
- Schulz, M.**  
Regression Strategies for Parameter Space Exploration. A Case Study in Semicoarsening Multigrid and R – 435
- Schumacher, Corey**  
Optimal UAV Task Assignment and Scheduling (Preprint) – 24  
UAV Scheduling via the Vehicle Routing Problem with Time Windows (Preprint) – 20
- Schunemann, Peter G**  
Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP2 – 233
- Schuster, Brian E**  
Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – 114
- Schutte, J F**  
A Parallel Particle Swarm Optimizer – 533  
Parallel Global Optimization with the Particle Swarm Algorithm (Preprint) – 533  
Scale-Independent Biomechanical Optimization – 521
- Schutte, Jaco F**  
Evaluation of a Particle Swarm Algorithm for Biomechanical Optimization – 511
- Schuyler, C.**  
The Need for an Aerospace Pharmacy Residency – 419
- Schwab, Joseph J**  
Molecular Structure Analysis of Aminophenyl Silsesquioxane (Preprint) – 97
- Schwabel, Jason E**  
Command, Control, Coordination, and Cooperation during Defense Support to Civil Authority Operations – 182
- Schwartz, Bernie**  
The Independent Readiness Team (IRRT) of SMC – 49
- Schwartz, J. A.**  
Deployable Solar Array Assembly – 47
- Schwartz, Richard**  
Shuttle Entry Imaging Using Infrared Thermography – 57
- Schwarz, Ernest**  
Modeling JP-8 Fuel Effects on Diesel Combustion Systems – 120
- Schwarz, Gunther**  
Command and Control in Peace Support Operations Model PAX - Approaching New Challenges in the Modeling of C2 – 148
- Schwenk, Robert**  
The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites – 404
- Sciarretta, Albert A**  
Enhancing Army S&T Lessons from 'Project Hindsight Revisited' – 21
- Sciuto, A M**  
Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379
- Scofield, James**  
A Comparison of High Temperature Performance of SiC DMOSFETs and JFETs (Preprint) – 184
- Scofield, Jim**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184
- Scott, Alec J.**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Scott, Daniel**  
Establishment of a Non-human Primate Campylobacter Disease Model for the Pre-clinical Evaluation of Campylobacter Vaccine Formulations – 396
- Scott, David**  
High Temperature Heat Exchanger Development – 215
- Scott, Ron**  
Using Work-Centered Support System Technology to Enhance Command and Control – 488
- Scott, Robert C.**  
Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 3
- Scribner, David R**  
The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164
- Scurlock, Antonio J**  
Strategic Planning to Conduct Joint Force Network Operations: A Content Analysis of NETOPS Organizations Strategic Plans – 640
- Seabaugh, Alan C**  
Pseudomorphic Bipolar Quantum Resonant-Tunneling Transistor – 186
- Seaman, B T**  
Atomtronics: Ultracold Atom Analogs of Electronic Devices – 194
- Searle, I R**  
Durability Patch: Application of Passive Damping to High Cycle Fatigue Cracking on Aircraft – 583
- Seder, Joshua S**  
Examining Clandestine Social Networks for the Presence of Non-Random Structure – 523
- Seder, Robert A**  
HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397
- Seegal, Richard F**  
PCBs Alter Dopamine Mediated Function in Aging Workers – 294
- Seet, Alfred W**  
Constructible Assessment for Situation Awareness in a Distributed C2 Environment – 148
- Segaria, Frank**  
Supporting the Coalition Agents eXperiment (CoAX) through the Technology Integration Experiment (TIE) Process – 452
- Seguin, John M**  
Simulating Candidate Missions for a Novel Glider Unmanned Underwater Vehicle – 464
- Seifert, Jeffrey W**  
Data Mining and Homeland Security: An Overview – 647  
Homeland Security -- Reducing the Vulnerability of Public and Private Information Infrastructures to Terrorism: An Overview – 493  
Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – 497
- Seip, R.**  
Ultrasound Phased Arrays – 208
- Sellers, William R**  
The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway through High-Throughput Cell-Based Screens – 333
- Sellers, William R**  
The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway through High-Throughput Cell-Based Screens – 329
- Semiatin, S L**  
Determination of the Misorientation Dependence of the Relative Grain-Boundary Energy of Commercial-Purity Nickel (Preprint) – 118  
Recrystallization and Grain-Growth Behavior of a Nickel-Base Superalloy During Multi-Hit Deformation (Preprint) – 118
- Semones, E. J.**  
Operational Aspects of Space Radiation Analysis – 676
- Semprini, Lew**  
Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons – 101

- Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface – [102](#)
- Sen, Ahmet**  
First-Generation H1 Antihistamines Found in Pilot Fatalities of Civil Aviation Accidents, 1990-2005 – [9](#)  
Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots – [419](#)
- Sencar, Husrev T**  
Source Camera Identification and Blind Tamper Detections for Images – [504](#)
- Seppala, L. G.**  
Visible and Infrared Optical Design for the ITER Upper Ports – [599](#)
- Sepucha, David J**  
Challenges for Vertical Collaboration Among Warfighters for Missile Defense C2 – [443](#)
- Serfaty, Daniel**  
Performance Measurement for Diagnosing and Debriefing Distributed Command and Control Teams – [150](#)  
When Do Organizations Need to Change (Part II)? Incongruence in Action – [140](#)
- Serra, Margarita**  
Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – [393](#)  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – [389](#)
- Serrani, Andrea**  
Nonlinear Robust/Adaptive Controller Design for an Air-Breathing Hypersonic Vehicle Model (Preprint) – [21](#)
- Setlur, Pawan**  
Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – [224](#)
- Setzler, Scott D**  
Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP<sub>2</sub> – [233](#)
- Sha, Lui**  
Real-Time Communication and Coordination in Embedded Sensor Networks – [533](#)
- Shackelford, Scott A**  
Role of Thermochemical Decomposition in Energetic Material Initiation Sensitivity and Explosive Performance – [101](#)
- Shaffer, Gary R**  
Operational Agility: Composing and Orchestrating Mission Capability Packages Through Business Process Execution Language (BPEL) – [444](#)
- Shaffer, Patrick J**  
Fault Tolerant Optimal Trajectory Generation for Reusable Launch Vehicles (Preprint) – [48](#)
- Shah, M.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – [420](#)
- Shahady, David**  
A Modular, Scalable, Architecture for Unmanned Vehicles – [547](#)
- Shaheen, Hind**  
Diarrheal Illness Among Deployed U.S. Military Personnel During Operation Bright Star 2001-Egypt – [375](#)
- Shaker, Steven M**  
Lessons Learned from War Room Designs and Implementations – [628](#)
- Shakhnarovich, Gregory**  
Conditional Random People: Tracking Humans with CRFs and Grid Filters – [505](#)
- Shamieh, Lara S**  
Domain Specific Effects of Herstatin, an Alternative HER-2 (erbB-2) Product, on erbB Positive Breast Cancer – [348](#)
- Shan, X.**  
Modeling the Effects of Crevice Former, Particulates, and the Evolving Surface Profile In Crevice Corrosion – [119](#)
- Shang, Joseph S.**  
Hypersonic Magneto-Fluid-Dynamic Compression in Cylindrical Inlet – [221](#)
- Shannon, John**  
Analysis of Network-Enabled ASW Concepts of Operation – [529](#)  
Utilizing Network-Enabled Command and Control Concepts to Enhance ASW Effectiveness – [590](#)
- Shannon, Mark A**  
A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – [112](#)  
Microfabricated Electrochemical Sensor for Chemical Warfare Agents: Smaller is Better (Preprint) – [230](#)  
New Column Designs for MicroGC (Preprint) – [197](#)
- Shapiro, Charles L**  
The Effect of COX-2 Inhibitors on the Aromatase Gene (CYP19) Expression in Human Breast Cancer – [347](#)
- Sharma, Shashi K**  
Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – [403](#)
- Sharp, Trueman W**  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – [396](#)
- Shattuck, Lawrence G**  
A Process Model of Situated Cognition in Military Command and Control – [421](#)
- Shaw, Aubie**  
Identification of Sonic Hedgehog-Induced Stromal Factors That Stimulate Prostate Tumor Growth – [295](#)
- Shaw, Paul**  
Mediators in Infrastructure Survivability Enhancement – [449](#)
- Shaw, W. J.**  
Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – [274](#)
- She, M.**  
Two Bit/Four Bit SONOS Flash Memory Cell – [200](#)
- Shea, Dana A**  
Critical Infrastructure: Control Systems and the Terrorist Threat – [496](#)  
Detection of Explosives on Airline Passengers: Recommendation of the 9/11 Commission and Related Issues – [10](#)
- Shea, M T**  
Treatment of PTSD-Related Anger in Troops Returning from Hazardous Deployments – [384](#)
- Sheahan, Jim**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – [184](#)
- Shealy, J B**  
GaN Wide Band Power Integrated Circuits (Preprint) – [95](#)  
Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – [95](#)  
Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – [192](#)
- Shearer, Ruth**  
Network-Centric Applications and Tactical Networks – [173](#)
- Shebalin, John V.**  
Broken Symmetries and Magnetic Dynamics – [220](#)
- Sheeler, Ryan**  
Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – [340](#)
- Sheikh-Jabbari, M. M.**  
Gravi-Leptogenesis: Leptogenesis from Gravity Waves in Pseudo-Scalar Driven Inflation Models – [673](#)
- Shelfer, T.**  
Operational Aspects of Space Radiation Analysis – [676](#)
- Shen, Jun**  
A High Order WENO Scheme for a Hierarchical Size-Structured Model – [549](#)
- Shen, S.**  
LCLS XTOD Tunnel Vacuum Transport System (XVTS) Final Design Report – [563](#)
- Shen, Yu-Lin**  
Symposium on Nano- and Micro-Scale Mechanics of Engineering Materials – [660](#)

- Shenderova, Olga**  
Detonation Nanodiamonds and Related Materials. Bibliography Index, Issue 1 – 102
- Shenoy, Krishna**  
Toward Neural Control of Prosthetic Devices – 209
- Sheplak, Mark**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – 588  
Characterization of a Silicon-Micromachined Thermal Shear-Stress Sensor – 133  
Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – 314  
Low Dimensional Modeling of Zero-Net Mass-Flux Actuators – 215  
Lumped Element Modeling of Piezoelectric-Driven Synthetic Jet Actuators – 551  
MEMS Shear Stress Sensors: Promise and Progress – 190  
Optimization of Synthetic Jet Actuators – 235  
Phase-Shift-Based Time-Delay Estimators for Proximity Acoustic Sensors – 509
- Sheplak, M**  
Design and Validation of an Aeroacoustic Anechoic Test Facility – 587
- Sheridan, Robert E**  
Growth Factor Dependent Cholinergic Function and Survival in Primary Mouse Spinal Cord Cultures – 373
- Shiekhhattar, Ramin**  
Deciphering the Molecular Mechanisms of Breast Cancer – 324
- Shields, Janet E**  
Enhancement of Near-Real-Time Cloud Analysis and Related Analytic Support for Whole Sky Imagers – 272
- Shih, Tsung-Ming**  
Anticonvulsants for Nerve Agent-Induced Seizures: The Influence of the Therapeutic Dose of Atropine – 110  
Atropine and Other Anticholinergic Drugs – 372  
In Vivo Cholinesterase Inhibitory Specificity of Organophosphorus Nerve Agents – 77
- Shiltsev, V.**  
Possible Use of Electron Lenses in LHC – 586
- Shimeall, Timothy J**  
Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497
- Shimi, Tony**  
Army Fire Support Investment Framework – 472
- Shimko, Anthony**  
Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 3
- Shin, Dong H**  
Microstructural Evolution of Commercial-Purity Ti and Superplasticity of Ti-6Al-4V Alloy Processed by Equal Channel Angular Extrusion – 116
- Shin, Kang G**  
QoS Negotiation in Real-Time Systems and its Application to Automated Flight Control – 43  
User-Level QoS-Adaptive Resource Management in Server End-Systems – 485
- Shing, Man-Tak**  
Experiments with the Sun Java Real-Time System -- Part 2 – 466
- Shipley, James M**  
Modeling Phenotypes of Tuberosclerosis in the Mouse – 310
- Shirley, Bradley**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Shoffner, Brent**  
Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99
- Shoultz, Matthew V**  
From Stove-pipe to Network Centric Leveraging Technology to Present a Unified View – 616
- Showalter, David**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Shrader, Charles R**  
History of Operations Research in the USA Army, Volume 1: 1942-1962 – 546
- Shreyber, I.**  
Searching for new Physics at CDF – 560
- Shrobe, Howard**  
Simultaneous Localization, Calibration, and Tracking in an ad Hoc Sensor Network – 536
- Shteynberg, A.**  
Final Scientific/Technical Phase I Report on Sliding Mode Pulsed Current Averaging IC Drivers for High-Brightness Light Emitting Diodes – 602
- Shu, Chi-Wang**  
A High Order WENO Scheme for a Hierarchical Size-Structured Model – 549  
A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model – 508
- Convergence of High Order Finite Volume Weighted Essentially Non-Oscillatory Scheme and Discontinuous Galerkin Method for Nonconvex Conservation Laws – 515
- L2 Stability Analysis of the Central Discontinuous Galerkin Method and a Comparison between the Central and Regular Discontinuous Galerkin Methods – 523
- The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515
- Shu, X. Z.**  
Crosslinked Compounds and Methods of Making and Using Thereof – 72
- Shuey, Donald W**  
Combined Enterprise Regional Information Exchange System (CENTRIXS): Supporting Coalition Warfare Worldwide – 486
- Shuler, J.**  
Purple Computational Environment with Mappings to Ace Requirements for the General Availability User Environment Capabilities. Version 2.0 – 433
- Shvartsman, Alex**  
Autonomous Virtual Mobile Nodes – 535
- Sibener, Steven J**  
MURI Center for Materials Chemistry in the Space Environment – 112
- Sicuro, David L**  
Automatic Generation of Best Emergency Routes and Procedures on a Brazilian Frigate – 467
- Sidenbladh, Hedvig**  
Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – 450
- Sidmore, G.**  
Method, System and Device for Microscopic Examination Employing Fibre-Prepared Sample Grasping Element – 206
- Siedsma, C.**  
Assessing Technology, Methods, and Information for Committing and Combating Cyber Crime – 428
- Signoretti, Sabina**  
p63 in Development and Maintenance of the Prostate Epithelium – 355
- Sihn, Sangwook**  
Nano Enabled Thermo-Mechanical Materials in Adhesive Joints: A New Paradigm to Materials Functionality (Preprint) – 81
- Sikes, Robert A**  
Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362

- Silva, S.**  
Mixtures of Metals and Polynuclear Aromatic Hydrocarbons May Elicit Complex, Nonadditive Toxicological Interactions – 78
- Silva, Walter A.**  
Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 3
- Silverman, Edward**  
Challenges and Opportunities for Nanotechnology in Multi-Functional Composite Structures (Preprint) – 16
- Simnett, G M**  
Imaging Interplanetary Disturbances Causing Forbush Decreases – 670  
Interplanetary CMEs Without Observed Coronagraph CMEs – 669
- Simo, Donald L.**  
Toward a Real-Time Measurement-Based System for Estimation of Helicopter Engine Degradation Due to Compressor Erosion – 39
- Simon, Daniel H**  
SparkJet Actuators for Flow Control – 235
- Simon, J-L**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – 665
- Simon, Marcia**  
Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383
- Sims, C. E.**  
Chemical Modifications to Polymer Surfaces and the Application of Polymer Grafting to Biomaterials – 72
- Singh, Ranbir**  
Predictive & Prognostic Controller for Wide Band Gap (Silicon Carbide) Power Conversion (Preprint) – 184
- Singhsilarak, Tasawan**  
Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385
- Sinha, Pawan**  
Receptive Field Structures for Recognition – 190
- Siskind, David E**  
Naval Research Laboratory Space Science Division Newsletter: 01/2007 – 669  
On Recent Interannual Variability of the Arctic Winter Mesosphere: Implications for Tracer Descent – 263
- Sivananthan, Sivalingam**  
Narrow Gap HgCdTe Absorption Behavior Near the Band Edge Including Non-parabolicity and the Urbach Tail – 102
- Skadron, Kevin**  
Potential Thermal Security Risks – 441
- Skidmore, G.**  
Microconnectors and Non-Powered Microassembly Therewith – 202
- Skidmore, Sr , William E**  
A Pragmatic C4ISR Approach From the US Army CECOM Security Assistance Perspective – 614
- Skinner, D. E.**  
Experience Scaling-Up Manufacturing and Emerging Photovoltaic Technologies – 245
- SKinner, Kristin A**  
Evaluation of DNA Methylation as a Target for Intraductal Therapy for Ductal Carcinoma in Situ of the Breast – 319
- Skorstad, Gordon**  
Finding Stable Causal Interpretations of Equations – 506
- Slay, Jill**  
A Cultural Framework for the Interoperability of C2 Systems – 150
- Sleight, J W**  
Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186
- Sligh, Robert**  
Configuration Management Support for Long Haul C2 Circuit Switched Services – 154
- Sloan, Karen**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631
- Slone, D. H.**  
Assessing Error in PMI (Post-Mortem Interval) Prediction Using a Forensic Entomological Computer Model – 437
- Smalley, Richard E**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- Smeaton, Drew**  
Communication Security Establishment Briefing on Government of Canada Biometrics Reports – 477
- Smetek, Timothy E**  
Hyperspectral Imagery Target Detection Using Improved Anomaly Detection and Signature Matching Methods – 592
- Smillie, Robert J**  
Course of Action Analysis for Coalition Operations – 458  
Evolution of a Mission Plan – 646  
Human Systems Integration Assessment of Network Centric Command and Control – 421
- Smith, A. C.**  
Thermal Testing of Prototype General Purpose Fissile Packages Using a Furnace – 59  
Type B Radioactive Material Package Failure Modes and Contents Compliance – 238
- Smith, Austin L**  
Proportional Navigation With Adaptive Terminal Guidance For Aircraft Rendezvous (Preprint) – 7
- Smith, Bryon**  
IMMR Phase 1 Prototyping Plan Inputs – 663
- Smith, Byron**  
MDS MIC Catalog Inputs – 416
- Smith, C. B.**  
Ionic Cross-Linking of Ionic Cotton with Small Molecular Weight Anionic or Cationic Molecules – 103
- Smith, Dan**  
Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667
- Smith, David I**  
PARK2, a Large Common Fragile Site Gene, is Part of a Stress Response Network in Normal Cells That is Disrupted During the Development of Ovarian Cancer – 359
- Smith, David**  
Tissue Engineering Research – 307
- Smith, Dennis**  
Alkene- and Alkyne- Substituted Methylimidazolium Bromides: Structural Effects and Physical properties (Preprint) – 100  
System-of-Systems Governance: New Patterns of Thought – 465
- Smith, II, James D**  
Topics in Interoperability: Structural Programatics in a System of Systems – 465
- Smith, J. G.**  
Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83
- Smith, J R**  
Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374
- Smith, Jack W.**  
Translational Research from an Informatics Perspective – 416
- Smith, Jacqueline**  
Challenges to Ensuring Secure .COM and .EDU Access to a Web-Based Air Force Laboratory Program Management – 488
- Smith, J**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230
- Smith, Jeremy J**  
Simulation of the Dynamically Coupled KC-135 Tanker and Refueling Boom – 11
- Smith, Jim Q**  
From Simple Prescriptive to Complex Descriptive Models: An Example from a Recent Command Decision Experiment – 147



- Smith, Johnnie L**  
A Model for Effective Organization and Communication of Homeland Security Activity at the State Level – [157](#)
- Smith, Jr, Dennis W**  
Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – [100](#)
- Smith, Kevin B**  
Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model – [514](#)
- Smith, L. S.**  
Reconfigurable Linear Sensor Arrays for Reduced Channel Count – [208](#)
- Smith, Leonard A**  
Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – [353](#)  
  
Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – [369](#)
- Smith, Marcia S**  
Internet: An Overview of Key Technology Policy Issues Affecting Its Use and Growth – [497](#)
- Smith, P. C.**  
Stratospheric Relaxation in IMPACTs Radiation Code – [275](#)
- Smith, Pauline M**  
Nanoengineered Additives for Active Coatings – [61](#)
- Smith, R. F.**  
High Efficiency Grazing Incidence Pumped X ray Laser – [601](#)
- Smith, Scott G**  
The Forcing of 25-Knot Winds at Hickam and Andersen AFB – [270](#)
- Smith, Theresa J**  
Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – [369](#)
- Smith, Thomas**  
Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – [251](#)
- Smith, William J**  
Sulfur Mustard-induced Neutropenia: Treatment with Granulocyte Colony-stimulating Factor – [110](#)
- Smither, R. K.**  
High Spatial Resolution X-ray and Gamma Ray Imaging System Using Crystal Diffraction Lenses – [556](#)
- Snavelly, Jeffrey D**  
Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – [379](#)
- Snell, Simon**  
Methodology for Rapid Development of C2 Planning Systems – [173](#)
- Snider, G**  
Fabrication of Nanoscaled Systems – [229](#)
- Snoha, Daniel**  
Shot-Peening Sensitivity of Aerospace Materials – [5](#)
- Snyder, Don**  
Programmed Depot Maintenance Capacity Assessment Tool: Workloads, Capacity, and Availability – [33](#)  
  
Sustaining Air Force Space Systems: A Model for the Global Positioning System – [26](#)
- Snyder, Jr, Carl E**  
Purification of Contaminated MIL-PRF-83282 Hydraulic Fluid Using the Pall Purifier and Multiple Process Configurations (Preprint) – [123](#)
- Sobell, Linda C**  
Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption – [337](#)
- Sobell, Mark B**  
Facilitating Smoking Cessation and Preventing Relapse in Primary Care: Minimizing Weight Gain by Reducing Alcohol Consumption – [337](#)
- Socha, John**  
Using Formal Methods to Reason about Architectural Standards – [472](#)
- Socie, Gerard**  
National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – [397](#)
- Socker, Dennis G**  
Naval Research Laboratory Space Science Division Newsletter: 01/2007 – [669](#)
- Soffel, M**  
Progress Report of the IAU Working Group on Precession and the Ecliptic – [665](#)
- Sohn, Chang W**  
Resuspension Physics of Fine Particles – [260](#)
- Sohn, E J**  
Working Report on Visible and IR Electromagnetic Emissions from HMMWV External Black-Out (BO) Lighting – [597](#)
- Solis, William M**  
Defense Logistics: Army and Marine Corps' Body Armor Requirements, Controls, and Other Issues – [425](#)
- Soloviev, Victor**  
Mathematical Fluid Dynamic Modeling of Plasma Stall-Spin Departure Control – [518](#)
- Soltz, R.**  
BlueGene/L Supercomputer and Quantum ChromoDynamics – [560](#)
- Son, Sang H**  
Using Dynamic Adjustment of Serialization Order for Real-Time Database Systems – [613](#)
- Soni, Sunil-Datta**  
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – [77](#)
- Soo, John K**  
Constructible Assessment for Situation Awareness in a Distributed C2 Environment – [148](#)
- Sorensen, Brett R**  
A Multipurpose Projectile for Penetrating Urban Targets – [519](#)
- Soria, Julio**  
Dynamic-Active Flow Control - Phase I – [2](#)
- Soroush, M.**  
Constraints on Meta-Stable de Sitter Flux Vacua – [579](#)
- Sosa, Ognjen**  
Design and Implementation of a Modular Manipulator Architecture – [546](#)
- Sosa-Estani, Sergio**  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – [389](#)
- Southall, B.**  
NOAA National Passive Acoustics Workshop, 2006 – [590](#)
- Southworth, B**  
Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – [251](#)
- Sovereign, Michael G**  
Use of Information Technology to Develop a Collaborative Decision Support System for Command and Control – [469](#)
- Sovero, M**  
Epidemiology of Transfusion-Transmitted Infections Among Multi-Transfused Patients in Seven Hospitals in Peru – [403](#)
- Spearman, M. Leroy**  
Innovative Concept for a Heavy-Load Aircraft Utilizing a Two-Dimensional Wing – [36](#)
- Spector, Myron**  
Autologous Marrow-Derived Stem Cell-Seeded Gene-Supplemented Collagen Scaffolds for Spinal Cord Regeneration as a Treatment for Paralysis – [299](#)
- Speer, Benjamin G**  
A Value-Focused Thinking Model for the Selection of the Best Rigid Pavement, Partial-Depth Spall Repair Material – [19](#)

- Speer, R. D.**  
Understanding and Improving High Voltage Vacuum Insulators for Microsecond Pulses – 203
- Spellman, Steve M**  
Quarterly Performance/Technical Reports: HLA Typing for Bone Marrow Transplantation, and Development of Medical Technology for Contingency Response to Marrow Toxic Agents – 305
- Sperka, Jonathan**  
Unexploded Ordnance Site Investigation of US Military Ranges in Panama: Empire, Balboa West and Pina Ranges – 135
- Spero, Amy R**  
Processing of Multifunctional Epoxy Resins Modified with Silicon Based Nanomaterials (POSTPRINT) – 124
- Spetka, Scott E**  
A Distributed Parallel Processing System for Command and Control Imagery – 466  
Grid Computing for High Performance Computing (HPC) Data Centers – 451  
Rapid C4I High Performance Computing for Hyperspectral Imaging Exploitation – 598
- Spiker, V A**  
The Effectiveness of a PC-Based C-130 Crew Resource Management Aircrew Training Device – 8
- Spinhirne, J.**  
Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 255
- SPita, Claudia**  
Aircraft Downwind Hazard Distance After a Chemical Attack – 34
- Spitsberg, I.**  
Mixed Metal Oxide Ceramic Compositions for Reduced Conductivity Thermal Barrier Coatings – 65
- Splinter, Scott C.**  
Characterization and Evaluation of a Mass Efficient Heat Storage Device. – 237
- Sponable, Jess**  
Fully Reusable Access to Space Technology (FAST) Methane Rocket – 46
- Spowart, Jonathan E**  
High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – 125  
Thermal Applications for Advanced Metallic Materials (Preprint) – 18
- Sproles, Noel**  
Modelling Operational Command Structures Using ORGAHEAD – 451  
The Contribution of Command and Control to Unity of Effort – 157
- Sprung, George**  
A Unifying Strategy for Data Integration for Global Force Management (Briefing Charts) – 147
- Squassoni, Sharon**  
India's Nuclear Separation Plan: Issues and Views – 595  
Iran's Nuclear Program: Recent Developments – 594
- Srijan, Apichai**  
Establishment of a Non-human Primate *Campylobacter* Disease Model for the Pre-clinical Evaluation of *Campylobacter* Vaccine Formulations – 396
- St John, Ted**  
Correcting the Response of an Albedo Neutron Dosimeter for Energy – 219
- Stachelek, S. J.**  
Steroid Lipid-Modified Polyurethane as an Implantable Biomaterial, the Preparation and Uses Thereof – 72
- Stafford, Max**  
Control of Spinning Symmetric Airframes – 552
- Stamper-Kurn, Dan**  
Scalability, Complexity and Reliability in Quantum Information Processing – 591
- Stankovic, John A**  
Real-Time Communication and Coordination in Embedded Sensor Networks – 533
- Staples, J.**  
Fermi Timing and Synchronization System – 605
- Staples, R. J.**  
Effect of Excess Carbon on the Crystallographic, Microstructural, and Mechanical Properties of CVD Silicon Carbide Fibers – 83
- Stark, N.**  
Use of Saltcedar and Utah Juniper as Fillers in Wood-Plastic Composites – 82
- Starke, Edgar A**  
The Effect of Inhomogeneous Plastic Deformation on the Ductility and Fracture Behavior of Age Hardenable Aluminum Alloys – 115
- Starr, Stuart**  
Assessing C3I in Support of Dismounted Operations in Complex Terrain – 539  
Defense Horizons. I-Power: The Information Revolution and Stability Operations. Number 55 – 619  
Modeling and Simulation to Support C4ISR Acquisition and Transformation – 461
- Statham, Philip**  
Biometric Security Issues – 474
- Stechel, Ellen B**  
Applications of Molecular and Materials Modeling – 94
- Steckl, Andrew J**  
Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – 63
- Steeman, Wilma**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377
- Steers, Nick**  
The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious *Plasmodium berghei* sporozoites – 404
- Stevens, Jeffrey**  
Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – 251
- Steffes, Gary**  
Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Postprint) – 534
- Stein, Fred P**  
Army Digitization Operational Impacts – 661
- Stein, Michael**  
Using a Shortest Path Algorithm for Identifying Areas of Interest in An Area of Operations – 543
- Steiner, N K**  
Genomic Characterization of KIR2DL4 in Families and Unrelated Individuals Reveals Extensive Diversity in Exon and Intron Sequences Including a Common Frameshift Variation Occurring in Several Alleles – 381  
Ten Novel HLA-DRB1 Alleles and One Novel DRB3 Allele – 394
- Stell, Mark**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – 143
- Stelly, John M**  
Price vs. Performance: The Value of Next Generation Fighter Aircraft – 25
- Stenhoff, Andrea D**  
Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243
- Stephenson, L A**  
Skin Temperature Feedback Optimizes Microclimate Cooling – 272
- Sterling, Bruce S**  
Galvanic Skin Response as a Measure of Soldier Stress – 410  
Workload, Stress, and Situation Awareness of Soldiers Who are Controlling Unmanned Vehicles in Future Urban Operations – 408
- Stern, Seymour**  
Firefighting Agent Research, Phase I – 10

- Stevens, Gina M**  
Critical Infrastructure Information Disclosure and Homeland Security – 656  
Homeland Security Act of 2002: Critical Infrastructure Information Act – 639  
Privacy: An Abbreviated Outline of Federal Statutes Governing Wiretapping and Electronic Eavesdropping – 156
- Stevens, William K**  
Use of Modeling and Simulation (M&S) in Support of the Quantitative Assessment of FORCEnet Systems and Concepts – 456
- Stevenson, Robert S**  
Improved Wound Healing of Cutaneous Sulfur Mustard Injuries in a Weanling Pig Model – 383  
Noninvasive Methods for Determining Lesion Depth from Vesicant Exposure – 373
- Stewart, Derek B**  
DoD Personnel Clearances: Delays and Inadequate Documentation Found for Industry Personnel – 643
- Stewart, K**  
Modular Structures in a Multinational Force Headquarters – 147
- Stillerman, M. A.**  
Secure Peer-to-Peer Object Storage System – 439
- Stinga, Aurelian**  
European Security in the Wider Black Sea Area – 242
- Stobie, James**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Stoeffl, W.**  
Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – 570
- Stolper, E.**  
Infrared Spectroscopy and Stable Isotope Geochemistry of Hydrated Silicate Glasses – 254
- Storage, T M**  
Oxygen Plasma Treatment and Deposition of CNx on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121
- Storey, Thomas**  
A 4-Mbit Non-Volatile Chalcogenide-Random Access Memory Designed for Space Applications (Preprint) – 53
- Stoyen, Alexander D**  
Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627  
Intelligent Agent-Based Software Architecture for Tactical Decision Aid under Overwhelming Information Inflow and Uncertainty – 502
- Stoyen, Alexander**  
Eyekon: Distributed Augmented Reality for Soldier Teams – 655
- Stratton, Robert**  
High-Energy Laser Weapon Integration with Ground Vehicles – 234
- Strebing, A**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – 339
- Street, Thomas T**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Strei, Thomas J**  
Open Architecture in Naval Combat System Computing of the 21st Century: Network-Centric Applications – 442
- Stribling, R. A.**  
Deployable Solar Array Assembly – 47
- Stroeher, Ute**  
Cross-Protection against Marburg Virus Strains by Using a Live, Attenuated Recombinant Vaccine – 331
- Strom, S**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – 226
- Strother, P. D.**  
Design and Application of the Reconstruction Software for the BaBar Calorimeter – 584
- Struzelecka, E.**  
Vertical Cavity Surface Emitting Laser Having a Gain Guide Aperture Interior to an Oxide Confinement Layer – 599
- Stuart, Phillip C.**  
Probabilistic Modeling of Space Shuttle Debris Impact – 58
- Studer, A**  
Making Network Intrusion Detection Work With IPsec – 505
- Stuhmiller, James H**  
Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults – 297
- Stupian, G W**  
X-Ray Dose in Microfocus Radiographic Inspections – 137
- Stytz, Martin R**  
Advancing Software Security - The Software Protection Initiative – 626  
Issues and Requirements for Cybersecurity in Network Centric Warfare – 446  
Realistic and Affordable Cyberware Opponents for the Information Warfare Battlespace – 537
- Suarez, L. A.**  
USA Meteorological Data: Daily and Hourly Files to Support Predictive Exposure Modeling – 277
- Subramaniyan, Raj**  
Fault-Tolerant Parallel Algorithms for Adaptive Matched-Field Processing on Distributed Array Systems – 509
- Sue, Hung-Jue**  
Development of Nanocomposite Reinforced Polymeric Materials to be Used for Racks for Retorting Polymeric Trays – 123
- Sullivan, J. P.**  
Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems – 204
- Sullivan, Keith**  
The Analysis of Network Centric Maritime Interdiction Operations (MIO) Using Queueing Theory – 625
- Sullivan, Kevin J**  
Mediators in Infrastructure Survivability Enhancement – 449  
Using Formal Methods to Reason about Architectural Standards – 472
- Sullivan, Kimberly**  
Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide – 350
- Sullivan, P.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415
- Sultana, Afroz M**  
Detection of Staphylococcus Aureus Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331
- Summers, Richard L**  
A Multipurpose Projectile for Penetrating Urban Targets – 519
- Sumner, John W**  
Phylogenetic Analysis of a Novel Molecular Isolate of Spotted Fever Group Rickettsiae from Northern Peru – 404
- Sumpter, Kenneth B**  
Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306
- Sun, Jianlong**  
BRCA1 in Gene-Specific Coordination of Transcription and DNA Damage Response – 406
- Sun, Peifang**  
Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378
- Sun, Wellington**  
Differential Effects of Dengue Virus on Infected and Bystander Dendritic Cells – 378
- Sun, Y. P.**  
Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83

- Sunkara, A.**  
Cost-Effective Strategies for Communicating with Remote Surveillance Stations: A Summary – 178  
Guidebook for Selecting Cost-Effective Wireless Communication Technologies for Intelligent Transportation Systems – 183
- Sunkara, M. K.**  
Tubular Carbon Nano/micro Structures and Method of Making Same – 74
- Superfine, Richard**  
Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale – 188
- Suri, Niranjan**  
Software Agents as Facilitators of Coherent Coalition Operations – 459
- Sutton, Kenneth**  
Nonequilibrium Stagnation-Line Radiative Heating for Fire II – 220
- Svejda, Steven A**  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- Svennerholm, Ann-Mari**  
Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379
- Svenson, Pontus**  
Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – 450
- Swaminathan, S**  
Structural Studies on Toxins and Virulence Factors of Yersinia Pestis – 284
- Swaminathan, Subramanyam**  
Structural Studies on Intact Clostridium Botulinum Neurotoxins Complexed with Inhibitors Leading to Drug Design – 304
- Swanson, Gary**  
Catalog of Air Force Weather Technical Documents, 1941-2006 – 266
- Swanson, Steven M**  
Role of Growth Hormone in Prostate Cancer – 342
- Sweed, Richard**  
The Interactive DataWall – 209
- Sweeney, R E**  
Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374
- Sweeney, Richard E**  
A Physiologically Based Pharmacokinetic (PB/PK) Model for Multiple Exposure Routes of Soman in Multiple Species – 374  
Acetylcholinesterase Inhibition: Does it Explain the Toxicity of Organophosphorus Compounds? – 372
- Sweeney, Steven C**  
Seismic Response of a Half-Scale Masonry Building with Flexible Diaphragms – 239
- Swendiman, Kathleen S**  
Extensively Drug-Resistant Tuberculosis (XDR-TB): Quarantine and Isolation – 398
- Swierczek, Robert**  
Defense Acquisitions: Analysis of Processes Used to Evaluate Active Protection Systems – 426
- Swift, Austin T**  
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77
- Swift, Daniel C**  
Transforming the Way DOD Looks at Energy. An Approach to Establishing an Energy Strategy – 243
- Sykes, Michelle C.**  
Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411
- Sylvester, A J**  
Genomic Analysis of Rodent Pulmonary Tissue Following Bis-(2-chloroethyl) Sulfide Exposure – 379
- Symans, J. S.**  
Battery System – 246
- Szewczyk, Steven T**  
Titanium Brazing for Structures and Survivability – 120
- Sztejn, Marcelo B**  
HLA-A2 Supertype-Restricted Cell-Mediated Immunity by Peripheral Blood Mononuclear Cells Derived from Malian Children with Severe or Uncomplicated Plasmodium falciparum Malaria and Healthy Controls – 400
- Tabak, M.**  
Isochoric Implosions for Fast Ignition – 570
- Taban, Gelareh**  
Key Establishment in Heterogeneous Self-Organized Networks – 484
- Tack, Steve**  
Shuttle Entry Imaging Using Infrared Thermography – 57
- Tadmor, Eitan**  
L2 Stability Analysis of the Central Discontinuous Galerkin Method and a Comparison between the Central and Regular Discontinuous Galerkin Methods – 523
- Taft, Nina**  
Analysis of Origin Destination Flows (Raw Data) – 521
- Tahsiri, H.**  
Formation of a Field Reversed Configuration for Magnetic and Electrostatic Confinement of Plasma – 574
- Tailliez, Dominique**  
BOUSSOLE: A Joint CNRS-INSU, ESA, CNES, and NASA Ocean Color Calibration and Validation Activity – 279
- Takai, Mineo**  
Optimizing Parallel Execution of Detailed Wireless Network Simulation – 624
- Takeuchi, H.**  
Damascene Process for Use in Fabricating Semiconductor Structures Having Micro/Nano Gaps – 213
- Talapatra, Sukomal**  
RF Design for Tactical Ultra-Light Unmanned Aerial Vehicle Radar System – 27
- Talcott, James A**  
Long-Term Outcomes of Alternative Brachytherapy Techniques for Early Prostate Cancer – 294
- Talkington, Darin**  
Information Technology: When is Enough? – 663
- Talley, D G**  
A Method to Predict Atomization Performance in Gas-Centered Swirl-Coaxial Injectors – 218  
A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions (POSTPRINT) – 218
- Talley, Douglas G**  
Atomization Performance Predictions of Gas-Centered Swirl-Coaxial Injectors – 216
- Talley, Douglas**  
Dark Core Analysis of Coaxial Injectors at Sub-, Near-, and Supercritical Conditions in a Transverse Acoustic Field – 589
- Tamirisakandala, Seshacharyulu**  
Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99
- Tammariello, Ralph F**  
Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353
- Tammen, Ronald L**  
Forecasting Complex Political and Military Events: The Application of Expected Utility to Crisis Situations – 653
- Tan, Loon-Seng**  
Large Concentration-Dependent Nonlinear Optical Responses of Starburst Diphenylamino-fluorenocarbonyl Methano[60]Fullerene Pentaads – 87
- Tan, Ratna**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394
- Tandon, V.**  
System and Method for Field Testing a Tack Coat Layer – 75
- Tang, Dean**  
Apoptosis-Dependent and Apoptosis-Independent Functions of Bim in Prostate Cancer Cells – 307

- Tao, S.**  
Optical Fiber Chemical Sensor with Sol-Gel Derived Refractive Material as Transducer for High Temperature Gas Sensing in Clean Coal Technology (Final Report, October 1, 2004-December 31, 2006) – 254
- Tarlowski, Chris**  
Detection of Atmospheric Explosions at IMS Monitoring Stations using Infrared Sound Techniques – 265
- Tarver, William J.**  
An Introduction to the History of Aerospace Medicine – 419
- Tate, Austin**  
Software Agents as Facilitators of Coherent Coalition Operations – 459
- Tauber, Joshua**  
Proving Atomicity: An Assertional Approach – 487
- Taycher, Leonid**  
Conditional Random People: Tracking Humans with CRFs and Grid Filters – 505
- Taye, A**  
Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398
- Taylor, Christopher J**  
Simultaneous Localization and Tracking in Wireless Ad-hoc Sensor Networks – 188
- Taylor, Christopher**  
Simultaneous Localization, Calibration, and Tracking in an ad Hoc Sensor Network – 536
- Taylor, II, Russell M**  
Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale – 188
- Taylor, J. S.**  
Object Detection in Electro-Optic Sensor Images – 208
- Taylor, Sarah M**  
Improving Analysis with Information Extraction Technology – 630
- Taylor, Teletia R**  
Short-Term Exercise and Prostate Cancer Prevention in African American Men – 359
- Tedeschi, D.**  
Implementation of the Polarized HD Target at the Thomas Jefferson National Accelerator. Reporting Period for January 1, 2002 to December 31, 2006 – 583
- Teh, Cheryl A**  
Constructible Assessment for Situation Awareness in a Distributed C2 Environment – 148
- Teliovich, Roman V**  
Processing, Microstructure, and Tensile Properties of the Ti-6Al-4V-1.55B Eutectic Alloy (Preprint) – 99
- Tempel, Jr , Thomas R**  
Dental Considerations in a Unified Medical Command – 402
- Tempestilli, Mark**  
'How Much is a Pound of C4ISR Worth?' An Assessment methodology to Evolve Network Centric Measures and Metrics for Application to FORCENet – 173  
Preparing Junior Officers for Roles in FORCENet & Network Centric Operations – 152
- Tench, D. M.**  
Reversible Electrodeposition Optical Modulation Device with Conducting Polymer Counter Electrode – 213
- Tenenbaum, P.**  
Emittance Correction in the 2006 ILC Bunch Compressor – 580
- Tenniswood, Martin**  
Apoptosis and Tumor Progression in Prostate Cancer – 338
- Tennyson, J.**  
Closed Orbit Distortion and the Beam-Beam Interaction – 556
- Teo, Leonghwee**  
Constructible Assessment for Situation Awareness in a Distributed C2 Environment – 148
- Terzian, Yervant**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665
- Tessier, Phil**  
Distributed Command and Control Research: Networking Multiple Simulation Platforms – 495
- Tester, Rodrick A**  
Risk of Cyberterrorism to Naval Ships Inport Naval Station Everett: A Model Based Project Utilizing SIAM – 491
- Teytelman, D.**  
Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 580
- Tharion, Ingrid V Sils, and John W Castellani, William J**  
Cognitive, Psychomotor, and Physical Performance in Cold Air After Cooling by Exercise in Cold Water – 409
- Thate, Timothy**  
A Limited Objective Experiment on Wireless Peer-To-Peer Collaborative Networking – 492
- Thaxton, Sherry**  
Anthropometric Accommodation in Space Suit Design – 424
- Theocharous, Georgios**  
Spatial and Temporal Abstractions in POMDPs Applied to Robot Navigation – 523
- Thibault, Gaetan**  
The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 1: The Info-Centric Collaborative Workspace from an Organizational Perspective – 621  
The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 2: The Info-Centric Collaborative Workspace from the Processes Perspective – 623  
The Canadian ISTAR Information-Centric Collaborative Workspace Concept. Paper 3: The Info-Centric Collaborative Workspace from a Systems Perspective – 623
- Thieme, Michael**  
Independent Testing of Iris Recognition Technology (ITIRT) – 475
- Thomas, Alan W**  
Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379
- Thomas, Angela**  
Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities – 631
- Thomas, David**  
Establishment of a Center for Defense Robotics – 508
- Thomas, Matthew**  
Laser Induced Breakdown Spectroscopy (LIBS) Applied to Reacting Gases for Mixture Ratio Measurement and Detection of Metallic Species – 99
- Thomas, Michael**  
Knowledge Based Systems as a Means of Managing Aspects of Datalink Within a Decision Support System for Naval Airborne Early Warning – 460
- Thomas, Robert J**  
Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597
- Thomas, Scott K**  
Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint) – 55
- Thomas, Timothy L**  
Russian and Chinese Information Warfare: Theory and Practice – 628
- Thomas, Valor**  
A Study of the Attraction Forces of Lunar Dust Simulant – 664
- Thome, K J**  
Preflight and Vicarious Calibration of Hyperspectral Imagers – 598
- Thomenius, K. E.**  
Reconfigurable Linear Sensor Arrays for Reduced Channel Count – 208

- Thompson, D. B.**  
Summary of Dimensionless Texas Hyetographs and Distribution of Storm Depth Developed for Texas Department of Transportation Research Project 0-4194 – [276](#)
- Thompson, Henry J**  
Selenium and Breast Cancer Chemoprevention – [339](#)
- Thompson, I.**  
Theory of (3He alpha) Surrogate Reactions for Deformed Uranium Nuclei – [582](#)
- Thompson, R. B.**  
Determination of Metal Ions in Solution by Photoluminescence Anisotropy – [115](#)
- Thompson, Timothy C**  
Role of Caveolin-1 in Prostate Cancer Angiogenesis – [286](#)
- Thoms, Keith H**  
Interim Heavy Airlift: Sea Base Logistics Glider Concept – [14](#)
- Thorn, K.**  
Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – [65](#)
- Tiah, Yao M**  
An Analysis of Small Navy Tactics Using a Modified Hughes' Salvo Model – [541](#)
- Tice, Jason R**  
Titanium Brazing for Structures and Survivability – [120](#)
- Tieso, John V**  
A Roadmap for Developing Architectures in a Net-Centric World – [609](#)
- Tieu, Brandon**  
The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – [314](#)
- Tiffany, W. S.**  
Berkeley Accelerator Space Effects (BASE) Light Ion Facility Upgrade – [584](#)
- Tiller, J. C.**  
Antimicrobial Polymeric Surfaces – [79](#)
- Tillman, Barry**  
Revitalization of Space-Related Human Factors, Environmental and Habitability Data – [425](#)
- Tiltman, A. G.**  
Gas Turbine Engine Including a Low Pressure Sump Seal Buffer Source and Thermally Isolated Sump – [41](#)
- Timian, Donald H**  
Report Out of the C4I Study Group – [162](#)
- Timko, Ken**  
Solutions Analysis for Helicopter Brownout – [33](#)
- Titov, M.**  
SUSY Multilepton Signatures at Tevatron – [576](#)
- Tjus, K.**  
Development of a Recovery System for Metals and Acids from Pickling Baths Using Nanofiltration and Crystallisation – [109](#)
- Tobar, M**  
A Chemoprevention Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress – [339](#)
- Tobias, Adam P**  
Experimental Methods to Characterize Nonlinear Vibration of Flapping Wing Micro Air Vehicles – [32](#)
- Todd, Robert W**  
Comparative Performance Analysis of Directed Flow Control for Real-Time SCI – [448](#)
- Toksoz, Nafi**  
Grid-Search Techniques for Seismic Event Location and Phase Association – [261](#)
- Tokunaga, A T**  
Design of the TMT Mid-Infrared Echelle: Science Drivers and Design Overview – [226](#)  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – [592](#)
- Tolk, Andreas**  
Coalition Interoperability Ontology: Sharing Situational Awareness with Allies and Agents – [619](#)  
Report Out of the C4I Study Group – [162](#)
- Tollestrup, E**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – [592](#)
- Tomatic, B.**  
T/R Module for Satellite TT&C Ground Link – [200](#)
- Tomaszewski, James W**  
Characterization of a Hall Effect Thruster Using Thermal Imaging – [607](#)
- Tomblin, J.**  
Best Practice in Adhesive-Bonded Structures and Repairs – [67](#)
- Tombul, Serdar**  
A Numerical Study of the Regimes of Weak Fluctuation Theory for Ocean Acoustic Propagation through Random Internal Wave Sound Speed Fields – [588](#)
- Tomczak, Sandra J**  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trade-mark) Polyimides (Preprint) – [52](#)
- Tomecek, Petr**  
The Synergic Integrated Concepts of C2S – [174](#)
- Tomko, Albert A**  
Wireless Intrusion Detection – [483](#)
- Tong, C.**  
Towards Multi Level Optimization. Space Mapping and Manifold Mapping – [433](#)
- Tong, Min**  
Cloning and Sequence Analysis of the 22-kDa Antigen Genes of Orientia tsutsugamushi Strains Kato, TA763, AFSC 7, 18-032460, TH1814, and MAK 119 – [399](#)
- Tong, Y C**  
A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division – [20](#)
- Topkaya, C.**  
Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – [240](#)
- Torney, S.**  
An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – [415](#)
- Torres, Mario**  
Leveraging Command and Control Technology to Provide Advanced Environmental Effects Decision Aids on the Battlefield – [273](#)
- Tour, J M**  
Molecular Random Access Memory Cell – [441](#)  
Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – [121](#)  
Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions – [187](#)
- Tower, Paul K**  
An Analysis of Robust Workforce Scheduling Models for a Nurse Rostering Problem – [300](#)
- Town, R. P. J.**  
Development and Application of a Predictive Computational Tool for Short-Pulse, High-Intensity Target Interactions – [603](#)
- Tran, Cam**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – [143](#)
- Tran, Chau**  
Mechanism of Action of Prostate Stem Cell Antigen Targeted Antibody Therapy and Its Relevance to Clinical Application in Prostate Cancer – [351](#)
- Tran, Thehue**  
A Study of Autonomous Micro-Robots and Their Application to Complex Environments, Volume 1 – [543](#)

- Trbovich, Sarah**  
Conceptual Modeling for the Probability of Raid Annihilation (Pra) Testbed – 453  
Distributed Simulation Run Automation Capability for the Navy PRA Testbed – 453
- Treece, R**  
Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents – 230
- Trevino, M.**  
Research Plan for Measuring Noise Levels in Highway Pavements in Texas – 259
- Trevino, S**  
Development of In Vitro Correlate Assays of Immunity to Infection with *Yersinia Pestis* – 327
- Trevino-Frias, M.**  
Preliminary Findings from Noise Testing on PFC Pavements in Texas – 260
- Tribble, David R**  
Impact of Illness and Non-Combat Injury During Operations Iraqi Freedom and Enduring Freedom (Afghanistan) – 396  
Posttreatment Changes in *Escherichia coli* Antimicrobial Susceptibility Rates Among Diarrheic Patients Treated with Ciprofloxacin – 385
- Tripp, Jr , Lloyd D**  
A Model of the Effects of Acceleration on a Pursuit Tracking Task – 37
- Triscari, Thomas**  
Supporting Effects-Based Operations with Information Technology Tools: Examining Underlying Assumptions of EBO Tool Development Practices – 536
- Trofimov, Denis**  
An Atlas of [N ii] and [O iii] Images and Spectra of Planetary Nebulae – 665
- Truong, L.**  
Development and Manufacture of Cost Effective Composite Drill Pipe. 2006 Annual Technical Progress Report – 84
- Tsai, Pei**  
Role of Superoxide in the Germination of *Bacillus Anthracis* Endospores – 380
- Tsapraillis, G.**  
Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420
- Tsukruk, V. V.**  
Compliant, Nanoscale Free-Standing Multilayer Films – 66
- Tsul, K.**  
Microconnectors and Non-Powered Microassembly Therewith – 202
- Tsyganov, Sergei A**  
Confined Detonations and Pulse Detonation Engines – 42
- Tu, Fang**  
PHM Integration with Maintenance and Inventory Management Systems (Preprint) – 498
- Tu, Haiying**  
Effects-Based Design of Robust Organizations – 520
- Tucci, Patrick**  
Database Dictionary for Ethiopian National Ground-Water Database (ENGDA) Data Fields – 631
- Tuck, K.**  
Method, System and Device for Microscopic Examination Employing Fibre-Prepared Sample Grasping Element – 206
- Tugcu, N.**  
High Throughput Screening of Potential Displacer Molecules – 73
- Tullos, J A**  
IHPPT Improvements to the Solid Performance Program (SPP) – 542
- Tully, L. K.**  
Electrostatic Modeling of Vacuum Insulator Triple Junctions – 205
- Turetsky, Abe**  
Vaporous Hydrogen Peroxide (VHP) Decontamination of a C-141B Starlifter Aircraft: Validation of VHP and Modified VHP (mVHP) Fumigation Decontamination Process via VHP-Sensor, Biological Indicator, and HD Simulant in a Large-Scale Environment – 31
- Turley, James P.**  
Translational Research from an Informatics Perspective – 416
- Turley, Steven D**  
Evaluation of *Daphnia Magna* Neonate Viability under Low Temperature Exposure Conditions – 310
- Turner, Andrew E**  
Hydrogen Pressurization of LOX: High Risk/High Reward (Preprint) – 97
- Turner, D D**  
A Multiservice Switch for Advanced Avionics Data Networks – 42
- Turner, Daniel D**  
Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – 225
- Turner, Jeffrey L**  
A Correlation Between Quality Management Metrics and Technical Performance Measurement – 636
- Turner, Paddy**  
Elicitation of British Army Commanders' Personal Constructs – 621
- Turner, William M**  
Wireless Intrusion Detection – 483
- Turtle, J. P.**  
T/R Module for Satellite TT&C Ground Link – 200
- Tutton, Stephanie J**  
Optimizing the Allocation of Sensor Assets for the Unit of Action – 531
- Twenhafel, Nancy A**  
Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340
- Twilley, R. R.**  
Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources – 277
- Tyler, M. E.**  
Systems and Methods for Altering Vestibular Biology – 506
- Tysor, Sue**  
Building the Readiness Data Warehouse – 479
- Tzamaloukas, Asimakis**  
Channel Hopping Multiple Access with Packet Trains for Ad Hoc Networks – 161
- Udpa, Lalita**  
Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Post-print) – 534
- Ulander, L. M.**  
Pilot Study: Parasitic and Passive Radar – 179
- Ulicny, Brian**  
New Metrics for Blog Mining – 622
- Ulrich, Robert G**  
Detection of *Staphylococcus Aureus* Enterotoxin A and B Genes with PCR-EIA and a Hand-Held Electrochemical Sensor – 331
- Underwood, Samantha**  
The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314
- Unger, Mike**  
Control of Spinning Symmetric Airframes – 552
- Urech, Lukas**  
Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites – 123
- Ury, M**  
Interaction of Intense Electron Beams with Plasma – 582
- Usher, David**  
Delaware Consortium for Undergraduate Minority Training in Prostate Cancer – 362
- Usher, Jeffrey M**  
Towards a Computational Model of Sketching – 450
- Uslenghi, Piergiorgio L**  
Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – 195
- Uzarski, Joel S**  
Analysis of USA' Broadband Policy – 491

- Vaia, Richard A**  
Nanoscience and Technology at the Air Force Research Laboratory (AFRL) – 54  
Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- Vail, Neal**  
Targeted Therapies for Myeloma and Metastatic Bone Cancers – 328
- Vale, R. D.**  
Method of Affinity Purifying Proteins Using Modified Bis-Arsenical Fluorescein – 65
- Vallyathan, Val**  
Proteomic Analysis of Bronchoalveolar Lavage Fluid: Effect of Acute Exposure to Diesel Exhaust Particles in Rats – 335
- van Dam, M.**  
Adaptive Optics Views of the Hubble Deep Fields Final Report on LLNL LDRD Project 03-ERD-002 – 672
- Van Dongen, Hans**  
A Collaborative Study of Sleep, Performance and Health Relationships – 382
- Van Fong, C W**  
Scenario-Based Assessment of Sensors for the Canadian Recognized Maritime Picture – 227
- van Leijen, A V**  
Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model – 514
- Van Nederveen, Gilles**  
Signals Intelligence Support to the Cockpit – 504
- Van Parijs, S.**  
NOAA National Passive Acoustics Workshop, 2006 – 590
- Van Patten, P G**  
Placement of Conjugated Oligomers in an Alkanethiol Matrix by Scanned Probe Microscope Lithography – 121
- Van Wagoner, Jarad L**  
The Demise of Russian Health Capital: The Continuity of Ineffective Government Policy – 323
- Van Winkle, D.**  
Modeling and Simulation of Longitudinal Dynamics for LEH-HER PEP II Rings – 580
- Vanderhyde, Michael J**  
Comparison of Thermodynamic Equilibrium and Non-Equilibrium Representation of Materials – 218
- Varghese, R S**  
Analysis of MALDI-TOF Serum Profiles for Biomarker Selection and Sample Classification – 308
- Varner, Philip E**  
Efficient Hierarchic Management for Reconfiguration of Networked Information Systems – 485
- Varner, Philip**  
Willow System Demonstration – 449
- Vartio, Eric**  
Development of Aeroservoelastic Analytical Models and Gust Load Alleviation Control Laws of a SensorCraft Wind-Tunnel Model Using Measured Data – 3
- Vashishta, Priya**  
Applications of Molecular and Materials Modeling – 94
- Vassilevski, P. S.**  
Parallel Auxiliary Space AMG for Definite Maxwell Problems – 436  
Parallel Eigensolver for H (curl) Problems using H1 Auxiliary Space AMG Preconditioning – 434  
Some Experience with a H1 Based Auxiliary Space AMG for H (curl) Problems – 437
- Vay, J. L.**  
Quantitative Experiments with Electrons in a Positively Charged Beam – 606  
Self-Consistent Simulations of High-Intensity Beams and E-Coulsds with WARP POSINST – 568
- Vazirani, Umesh**  
Scalability, Complexity and Reliability in Quantum Information Processing – 591
- Velev, G. V.**  
AC Field Measurements of Fermilab Booster Correctors Using a Rotating Coil System – 605
- Veletz, Juan**  
Minimization of Thruster Plume Effects on Spacecraft Surfaces – 52
- Venner, Marty**  
Heat Flux and Infrared Spectral Measurements of Burning SRM Propellant (Postprint) – 130
- Vennergrund, D.**  
Enhancing Child Support Enforcement Efforts: Summary of Data Warehouse Efforts in Nine States – 439
- Verkade, J. G.**  
Immobilized Iminophosphatranes Useful for Transesterification – 70
- Vernieuw, C R**  
Skin Temperature Feedback Optimizes Microclimate Cooling – 272
- Verri, Alessandro**  
Empirical Effective Dimension and Optimal Rates for Regularized Least Squares Algorithm – 524
- Vertegaal, Merel**  
Development of a Battlefield Management System: How to Use the User – 172
- Vest, Sandi**  
Configuration Management Support for Long Haul C2 Circuit Switched Services – 154
- Veth, Michael J**  
Fusion of Imaging and Inertial Sensors for Navigation – 228
- Vetury, R**  
GaN Wide Band Power Integrated Circuits (Preprint) – 95  
Linearity and Efficiency Performance of GaN HEMTs with Digital Pre-Distortion Correction (Preprint) – 95  
Performance and RF Reliability of GaN-ON-SiC HEMTs Using Dual-Gate Architectures – 192
- Viale, A.**  
Human Error Investigation Software Tool (HEIST) – 427
- Viani, B. E.**  
Controls of Fluid Chemistry on Fracture Growth – 105
- Viculis, Lisa**  
Processing of Multifunctional Epoxy Resins Modified with Silicon Based Nanomaterials (POSTPRINT) – 124
- Vietri, Nicholas J**  
Short-Course Postexposure Antibiotic Prophylaxis Combined with Vaccination Protects Against Experimental Inhalational Anthrax – 340
- Vij, Ashwani**  
Solid State Synthesis Under Supramolecular Control of a 2D Heterotetrapotic Self-complementary Tecton Tailored to Halogen Bonding – 98
- Vij, Vandana**  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- Villahermosa, Luis A**  
Army Fuels: Policies, Regulations, and Executive Orders – 129
- Vincent, Wilbur R**  
Signal Population in the License-Exempt Wireless-Radio Bands at the MOUT Site – 152  
The Mitigation of Radio Noise from External Sources at Receiving Sites – 163
- Vinch, Jr, Peter M**  
Design and Implementation of an Intelligent Primitive Driver – 550
- Vineberg, Maniel**  
Multipurpose Activity Definitions and Interfaces to Support Operational Needs (MADISON) – 542
- Vinoles, Jose**  
Seroincidence and Phylogeny of Human Immunodeficiency Virus Infections in a Cohort of Commercial Sex Workers in Montevideo, Uruguay – 389
- Vitkovitsky, I M**  
Interaction of Intense Electron Beams with Plasma – 582
- Vlasov, Y. A.**  
Method of Forming Quantum Dots at Predetermined Positions on a Substrate – 201



- Voevodin, A A**  
Oxygen Plasma Treatment and Deposition of CN<sub>x</sub> on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121  
Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127
- Voevodin, Andrey A**  
Ionic Liquid Lubrication of MEMS Devices: An AFM Based Analysis and Evaluation on Test Devices (Preprint) – 591
- Vogt, R.**  
HEND: A Database for High Energy Nuclear Data – 559
- Vogt, T. J.**  
Antiferromagnetically Stabilized Pseudo Spin Valve for Memory Applications – 438
- Volkman, A.**  
Gas Turbine Engine Including a Low Pressure Sump Seal Buffer Source and Thermally Isolated Sump – 41
- von Hofe, Eric**  
Intra-Prostate Cancer Vaccine Inducer – 316
- von Molnar, Stephan**  
Spin Electronics – 189
- Von Stackleberg, Katherine**  
Screening Level Ecological Risk Assessments of Some Military Munitions and Obscurant-related Compounds for Selected Threatened and Endangered Species – 251
- VonEllenrieder, K**  
Center for Coastline Security Technology, Year-2 – 228
- Voronov, Oleg A.**  
Composite Materials Containing a Nanostructured Carbon Binder Phase and High Pressure Process for Making the Same – 83
- Vourlidas, A**  
Fast Coronal Mass Ejection Environments and the Production of Solar Energetic Particle Events – 668
- Vowell, C. W.**  
IMMR Phase 1 Prototyping Plan Inputs – 663  
MDS MIC Catalog Inputs – 416
- Vranas, P.**  
BlueGene/L Supercomputer and Quantum ChromoDynamics – 560
- Vul', Alexander**  
Detonation Nanodiamonds and Related Materials. Bibliography Index, Issue 1 – 102
- Vulatov, V.**  
Collaborations in Nuclear Reactors – 559
- Wachsmann, A.**  
Cfetool. A General Purpose Tool for Anomaly Detection in Periodic Data – 439
- Wadhwa, Pathik**  
Physiological Stress Reactivity and Breast Cancer – 391
- Wadley, H N**  
An Electron Beam Method for Creating Combinatorial Libraries: Application to Next Generation Thermal Barrier Coatings Systems – 60
- Waesterby, P.**  
Priority of Chemicals for Detection in Air at International Missions for Reducing Threats to Personnel at Aqute Toxic Releases to Air – 256
- Wagener, P. J.**  
Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – 240
- Wagenhals, Lee W**  
Course of Action Analysis for Coalition Operations – 458  
Integration of Information Operations into Effects-Based Operations: Some Observations – 648
- Wagner, George W**  
Degradation of the Blister Agent BIS(2-Chloroethyl) Sulfide and Simulant 2-Chloroethyl Phenyl Sulfide on Concrete – 306
- Wagoner, J. L.**  
Review of the Stability Analysis for the LANL BSL-3 Building Foundation – 264
- Wai, Chien M**  
Advanced Materials Deposition for Semiconductor Nanostructures Using Supercritical Fluids – 184
- Waite, A R**  
Oxygen Plasma Treatment and Deposition of CN<sub>x</sub> on a Fluorinated Polymer Matrix Composite for Improved Erosion Resistance (Preprint) – 121
- Waldhart, Chris J.**  
Probabilistic Modeling of Space Shuttle Debris Impact – 58
- Wale, Nikil**  
Methods for Effective Virtual Screening and Scaffold-Hopping in Chemical Compounds – 653
- Wales, William J**  
Supporting Effects-Based Operations with Information Technology Tools: Examining Underlying Assumptions of EBO Tool Development Practices – 536
- Walker, D N**  
On the Non-Intrusive Determination of Electron Density in the Sheath of a Spherical Probe – 551
- Walker, David N**  
Hamiltonian Analysis of Charged Particle Gyromotion in Cylindrical Coordinates – 513
- Walker, K F**  
A Review and Assessment of Current Airframe Lifting Methodologies and Tools in Air Vehicles Division – 20
- Walker, Robert L**  
Finite Element Solution: Nonlinear Flapping Beams for Use with Micro Air Vehicle Design – 3
- Wall, Daniel S**  
Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI – 481
- Wall, M. A.**  
Changes in Delta-Plutonium Due to Self-Irradiation Aging Observed by Continuous In-Situ X-ray Scattering – 120
- Wall, M.**  
Application of Neutron-Absorbing Structural-Amorphous Metal (SAM) Coatings for Spent Nuclear Fuel (SNF) Container to Enhance Criticality Safety Controls – 130
- Walsh, Shawn P**  
Oil Vulnerabilities and USA Strategy – 241
- Walter, Johan**  
Methods and System Design of the FOI Information Fusion Demonstrator - IFD03 – 450
- Walter, Martin J**  
Modeling the Joint Battlespace Infosphere – 644
- Walton, C. M.**  
Electronic Vehicle Identification: Industry Standards, Performance, and Privacy Issues – 178  
Impacts of Traveler Information on Transportation Network Operations and Potential Deployment Technologies – 178
- Wang, Chenxi**  
Protection of Software-based Survivability Mechanisms – 447
- Wang, D Z**  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92
- Wang, F**  
Standard-Cell, Open-Architecture Power Conversion Systems – 247
- Wang, Genyuan**  
Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224
- Wang, Guiqin**  
Optimization of Synthetic Jet Actuators – 235
- Wang, J H**  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92
- Wang, Jun**  
A Multi-Ring Framework for Survivable Group Communications – 440

- Wang, Ruobing**  
Boosting of DNA Vaccine-Elicited Gamma Interferon Responses in Humans by Exposure to Malaria Parasites – 402
- Wang, Shaomeng**  
Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer – 302
- Wang, W.**  
Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274
- Wang, W**  
Room-Temperature Negative Differential Resistance in Nanoscale Molecular Junctions – 187
- Wang, Weizhong**  
Feasibility Study on Magnetic Content Addressable Memory – 196
- Wang, Yeong-Her**  
Novel Organic Field Effect Transistors via Nano-Modification – 197
- Wang, Z.**  
Impacts of Traveler Information on Transportation Network Operations and Potential Deployment Technologies – 178
- Wannemacher, Robert W**  
Improved Formulation of a Recombinant Ricin A-chain Vaccine Increases its Stability and Effective Antigenicity – 353
- Wapner, Phillip G**  
Carbonization Studies of Glassy Carbon Derived from Bis-Ortho-Diynylarenes (BODA) (Postprint) – 100
- Ward, B**  
Microphysics of Air-Sea Exchanges – 274
- Ward, Nancy E.**  
Simulated Microgravity Regulates Gene Transcript Profiles of 2T3 Preosteoblasts: Comparison of the Random Positioning Machine and the Rotating Wall Vessel Bioreactor – 411
- Ware, Lisa A**  
Mode of Action of Invasion-Inhibitory Antibodies Directed against Apical Membrane Antigen 1 of Plasmodium falciparum – 379
- Wargo, P. E.**  
Flash X-ray (FXR) Linear Induction Accelerator(LIA) Optimization Upgrade of the OTR Emittance Diagnostic – 575
- Waring, K.**  
Climate Change Impact on Forest Resources. White Paper – 277
- Warmflash, David**  
Assessing the Biohazard Potential of Putative Martian Organisms for Exploration Class Human Space Missions – 675
- Warne, Leoni**  
Evaluation of Organisational Interoperability in a Network Centric Warfare Environment – 146  
Yet Another Role for Team Building and Work Motivation -Enabler of Knowledge Creation and Knowledge Sharing – 457
- Warner, Neil**  
Information Superiority through Data Warehousing – 655  
Interoperability -- An Australian View – 639
- Warren, D**  
Design Tradeoffs for a High Spectral Resolution Mid-Infrared Echelle Spectrograph on the Thirty-Meter Telescope – 592
- Warren, L. F.**  
Reversible Electrodeposition Optical Modulation Device with Conducting Polymer Counter Electrode – 213
- Warren, Warren S**  
Measuring 'Impossible' Intermolecular Cross-Peaks to Improve Selectivity and Sensitivity in Breast MRI – 396
- Washburn, Anthony**  
Active Control of Flow Separation on a High-Lift System with Slotted Flap at High Reynolds Number – 4
- Washburn, Ephraim B**  
Development of Subscale Fast Cookoff Test – 134
- Washburn, Sean**  
Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale – 188
- Wasielewski, M. R.**  
Perylene N-Type Semiconductors and Related Devices – 205
- Watabe, Kounosuke**  
Mechanism of Tumor Metastasis Suppression by the KA11 Gene – 318
- Watkins, R. W.**  
Type B Radioactive Material Package Failure Modes and Contents Compliance – 238
- Watson, Ian A**  
Methods for Effective Virtual Screening and Scaffold-Hopping in Chemical Compounds – 653
- Watson, J. G.**  
Southern Nevada Air Quality Study – 236
- Watson, K. A.**  
Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83
- Watt, George**  
Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385
- Watters, Jennifer**  
The Effect of Hypotensive Resuscitation and Fluid Type on Mortality, Bleeding, Coagulation, & Dysfunctional Inflammation in a Swine Grade V Liver Injury Model – 314
- Watts, Douglas M**  
Cross-Serotype Neutralization of Dengue Virus in Aotus nancymae Monkeys – 387
- Way, Mark R**  
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection – 77
- Weatherless, Rachel A**  
Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPs) on Speech Communication: Talk-Through Systems – 630
- Weatherly, Jim**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – 143  
New Navy Solutions: Developing Simulation Based C4I Applications – 445
- Weaver, D S**  
Recrystallization and Grain-Growth Behavior of a Nickel-Base Superalloy During Multi-Hit Deformation (Preprint) – 118
- Weaver, Elise A**  
Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497
- Weaver, Valerie M**  
A Biophysico-computational Perspective of Breast Cancer Pathogenesis and Treatment Response – 324
- Webb, A.**  
Evaluation of Emission Control Strategies for the 8-Hour Ozone Standard in the Houston and Dallas Areas and A Pilot-Scale Study of In-Use Emissions from Heavy-Duty Diesel Dump Trucks using a Portable Emissions Monitoring System (PEMS) – 255
- Webb, Robert P**  
Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – 369
- Weber, John B**  
Spread Spectrum Signal Characteristic Estimation Using Exponential Averaging and an AD-HOC Chip rate Estimator – 195
- Weber, M. E.**  
Analysis of Operational Alternatives to the Terminal Doppler Weather Radar (TDWR) – 276
- Weedon, W. H.**  
Method for Constructing Antennas from Textile Fabrics and Components – 179

**Weeks, S**

Development of In Vitro Correlate Assays of Immunity to Infection with Yersinia Pestis – [327](#)

**Wei, Qiuming**

Microcompression of Bulk Metallic Glass and Tungsten - Bulk Metallic Glass Composites – [114](#)

**Weimer, Joseph**

Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – [91](#)

**Weiner, Matthew A**

Murine Macrophages Kill the Vegetative Form of Bacillus anthracis – [394](#)

**Weinstein, Amanda L**

UAV Scheduling via the Vehicle Routing Problem with Time Windows (Preprint) – [20](#)

**Weinstein, Amanda**

Optimal UAV Task Assignment and Scheduling (Preprint) – [24](#)

**Weisdorf, Daniel**

National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – [397](#)

**Weiss, David**

Scalability, Complexity and Reliability in Quantum Information Processing – [591](#)

**Weiss, Walter R**

HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – [397](#)

**Weiss, Walter**

Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – [389](#)

**Weissenbacher, Mercedes**

Prevalences, Genotypes, and Risk Factors for HIV Transmission in South America – [393](#)

**Weissenhorn, Winfried**

An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – [330](#)

**Welborn, Angie A**

Mandatory Vaccinations: Precedent and Current Laws – [393](#)

**Welch, D. F.**

Coolerless Photonic Integrated Circuits (PICs) for WDM Transmission Networks and PICs Operable with a Floating Signal Channel Grid Changing with Temperature but with Fixed Channel Spacing in the Floating Grid – [214](#)

**Welkos, S**

Development of In Vitro Correlate Assays of Immunity to Infection with Yersinia Pestis – [327](#)

**Wells, Jeffrey**

Assured Reference Technology Research (ARTHUR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – [596](#)

**Welsh, Jeffery S**

2-D Biaxial Testing and Failure Predictions of IM7/977-2 Carbon/Epoxy Quasi-Isotropic Laminates – [82](#)

**Welter, John**

Detection of Incipient Thermal Damage in Polymer Matrix Composites (Preprint) – [80](#)

Detection of Localized Heat Damage in a Polymer Matrix Composite by Thermo-Elastic Method (Preprint) – [81](#)

**Wemmer, David E**

New Structural Approaches to Understanding the Disease Related Forms of the Prion Protein – [348](#)

**Wen, J G**

Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – [92](#)

**Wen, Ten-Chin**

Novel Organic Field Effect Transistors via Nano-Modification – [197](#)

**Wendt, J. R.**

Defect-Related Internal Dissipation in Mechanical Resonators and the Study of Coupled Mechanical Systems – [204](#)

**Weng, Shaomeng**

Structure-Based Approach for Discovery of Small Molecule Inhibitors Targeted at AKT – [296](#)

**Weng, Yujuan**

Identifying Molecular Factors in Androgen Receptor Nuclear Export – [282](#)

**Wentz, Larry K**

Coalition Information Sharing: Lessons from Kosovo – [183](#)

Integration of Information Operations into Effects-Based Operations: Some Observations – [648](#)

**Wentz, Larry**

Defense Horizons. I-Power: The Information Revolution and Stability Operations. Number 55 – [619](#)

**Werthman, Robert W**

Comanche Helicopter Program - A Strategic Failure – [30](#)

**Wertman, Chris**

Report Out of the C4I Study Group – [162](#)

**Westenhoff, Charles M**

Military Airpower: A Revised Digest of Airpower Opinions and Thoughts – [14](#)

**Westergren, Mark**

A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations – [620](#)

**Westmoreland, Phillip R**

Applications of Molecular and Materials Modeling – [94](#)

**Westra, Hans**

Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – [377](#)

**Weyland, M. D.**

Operational Aspects of Space Radiation Analysis – [676](#)

**Whalen, E. A.**

Characteristics of Runback Ice Accretions and Their Aerodynamic Effects – [1](#)

**Whalen, Joseph B**

Rapid Wall-Breaching Kit, Ingress Hole Determination Experiment – [225](#)

**Whaley, K B**

Scalability, Complexity and Reliability in Quantum Information Processing – [591](#)

**Wheatley, Gary**

Analysis of Metrics Utilized in U.S. Joint Experimentation of Future C2 Concepts – [171](#)

**Wheaton, Kendall**

A Conceptual Operational Model for Command and Control of International Missions in the Canadian Forces – [180](#)

**Wheeler, B.**

Active Detection of Small Quantities of Shielded Highly-Enriched Uranium Using Low-Dose 60-keV Neutron Interrogation – [570](#)

**Whelan, G.**

Concepts Associated with Transferring Temporal and Spatial Boundary Conditions Between Modules in the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) – [431](#)

**Whilden, J N**

Preliminary Findings: Design of Experiments University XXI (FY05) Research and Support for the US Army – [621](#)

**Whitaker, Katherine**

Physical, Nutrient, and Biological Measurements of Coastal Waters off Central California in October 2006 – [407](#)

**White, Barry C**

Rotational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions – [265](#)

**White, Brad**

High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) – [125](#)

**White, Timothy L**

Effects of Multimodal Displays About Threat Location on Target Acquisition and Attention to Visual and Auditory Communications – [153](#)

**Whiting, Richard C**

Evaluation of Lateral-Flow Clostridium botulinum Neurotoxin Detection Kits for Food Analysis – 403

**Whitlock, B.**

Visual Spreadsheets in VisIt – 432

**Whitmore, Jeff**

Investigation of Complex Command, Control and Communications Decision-making under Sustained Operations – 166

**Whittaker, Allan**

Multi-Sensor Information Fusion Technology Applied to the Development of Smart Aircraft – 8

**Widjaja, Susana**

Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394

**Wierzba, Thomas F**

Serologic Correlates of Protection against Enterotoxigenic Escherichia coli Diarrhea – 379

**Wigeland, R.**

AFCI Storage and Disposal FY-06 Progress Report – 106

**Wiken, R T**

Guidance Material for Mode S-Specific Protocol Application Avionics – 37

**Wilcox, R.**

Fermi Timing and Synchronization System – 605

**Wilcox, S.**

National Solar Radiation Data Base 1991-2005 Update: User's Manual – 245

**Wilder, Michael C.**

Boundary Layer Transition Experiments in Support of the Hypersonics Program – 1

**Wiley, Patrick H**

The Development of a Virtual McKenna Military Operations in Urban Terrain (MOUT) Site for Command, Control, Communication, Computing, Intelligence, Surveillance, and Reconnaissance (C4ISR) Studies – 164

**Wilk, P.**

Progress on the Europium Neutron-Capture Study Using DANCE – 673

**Wilke, Paul S**

Payload Isolation System for Launch Vehicles – 54

**Wilken, Brian A**

Change-Point Methods for Overdispersed Count Data – 522

**Wilkerson, Jordan T**

SparkJet Actuators for Flow Control – 235

**Wilkinson, N.**

An Evidence-based Approach to Developing a Management Strategy for Medical Contingencies on the Lunar Surface: The NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island – 415

**Wille-Reece, Ulrike**

HIV Gag Protein Conjugated to a Toll-like Receptor 7/8 Agonist Improves the Magnitude and Quality of Th1 and CD8+ T Cell Responses in Nonhuman Primates – 397

**Williams, Andrew**

Chamber Core Structures for Fairing Acoustic Mitigation – 50

**Williams, Frederick W**

Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145

**Williams, Jackie**

The Immune Status of Kupffer Cells Profoundly Influences their Responses to Infectious Plasmodium berghei sporozoites – 404

**Williams, Richard T**

Biodegradation of DIMP, Dieldrin, Isodrin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – 305

Review of Laboratory Program on Degradation Mechanisms in Soil of Wastewater From Nitroguanidine Manufacture – 93

**Williamson, E. B.**

Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – 240

**Willis, Peter A**

Synthesis, Structure, and Properties of PBO/SWNT Composites – 104

**Willke, Bradford J**

Management and Education of the Risk of Insider Threat (MERIT): Mitigating the Risk of Sabotage to Employers' Information, Systems, or Networks – 497

**Wilson, Clay**

High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments – 554

Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues – 618

Network Centric Operations: Background and Oversight Issues for Congress – 486

**Wilson, Daniel D**

Multi-Hypothesis Structures, Taxonomies and Recognition of Tactical Elements for Combat Identification Fusion – 622

**Wilson, E L**

Origin and Properties of Prostatic Stem Cells – 299

**Wilson, J. W.**

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – 420

**Wilson, Kenneth J**

Development of Subscale Fast Cookoff Test – 134

**Wilson, P. B.**

Theory for the RF Surface Field for Various Metals at the Destructive Breakdown Limit – 73

**Wilson, Rhoda M**

Effects of the Advanced Combat Helmet (ACH) and Selected Communication and Hearing Protection Systems (C&HPSS) on Speech Communication: Talk-Through Systems – 630

**Wingard, John R**

National Institutes of Health Consensus Development Project on Criteria for Clinical Trials in Chronic Graft-versus-Host Disease: I. Diagnosis and Staging Working Group Report – 397

**Winkler, Robert**

Integration of SATURN System and VGIS – 530

**Winterbottom, Marc D**

Helmet-Mounted Displays for Use in Air Force Training and Simulation – 6

**Winters, Patrick J**

Correcting the Response of an Albedo Neutron Dosimeter for Energy – 219

**Wintersteiner, Peter**

Observation of Tidal Effects on LWIR Radiance Above the Mesopause – 262

**Winzeler, Elizabeth A**

The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401

**Wirzburger, John**

Zero Gyro Kalman Filtering in the Presence of a Reaction Wheel Failure – 667

**Wisniewski, J. J.**

Unattended Ground Sensor Assembly – 436

**Wit, Jeffrey S**

Vector Pursuit Path Tracking for Autonomous Ground Vehicles – 507

**Wit, Jeffrey**

A Modular, Scalable, Architecture for Unmanned Vehicles – 547

**Witney, Adam**

Transcriptional Analysis of In vivo Plasmodium yoelii Liver Stage Gene Expression – 404

**Wodnicko, R. G.**

Reconfigurable Linear Sensor Arrays for Reduced Channel Count – 208

**Wojcik, G. J.**

Massive Metrology: Development and Implementation of a 3D Reference Frame for the Realignment of Fermilab's Tevatron – 606

- Wolf, Alexander L**  
Willow System Demonstration – 449
- Wolf, Emil**  
Coherence and Polarization Properties of Far Fields Generated by Quasi-Homogeneous Planar Electromagnetic Sources (Postprint) – 602
- Wolfe, Douglas E**  
Mechanical and Microstructural Effects of Cold Spray Aluminum on Al 7075 Using Kinetic Metallization and Cold Spray Processes (Preprint) – 99
- Wolff, Phillip**  
Analogical Reasoning and Conceptual Change: A Case Study of Johannes Kepler – 666
- Wolfson, Michael A**  
Correction to Attenuation Treatment in the Monterey-Miami Parabolic Equation Model – 514
- Wolozin, Benjamin**  
Mechanisms of Alpha-synuclein Aggregation and Toxicity – 330
- Womble, Jennie**  
C4I-Simulation Interoperability Using the DII COE and HLA – 468
- Won, Chang-Hee**  
System Level Architecture of Cooperative Satellite Control Using Hierarchical Hybrid Systems and Automata Theory – 50
- Won, I J**  
Handheld Broadband Electromagnetic UXO Sensor – 198
- Wong, George C**  
A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model – 508
- Wong, George**  
Configuration Management Support for Long Haul C2 Circuit Switched Services – 154
- Wong, L Y**  
Active Conceptual Modeling of Learning Workshop 10-12 May 2006 – 656
- Wong, S C**  
A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model – 508  
  
The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515
- Wongchotigul, Varee**  
Short Report: Detection of Orientia Tsutsugamushi in Clinical Samples by Quantitative Real-Time Polymerase Chain Reaction – 385
- Wongsrichanalai, Chansuda**  
Sources of Variability in Determining Malaria Parasite Density by Microscopy – 392  
  
White Blood Cell Counts and Malaria – 400
- Woo, L. Y.**  
Impedance Analysis of Electrochemical NOx Sensor Using a Au/Yttria-Stabilized Zirconia (YSZ) Au Cell – 247
- Wood, J. H.**  
Pneumatically Actuated Flexible Coupling and Effectors for Lapping/Polishing – 34
- Wood, S. L.**  
Evaluation of Serviceability Requirements for Load Rating Prestressed Concrete Bridges – 240
- Wood, Scott D**  
An Intelligent Interface-Agent Framework for Supervisory Command and Control – 498
- Wood, William A.**  
Re-Entry Aeroheating Analysis of Tile-Repair Augers for the Shuttle Orbiter – 58
- Wood, William G**  
A Practical Example of Applying Application-Driven Design (ADD), Version 2.0 – 545
- Woodcock, Alexander E**  
The Challenge of New and Emerging Information Operations – 649
- Wooding, Pete**  
Sense Making - Underpinning Concepts and Relation to Military Decision-Making – 617
- Woodliffe, Elizabeth**  
Coalition CINC 21 - Leading-Edge Information Technologies to Support Coalition Operations – 627
- Woods, Heather**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – 143
- Woodson, Randy**  
Focused Knowledge to the Warfighter – 617
- Woodward, C. S.**  
Code Verification Results of an LLNL ASC Code on Some Tri-Lab Verification Test Suite Problems – 562  
  
Implicit Solvers for Large Scale Nonlinear Problems – 433
- Woollett, J.**  
LLNL 10(a)(1)(A) Annual Report (TE-053672-2)-2006 – 253
- Working, D. C.**  
Thermal Conductivity of Copoly(ethylene vinyl acetate)/Nano-Filler Blends – 83
- Worsham, Maria J**  
Molecular Differentiation of Risk for Disease Progression: Delineating Stage-Specific Therapeutic Targets for Disease Management in Breast Cancer – 289
- Wright, Candice L**  
Bridging the Gap in Port Security; Network Centric Theory Applied to Public/Private Collaboration – 492
- Wright, E M**  
Computational Nonlinear Optics: Femtosecond Atmospheric Light String Applications – 266
- Wright, Gary L**  
A Comparative Assessment of Knowledge Management Education Across the USA Department of Defense – 636
- Wright, Michael E**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125
- Wright, Micheal E**  
Synthesis and Characterization of Space-Survivable POSS-Kapton (Trademark) Polyimides (Preprint) – 52
- Wright, Patrick M**  
Protection with Recombinant Clostridium botulinum C1 and D Binding Domain Subunit (Hc) Vaccines Against C and D Neurotoxins – 369
- Wu, H.**  
Inter- and Intra-Chromosomal Aberrations in Human Cells Exposed in vitro to Space-like Radiations – 370
- Wu, Honglu**  
Utility of DF-1 for Radioprotection in Lymphocytes – 420
- Wu, Jian**  
Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer – 81
- Wu, M K**  
High Resolution Real Time Phase Contrast Radiology Study of Hydrodynamic in Micrometer Scale – 133
- Wu, Maw-Kuen**  
Synthesis of One-dimensional Nano-sized Defects in High Tc Superconductor – 552
- Wu, Renbiao**  
Acoustic Proximity Ranging in the Presence of Secondary Echoes – 588
- Wu, Richard L**  
Multilayer Aluminum Oxynitride Capacitors for Higher Energy Density, Wide Temperature Applications (Preprint) – 91
- Wu, Ya-Ling**  
Structural Determination of Certain Novel ER Complexes – 304
- Wunder, Michael A**  
The Benefit of Ontologies for Interoperability of CCIS. (Easy, Quick and Cheap Solutions are Impossible, if Semantics of CCIS are Affected.) – 620
- Wurthh, Timothy**  
Assured Reference Technology Research (ARTHR) Project. Delivery Order 0004: Fiber-Optic RF Distribution (FORD) (PREPRINT) – 596
- Wuryadi, Suharyono**  
Early Detection of Dengue Infections using Cluster Sampling Around Index Cases – 394

- Xiao, Qinghan**  
Challenges and Potential Research Areas in Biometrics – 476  
Future Applications in Using Biometrics to Enhance Security Level of Coalition Information Sharing Networks – 477
- Xie, Huikai**  
Fabrication, Characterization, and Analysis of a DRIE CMOS-MEMS Gyroscope – 140
- Xie, Y.**  
Meteorological Integration for the Biological Warning and Incident Characterization (BWIC) System: General Guidance for BWIC Cities – 274  
Micromechanical Resonator Device Having a Desired Mode Shape – 201
- Xing, Jing**  
Developing the Federal Aviation Administration's Requirements for Color Use in Air Traffic Control Displays – 16
- Xing, Lei**  
Intensity Modulated Radiation Treatment of Prostate Cancer Guided by High Field MR Spectroscopic Imaging – 355
- Xu, Guang**  
Short- and Long-Term Immune Responses of CD-1 Outbred Mice to the Scrub Typhus DNA Vaccine Candidate: p47Kp – 399
- Xu, J W**  
Growth of a Single Freestanding Multi-wall Carbon Nanotube on each Nanonickel Dot – 92
- Xu, Minzhen**  
Intra-Prostate Cancer Vaccine Inducer – 316
- Xu, W B**  
Identification, Cloning, and Expression of Potential Diagnostic Markers for Q Fever – 388
- Yakovenko, Andriy**  
Ukraine's Search for its Place in Europe: The East or the West? – 548
- Yalavarthy, Phaneendra K**  
Three-Dimensional near Infrared Imaging of Pathophysiological Changes within the Breast – 363
- Yamada, R.**  
Characteristics of Round and Extracted Strands of Mb(3)A1 Rutherford Cable – 558
- Yamakawa, Mineo**  
Microsystems Research in Japan – 191
- Yan, Hong**  
Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – 216
- Yan, Quingshan**  
Ethanol and Mesolimbic Serotonin/Dopamine Interactions via 5HT-1B Receptors – 346
- Yan, Xiaowei**  
Decipher the Transcriptional Program in Prostate Cancer Cells – 305
- Yancosek, Kathleen E**  
Voice Recognition Interface in the Rehabilitation of Combat Amputees – 307
- Yandek, Gregory R**  
A New Silicon-Containing Bis(Cyanate) Ester Resin with Improved Thermal Oxidation and Moisture Resistance – 125
- Yang, B.**  
X-Ray Absorption Edge Detector for High-Resolution Measurement of Undulator Effective K-Parameter – 577
- Yang, Hung-Yu D**  
Analysis and Design of Ultra Wide-Band and High-Power Microwave Pulse Interactions With Electronic Circuits and Systems – 195
- Yang, Vigor**  
Swirl-Stabilized Injector Flow and Combustion Dynamics for Liquid Propellants at Supercritical Conditions – 217
- Yang, X M**  
Test and Evaluation of Value Engineering Proposal: Removal of Rubber PAD in 120 MM PA 153 Ammunition Fiber Container – 140
- Yang, Yang**  
High Performance Polymer Memory and Its Formation – 210
- Yankowich, Paul R.**  
Reduced Exhaust Emissions Gas Turbine Engine Combustor – 39
- Yariv, Avi**  
Using a Combination of UML, C2RM, XML, and Metadata Registries to Support Long-Term Development/Engineering – 452
- Yassine, A.**  
Methods and Program Products for Optimizing Problem Clustering – 435
- Yates, Alex**  
Modelling Operational Command Structures Using ORGAHEAD – 451
- Yeboah, Frank**  
Proceedings of the 1st Army Installation Energy Security and Independence Conference – 245
- Yeh, Brian T**  
Intelligence Reform and Terrorism Prevention Act of 2004: 'Lone Wolf' Amendment to the Foreign Intelligence Surveillance Act – 664
- Yei, Brian**  
Study on Wide-gap Gallium-nitride Based Films and Their Quantum-dots Devices – 196
- Yen, Leong**  
Optimising the Design of Land Force C2 Architectures – 152
- Yeom, Junghoon**  
A Fully-Integrated MEMS Preconcentrator for Rapid Gas Sampling (Preprint) – 112
- Yepez, Jeffrey**  
Proceedings of the Quantum Computation for Physical Modeling Workshop 2004. Held in North Falmouth, MA on 12-15 September 2004 – 592  
Proceedings of the Quantum Computation for Physical Modeling Workshop Held in North Falmouth, Massachusetts on October 18-19, 2000 – 519
- Yerkes, Kirk L**  
Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Dissolved Air (Postprint) – 55  
Cooling Performance of a Partially-Confined FC-72 Spray: The Effect of Variable Gravity (Postprint) – 55
- Yeung, D T**  
Direct Detection of Stereospecific Soman Hydrolysis by Wild-Type Human Serum Paraoxonase – 374
- Yi, Gyu-Chul**  
Fabrications and Characterizations of ZnO/Zn1-xMgxO Nanorod Quantum Structures – 186
- Ying, J. Y.**  
Mesoporous Zeolitic Materials, and Methods of Making and Using the Same – 76
- Ylquimiche, Laura**  
Efficacy and Tolerability of Artesunate Plus Sulfadoxine-Pyrimethamine and Sulfadoxine-Pyrimethamine Alone for the Treatment of Uncomplicated Plasmodium Falciparum Malaria in Peru – 380
- Yonehara, K.**  
Studies of a Gas-Filled Helical Muon Beam Cooling Channel – 565
- Youn, Wonita**  
Modeling and Simulation in Support of Network Centric Warfare Analysis – 143
- Younes, W.**  
Systematic Procedure for Assigning Uncertainties to Data Evaluations – 567
- Young, David A**  
Building an Experimental Joint Battlespace Infosphere (YJBI-CB) – 460
- Young, Jason A**  
The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401
- Young, Michael J**  
Realistic and Affordable Cyberware Opponents for the Information Warfare Battlespace – 537
- Yunker, John**  
A New Multi-Sensor Track Fusion Architecture for Multi-Sensor Information Integration – 510

- Yow, Raylon M**  
Experiments, Computation, and Modeling for Temperature Dependence of Absorption, Scattering, Reflection, Transmission, and Index of Refraction of Optical Radiation in Biological Tissues – 597
- Yu, Erik Z**  
Postexposure Protection of Guinea Pigs against a Lethal Ebola Virus Challenge is Conferred by RNA Interference – 330
- Yu, Feili**  
Effects-Based Design of Robust Organizations – 520
- Yu, Hu**  
Integration of SATURN System and VGIS – 530
- Yu, S. S.**  
Search for Higgs at CDF – 564
- Yu, T. L.**  
Methods and Program Products for Optimizing Problem Clustering – 435
- Yu, Zhou**  
Red Photoluminescence Emission of Laser Dye Doped DNA and PMMA (Preprint) – 63
- Yue, Dick K**  
Studies on Three-Dimensional Slamming on Slender Ships – 221
- Yufik, Y M**  
Towards Dominant Battlespace Comprehension in Network Centric Warfare – 549
- Yura, J. A.**  
Composite Action during Construction of Steel Trapezoidal Box Girder Bridges – 240
- Yurcik, William**  
A Multi-Ring Framework for Survivable Group Communications – 440
- Yusibov, Vidadi**  
Human-Derived, Plant-Produced Monoclonal Antibody for the Treatment of Anthrax – 377
- Yusko, Ryan S**  
Platform Camera Aircraft Detection for Approach Evaluation and Training – 29
- Zabinski, J S**  
Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) – 127
- Zaharevitz, Dan W**  
An All-Atom Model of the Pore-Like Structure of Hexameric VP40 from Ebola: Structural Insights into the Monomer-Hexamer Transition – 330
- Zajicek, Mark**  
Incident Management Capability Metrics Version 0.1 – 482
- Zak, Stephen**  
Future Naval Concepts -- Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC) – 145
- Zander, Nicole**  
Nanoengineered Additives for Active Coatings – 61  
Self Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces – 79
- Zapp, N. E.**  
Operational Aspects of Space Radiation Analysis – 676
- Zaret, David R**  
Wireless Intrusion Detection – 483
- Zawada, Larry P**  
Off-Axis Creep Behavior of Oxide/Oxide Nextel(Trademark)720/AS-0 (Preprint) – 122
- Zawilski, Kevin T**  
Increasing the Laser Induced Damage Threshold of Single Crystal ZnGeP2 – 233
- Zaworski, M. J.**  
Assessing an Automated, Information Sharing Technology in the Post '9-11' Era: Do Local Law Enforcement Officers Think It Meets Their Needs – 658
- Zeman, Laurinda L**  
Hurricane Katrina: Lessons for Army Planning and Operations – 163
- Zeng, Zhiwei**  
Reduced Magnetic Vector Potential and Electric Scalar Potential Formulation for Eddy Current Modeling (Postprint) – 534
- Zhang, Mengping**  
A High Order WENO Scheme for a Hierarchical Size-Structured Model – 549  
A Weighted Essentially Non-Oscillatory Numerical Scheme for a Multi-Class LWR Model – 508  
L2 Stability Analysis of the Central Discontinuous Galerkin Method and a Comparison between the Central and Regular Discontinuous Galerkin Methods – 523  
The Entropy Solutions for the Lighthill-Whitham-Richards Traffic Flow Model with a Discontinuous Flow-Density Relationship – 515
- Zhang, Michael**  
Victim Migration: Dynamically Adapting Between Private and Shared CMP Caches – 442
- Zhang, N**  
GaN Wide Band Power Integrated Circuits (Preprint) – 95
- Zhang, T**  
Proteomic Analysis of Rickettsia prowazekii – 395
- Zhang, Xiefei**  
Synthesis, Structure, and Properties of PBO/SWNT Composites – 104
- Zhang, Yimin**  
Classification and Discrimination of Sources with Time-Varying Frequency and Spatial Spectra – 224
- Zhang, Z**  
Production of Recombinant Protein Pap31 and Its Application for the Diagnosis of Bartonella bacilliformis Infection – 398
- Zhao, Jean J**  
Targeting Breast Cancers Featuring Activating Mutations in PIK3CA by Generating a Lethal Dose of PIP3 – 358
- Zheltovodov, Alexander**  
Fundamental Physics and Practical Applications of Electromagnetic Local Flow Control in High Speed Flows – 216
- Zheng, Hong**  
Identification, Cloning, Expression, and Characterization of the Gene for Plasmodium knowlesi Surface Protein Containing an Altered Thrombospondin Repeat Domain – 389
- Zheng, Jie**  
Cell Multipole Method for Molecular Simulations in Bulk and Confined Systems – 454
- Zhong, Xiaolin**  
Direct Numerical Simulation and Experimental Validation of Hypersonic Boundary-Layer Receptivity and Instability – 512
- Zhou, C**  
Microfabrication of a Mechanically Controllable Break Junction in Silicon – 186
- Zhou, Eric**  
Image Reconstruction Based Modeling of 3D Textile Composite (Postprint) – 127
- Zhou, J.**  
Sinodal Decomposition and Order Disorder Transformation in a Water Quenched U-6wtNb Alloy – 70
- Zhou, Junlan**  
Optimizing Parallel Execution of Detailed Wireless Network Simulation – 624
- Zhou, Yingyao**  
The Plasmodium falciparum Sexual Development Transcriptome: A Microarray Analysis using Ontology-Based Pattern Identification – 401
- Zhou, Yuanxin**  
Influence of Multi-Walled Carbon Nanotubes on the Thermal and Mechanical Behavior of Carbon/Epoxy Composites (Preprint) – 113
- Zhu, Qiuming**  
Intelligent Agent-Based Software Architecture for Tactical Decision Aid under Overwhelming Information Inflow and Uncertainty – 502
- Zhu, Quiming**  
Consolidated Situational Awareness for Aircraft Carrier Decision Centers – 627
- Zhu, Richard**  
Atomistic Calculation of Elastic Moduli in Strained Silicon – 187

On the Correlation Between the Self-Organized Island Pattern and Substrate Elastic Anisotropy – [552](#)

**Zhu, Yuan**

Characterization of Neurofibromas of the Skin and Spinal Roots in a Mouse Model – [407](#)

**Zhu, Yu**

PARK2, a Large Common Fragile Site Gene, is Part of a Stress Response Network in Normal Cells That is Disrupted During the Development of Ovarian Cancer – [359](#)

**Ziegenfuss, P S**

Biodegradation of DIMP, Dieldrin, Iso-drin, DBCP, and PCPMSO in Rocky Mountain Arsenal Soils. Installation Restoration Program, Environmental Technology Development – [305](#)

**Zielinski, Alex**

Incident, Action, Recovery, and Recommissioning for the 4.5-MJ Pulsed Power Supply Located at the Electromagnetic Gun Facility, Barricade C, Aberdeen Proving Ground, MD – [202](#)

**Zimmer, Jeannot**

Human Exposure Biomarkers - Permethrin as a Militarily-Relevant Model – [375](#)

**Zirkelbach, Thomas**

Pictorial Display Design to Enhance Spatial Awareness of Operators in Unmanned Aviation – [28](#)

**Zmuda, Henry**

Contrast Enhancement for Thermal Acoustic Breast Cancer Imaging via Resonant Stimulation – [314](#)

**Zou, H.**

Atomic-Scale Design of Iron Fischer-Tropsch Catalysts: A Combined Computational Chemistry, Experimental, and Microkinetic Modeling Approach. (3rd Annual Report) – [105](#)

**zuBentrup, K. Honer**

Spaceflight Alters Bacterial Gene Expression and Virulence and Reveals Role for Global Regulator Hfq – [420](#)

**Zundel, Alan K**

Infra-Gravity Wave Input Toolbox (IGWT): User's Guide – [470](#)

**Zundel, Alan**

WABED Model in the SMS: Part 2. Graphical Interface – [470](#)

**Zupanc, Frank J.**

Reduced Exhaust Emissions Gas Turbine Engine Combustor – [39](#)

**Zweber, Jeffrey**

Fully Reusable Access to Space Technology (FAST) Methane Rocket – [46](#)

**Zwick, Michael E**

Microarray-based Resequencing of Multiple Bacillus anthracis Isolates – [386](#)

**Zwicker, Theodore**

Flight Test Results From the Ultra High Resolution, Electro-Optical Framing Camera Containing a 9216 by 9216 Pixel, Wafer Scale, Focal Plane Array – [222](#)

**Zybala, Michel**

HUMINT Communication Information Systems for Complex Warfare – [642](#)