National Aeronautics and Space Administration
Langley Research Center
Scientific and Technical Information Program Office

# Scientific and Technical Aerospace Reports

# STAR

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## WHAT'S INSIDE

# NASA STI Program ... in Profile

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- 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.

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- Phone the NASA STI Help Desk at (301) 621-0390

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  NASA Center for AeroSpace Information
  7115 Standard Drive
  Hanover, MD 21076-1320

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*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.

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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, 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.

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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



### Astronautics



### Chemistry and Materials



### Engineering



### Geosciences

### Life Sciences



### Mathematical and Computer Sciences



### Physics



### Social and Information Sciences



### Space Sciences



## 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.

# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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

VOLUME 46, NUMBER 11 JUNE 9, 2008

## 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.

**20080018481** Armstrong Teasdale, LLP, Saint Louis, MO, USA
**Methods and Apparatus for Reducing Peak Wind Turbine Loads**
Moroz, E. M., Inventor; Jun. 30, 2004; 8 pp.; In English
Contract(s)/Grant(s): DE-AC36-83CH10093
Patent Info.: Filed Filed 30 Jun 04; US-Patent-Appl-SN-10-880-731
Report No.(s): PB2007-109441; No Copyright; Avail.: CASI: A02, Hardcopy

A method for reducing peak loads of wind turbines in a changing wind environment includes measuring or estimating an instantaneous wind speed and direction at the wind turbine and determining a yaw error of the wind turbine relative to the measured instantaneous wind direction. The method further includes comparing the yaw error to a yaw error trigger that has different values at different wind speeds and shutting down the wind turbine when the yaw error exceeds the yaw error trigger corresponding to the measured or estimated instantaneous wind speed.
NTIS
*Loads (Forces); Patent Applications; Wind Turbines*

**20080018638** Government Accountability Office, Washington, DC, USA
**Unmanned Aircraft Systems: Federal Actions Needed to Ensure Safety and Expand Their Potential Uses within the National Airspace System**
May 2008; 73 pp.; In English; Original contains black and white illustrations
Report No.(s): GAO-08-511; No Copyright; Avail.: CASI: A04, Hardcopy

Government and private-sector interest is growing in unmanned aircraft systems (UAS) for use in a variety of missions such as U.S. border protection, hurricane research, law enforcement, and real estate photography. However, UASs can fly only after the Federal Aviation Administration (FAA) conducts a case-by-case safety analysis. GAO#s research questions included (1) What are the current and potential uses and benefits of UASs? (2) What challenges exist in operating UASs safely and routinely in the national airspace system? and (3) What is the federal government#s response to these challenges? To address these questions, GAO reviewed the literature, interviewed agency officials and aviation stakeholders, and surveyed 23 UAS experts. GAO suggests that Congress create an overarching body within FAA to coordinate UAS development and integration efforts. To realize public benefits from UASs as soon as possible, GAO recommends that FAA issue its program plan and analyze the data it has collected, and that the Department of Homeland Security (DHS) assess the security implications of routine UAS access to the airspace. Relevant agencies reviewed a draft of this report. The Department of Transportation agreed to consider its relevant recommendations. DHS agreed with its relevant recommendation.
Author
*National Airspace System; Pilotless Aircraft; Unmanned Aircraft Systems; Aerospace Safety; Remotely Piloted Vehicles*

**20080018645** NASA Langley Research Center, Hampton, VA, USA
**Impact of Azimuthally Controlled Fluidic Chevrons on Jet Noise**
Henderson, Brenda S.; Norum, Thomas D.; May 05, 2008; 13 pp.; In English; 14th AIAA CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color illustrations
Contract(s)/Grant(s): WBS 984754.02.07.07.17.03; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018645

The impact of azimuthally controlled air injection on broadband shock noise and mixing noise for single and dual stream

jets was investigated. The single stream experiments focused on noise reduction for low supersonic jet exhausts. Dual stream experiments included high subsonic core and fan conditions and supersonic fan conditions with transonic core conditions. For the dual stream experiments, air was injected into the core stream. Significant reductions in broadband shock noise were achieved in a single jet with an injection mass flow equal to 1.2% of the core mass flow. Injection near the pylon produced greater broadband shock noise reductions than injection at other locations around the nozzle periphery. Air injection into the core stream did not result in broadband shock noise reduction in dual stream jets. Fluidic injection resulted in some mixing noise reductions for both the single and dual stream jets. For subsonic fan and core conditions, the lowest noise levels were obtained when injecting on the side of the nozzle closest to the microphone axis.
Author
*Jet Aircraft Noise; Aerodynamic Noise; Supersonic Jet Flow; Noise Intensity; Jet Exhaust; Gas Injection; Core Flow; Fluidics*

## 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.

**20080018137** European Space Agency. Ulysses Office, Pasadena, CA USA
**Aerothermodynamic Reentry Flight Experiments - EXPERT**
Muylaert, J; Walpot, L; Ottens, H; Cipollini, F; Oct 2005; 130 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476526; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476526
No abstract available
*Aerospace Vehicles; Aerothermodynamics; Flight Tests; Instruments*

**20080018161** Calspan-Buffalo Univ. Research Center, NY USA
**Aerothermal and Propulsion Ground Testing That Can Be Conducted to Increase Chances for Successful Hypervelocity Flight Experiments**
Holden, Michael S; Oct 2005; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476574; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476574
No abstract available
*Aerothermodynamics; Flight Tests; Ground Tests; Hypersonic Flight; Hypersonic Flow; Propulsion; Research Management*

**20080018166** Centre National d'Etudes Spatiales, Toulouse, France
**Pre-X Experimental Re-Entry Lifting Body: Design of Flight Test Experiments for Critical Aerothermal Phenomena**
Baiocco, Paolo; Jun 1, 2007; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476581; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476581
No abstract available
*Aerothermodynamics; Experiment Design; Flight Tests; Lifting Reentry Vehicles; Reentry; Thermal Protection*

**20080018347** Princeton Univ., NJ USA
**Unsteady Aerodynamic Models for Flight Control of Agile Micro Air Vehicles**
Rowley, Clancy; Jan 2008; 5 pp.; In English
Contract(s)/Grant(s): FA9550-06-1-0371
Report No.(s): AD-A476955; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476955
Objective: Obtain models for unsteady aerodynamics of fixed-wing MAVs (e.g. incorporating dynamic stall, vortex

shedding). Technical approach: Systematic models using approximate balanced truncation (balanced POD); empirical, phenomenological models that capture correct bifurcation behavior.
DTIC
*Aerodynamic Characteristics; Flight Control; Lagrangian Function; Models; Pods (External Stores); Remotely Piloted Vehicles; Unsteady Aerodynamics*

**20080018502** Hyperschall Technologie Goettingen (HTG), Goettingen, Germany
**Controlled Hypersonic Flight Air Data System and Flight Instrumentation**
Koppenwallner, Georg; Jun 1, 2007; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476630; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476630
No abstract available
*Aerodynamics; Air Data Systems; Flight Control; Flight Instruments; Hypersonic Flight*

**20080018591** NASA Langley Research Center, Hampton, VA, USA
**Assessment of 3D Codes for Predicting Liner Attenuation in Flow Ducts**
Watson, W. R.; Nark, D. M.; Jones, M. G.; May 05, 2008; 20 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-8 May 2008, Vancouver, BC, Canada; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018591
This paper presents comparisons of seven propagation codes for predicting liner attenuation in ducts with flow. The selected codes span the spectrum of methods available (finite element, parabolic approximation, and pseudo-time domain) and are collectively representative of the state-of-art in the liner industry. These codes are included because they have two-dimensional and three-dimensional versions and can be exported to NASA's Columbia Supercomputer. The basic assumptions, governing differential equations, boundary conditions, and numerical methods underlying each code are briefly reviewed and an assessment is performed based on two predefined metrics. The two metrics used in the assessment are the accuracy of the predicted attenuation and the amount of wall clock time to predict the attenuation. The assessment is performed over a range of frequencies, mean flow rates, and grazing flow liner impedances commonly used in the liner industry. The primary conclusions of the study are (1) predicted attenuations are in good agreement for rigid wall ducts, (2) the majority of codes compare well to each other and to approximate results from mode theory for soft wall ducts, (3) most codes compare well to measured data on a statistical basis, (4) only the finite element codes with cubic Hermite polynomials capture extremely large attenuations, and (5) wall clock time increases by an order of magnitude or more are observed for a three-dimensional code relative to the corresponding two-dimensional version of the same code.
Author
*Flow Velocity; Ducts; Linings; Time Measurement; Finite Element Method; Numerical Analysis; Predictions; Differential Equations*

**20080018593** NASA Langley Research Center, Hampton, VA, USA
**Aeroacoustic Simulations of Tandem Cylinders with Subcritical Spacing**
Lockard, David P.; Choudhari, Meelan M.; Khorrami, Mehdi R.; Neuhart, Dan H.; Hutcheson, Florence V.; Brooks, Thomas F.; Stead, Daniel J.; May 05, 2008; 16 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08
Report No.(s): AIAA Paper 2008-2862; Copyright; Avail.: CASI: A03, Hardcopy
Tandem cylinders are being studied because they model a variety of component level interactions of landing gear. The present effort is directed at the case of two identical cylinders with their centroids separated in the streamwise direction by 1.435 diameters. Experiments in the Basic Aerodynamic Research Tunnel and Quiet Flow Facility at NASA Langley Research Center have provided an extensive experimental database of the nearfield flow and radiated noise. The measurements were conducted at a Mach number of 0.1285 and Reynolds number of 1.66x10(exp 5) based on the cylinder diameter. A trip was used on the upstream cylinder to insure a fully turbulent flow separation and, hence, to simulate a major aspect of high Reynolds number flow. The parallel computational effort uses the three-dimensional Navier-Stokes solver CFL3D with a hybrid, zonal turbulence model that turns off the turbulence production term everywhere except in a narrow ring surrounding solid surfaces. The experiments exhibited an asymmetry in the surface pressure that was persistent despite attempts to

eliminate it through small changes in the configuration. To model the asymmetry, the simulations were run with the cylinder configuration at a nonzero but small angle of attack. The computed results and experiments are in general agreement that vortex shedding for the spacing studied herein is weak relative to that observed at supercritical spacings. Although the shedding was subdued in the simulations, it was still more prominent than in the experiments. Overall, the simulation comparisons with measured near-field data and the radiated acoustics are reasonable, especially if one is concerned with capturing the trends relative to larger cylinder spacings. However, the flow details of the 1.435 diameter spacing have not been captured in full even though very fine grid computations have been performed. Some of the discrepancy may be associated with the simulation s inexact representation of the experimental configuration, but numerical and flow modeling errors are also likely contributors to the observed differences.
Author
*Aeroacoustics; Centroids; Aerodynamic Configurations; Navier-Stokes Equation; Turbulent Flow; Turbulence Models; Vortex Shedding; Separated Flow; Boundary Layer Separation*

**20080018691** NASA Langley Research Center, Hampton, VA, USA
**Development of Advanced Computational Aeroelasticity Tools at NASA Langley Research Center**
Bartels, R. E.; May 05, 2008; 15 pp.; In English; NATO RTO Specialists' Meeting AVT-154 on Advanced Methods in Aeroelasticity, 5-7 May 2008, Norway, Norway; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 136905.02.04.04.01.05
Report No.(s): AVT-154-003; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018691

NASA Langley Research Center has continued to develop its long standing computational tools to address new challenges in aircraft and launch vehicle design. This paper discusses the application and development of those computational aeroelastic tools. Four topic areas will be discussed: 1) Modeling structural and flow field nonlinearities; 2) Integrated and modular approaches to nonlinear multidisciplinary analysis; 3) Simulating flight dynamics of flexible vehicles; and 4) Applications that support both aeronautics and space exploration.
Author
*Aeroelasticity; Flow Distribution; Dynamic Structural Analysis; Aerodynamics; Nonlinearity; Flexible Bodies*

**20080018694** NASA Langley Research Center, Hampton, VA, USA
**Modeling State-Space Aeroelastic Systems Using a Simple Matrix Polynomial Approach for the Unsteady Aerodynamics**
Pototzky, Anthony S.; May 05, 2008; 21 pp.; In English; NATO RTO Specialists Meeting AVT-154 on Advanced Methods in Aeroelasticity, 5-7 May 2008, Norway, Norway; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.07.20.02
Report No.(s): RTO-AVT-154; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018694

A simple matrix polynomial approach is introduced for approximating unsteady aerodynamics in the s-plane and ultimately, after combining matrix polynomial coefficients with matrices defining the structure, a matrix polynomial of the flutter equations of motion (EOM) is formed. A technique of recasting the matrix-polynomial form of the flutter EOM into a first order form is also presented that can be used to determine the eigenvalues near the origin and everywhere on the complex plane. An aeroservoelastic (ASE) EOM have been generalized to include the gust terms on the right-hand side. The reasons for developing the new matrix polynomial approach are also presented, which are the following: first, the 'workhorse' methods such as the NASTRAN flutter analysis lack the capability to consistently find roots near the origin, along the real axis or accurately find roots farther away from the imaginary axis of the complex plane; and, second, the existing s-plane methods, such as the Roger s s-plane approximation method as implemented in ISAC, do not always give suitable fits of some tabular data of the unsteady aerodynamics. A method available in MATLAB is introduced that will accurately fit generalized aerodynamic force (GAF) coefficients in a tabular data form into the coefficients of a matrix polynomial form. The root-locus results from the NASTRAN pknl flutter analysis, the ISAC-Roger's s-plane method and the present matrix polynomial method are presented and compared for accuracy and for the number and locations of roots.
Author
*Unsteady Aerodynamics; Matrix Methods; Polynomials; Flutter Analysis; Aeroelasticity; Aerodynamic Forces; Eigenvalues*

## 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.

**20080018085** Army Natick Soldier Center, Natick, MA USA
**NATO Precision Airdrop Initiatives and Modeling and Simulation Needs**
Benney, Richard J; Krainski, Walter J; Onckelinx, Pieter; Delwarde, Cecile; Mueller, Lutz; Vallance, Mick; Oct 1, 2006; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476394; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476394
No abstract available
*Air Drop Operations; Airdrops; North Atlantic Treaty Organization (NATO); Precision; Simulation*

**20080018087** Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russian Federation
**Experimental and Computational Modeling of Parachutes Fluid Dynamics**
Lipatov, I I; Oct 1, 2006; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476399; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476399
No abstract available
*Computational Fluid Dynamics; Fluid Dynamics; Numerical Analysis; Parachutes; Wind Tunnel Tests*

**20080018101** Army Natick Soldier Center, Natick, MA USA
**Technical Evaluation Report**
Benney, Richard J; Krainski, Walter J; Oct 1, 2006; 17 pp.; In English
Report No.(s): AD-A476428; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476428
No abstract available
*Air Drop Operations; Computational Fluid Dynamics*

**20080018102** Deutsche Airbus G.m.b.H., Bremen, Germany
**A400M Wake Flow Studies Based on RANS CFD Methods on Hybrid Meshes**
Doetter, F; Aumann, P; Acisu, I; Brodersen, O; Ronzheimer, A; Oct 1, 2006; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476430; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476430
No abstract available
*Air Cargo; Computational Fluid Dynamics; Delivery; Navier-Stokes Equation; Wakes*

**20080018107** Milan Univ., Italy
**Reacting Flows Simulation with Applications to Ground to Flight Extrapolation**
Barbante, P F; Jul 1, 2007; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476445; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476445
No abstract available
*Extrapolation; Hypersonic Flow; Reacting Flow; Reaction Kinetics; Simulation*

**20080018113** EADS CASA, Madrid, Spain

**Computer Simulation of Paratrooper Deployment by Static Line from A400M**

Mariscal-Sanchez, F -Javier; Cid-Arroyo, Sergio; Priebe, Stephan; Oct 1, 2006; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476456; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476456

No abstract available

*Air Drop Operations; Computerized Simulation; Deployment*

**20080018114** Office of Air Force History, Washington, DC USA

**The USAF in the Persian Gulf War. Airpower Advantage. Planning the Gulf War Air Campaign 1989-1991**

Putney, Diane T; Jan 2004; 498 pp.; In English

Report No.(s): AD-A476457; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476457

American air power is a dominant force in today's world. Its ascendancy, evolving in the half century since the end of World War II, became evident during the first Gulf War. Although a great deal has been written about military operations in Desert Shield and Desert Storm, this deeply researched volume by Dr. Diane Putney probes the little-known story of how the Gulf War air campaign plan came to fruition. Based on archival documentation and interviews with USAF planners, this work takes the reader into the planning cells where the difficult work of building an air campaign plan was accomplished on an around-the-clock basis. The tension among air planners is palpable as Dr. Putney traces the incremental progress and friction along the way. The author places the complexities of the planning process within the context of coalition objectives. All the major players are here: President George H. W. Bush, General H. Norman Schwarzkopf, General Colin Powell, General Chuck Horner, and Secretary of Defense Richard Cheney. The air planning process generated much debate and friction, but resulted in great success a 43-day conflict with minimum casualties. Dr. Putney's rendering- of this behind-the-scenes evolution of the planning process, in its complexity and even suspense, provides a fascinating window into how wars are planned and fought today and what might be the implications for the future.

DTIC

*Gulfs; Persian Gulf; Warfare*

**20080018120** Alenia Aeronautica, Turin, Italy

**Modeling & Simulation for Experimentation, Test & Evaluation and Training: Alenia Aeronautica Experiences and Perspectives**

Guido, Marcella; Montrucchio, Cristiano; Sep 1, 2006; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476492; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476492

No abstract available

*Distributed Interactive Simulation; Flight Simulators; Simulation*

**20080018139** SRI International Corp., Menlo Park, CA USA

**Laboratory Determination of Thermal Protection System Materials Surface Catalytic Properties**

Marschall, Jochen; Jul 1, 2007; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476528

No abstract available

*Catalysis; Efficiency; Measurement; Refractory Materials; Surface Properties; Surface Reactions; Thermal Protection*

**20080018141** Korea Advanced Inst. of Science and Technology, Taejon, Korea, Republic of

**Numerical Implementation of Surface Catalysis, Reaction, and Sublimation**

Park, Chul; Jul 1, 2007; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476530; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476530

No abstract available

*Catalysis; Gas-Solid Interactions; Reaction Kinetics; Sublimation; Surface Reactions*

**20080018191** Army Engineer Research and Development Center, Vicksburg, MS USA
**Full-Scale Instrumented Testing and Analysis of Matting Systems for Airfield Parking Ramps and Taxiways**
Gartrell, Chad A; Dec 2007; 141 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476667; ERDC/GSL-TR-07-33; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476667

The U.S. military requires the ability to rapidly deploy troops, equipment, and materials anywhere in the world. Recent operations have brought attention to the need to utilize austere, unsurfaced, and sometimes sub-standard airfields within a theater of interest. These airfields may require additional taxiways and aprons. One option for the rapid construction of such is airfield matting systems. The focus of the work for this thesis was commercially available airfield matting systems to support large military transport aircraft, such as the C-17. Several test sections with differing strength soils were built with chosen mats tested in an elimination method, using a load cart that simulates contingency loading of one main gear of the C-17. Matting systems were evaluated based on logistical and assembly requirements, and deformation and damage sustained during traffic. A modeling effort was performed to investigate the potential of a simple model to predict the response of these matting systems under full-scale testing.
DTIC
*Airports; Landing Sites; Runways*

**20080018293** Naval War Coll., Newport, RI USA
**Will Precision Airdrop Capability Provide the Joint Force Commander with the Rapid Response Required for Tomorrow's Humanitarian Relief Operations?**
Witham, Randy L; Nov 6, 2007; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476791; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476791

Advances in airdrop accuracy and employment strategy using the new Joint Precision Airdrop System (JPADS) now gives the Joint Force Commander (JFC) new precision engagement options, and will be especially useful during tomorrow's humanitarian relief operations. Internally steered Global Positioning System (GPS) guided parachutes now allow for airdrops with greater accuracy. JPADS has numerous applications across the Range Of Military Operations (ROMO), however this paper will focus on time-critical applications during humanitarian relief operations. Precision direct delivery promises to slash in-transit time, minimize hub and spoke shuttle operations, reduce handling costs and save lives early in a relief operation before larger forces can arrive on scene. This paper will describe JPADS and look at key attributes of its speed, precision and economy of force. Next, it will review the 2004 Pacific Tsunami as a limited case study, focusing on the DOD's response and if JPADS was available then, how it could have helped the JFC respond more rapidly and conclude the operation sooner. Additionally, it will draw conclusions from the author's research and finally make recommendations for the JFC.
DTIC
*Air Drop Operations; Airdrops; Precision*

**20080018308** Boeing Co., Seattle, WA USA
**Robust Airborne Networking Extensions (RANGE)**
Henderson, Thomas R; Feb 2008; 69 pp.; In English
Contract(s)/Grant(s): N00014-06-C-0023
Report No.(s): AD-A476827; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476827

The Boeing Robust Airborne Networking Extension (RANGE) research project, sponsored by ONR Code 31, is concerned with developing, evaluating, testing and demonstrating protocols and techniques for resilient mobile internetworking of UAVs to extend surveillance range and battlespace connectivity. The stated technical objectives of this contract are as follows: The primary objective is to provide Robust Airborne Networking Extensions (RANGE) by extending IP-based, QoS-capable protocols. The secondary objective is to investigate the application of these protocols to hybrid Navy/USMC/Joint/Coalition networks, including the integration of shore and ground-based (littoral) components. Finally, the Contractor shall demonstrate the developed protocol for proof-of-concept with UAVs to show enhanced battlespace connectivity and surveillance range extension. This Base Period Report summarizes the major accomplishments of the base program phase which ran from February 2006 through February 2008, and introduces the planned work for the Option period which is to run from February 2008 through February 2009. The technical work is coordinated with the Naval Research Laboratory (NRL), which also has an award under this program. Our program focuses on the following new applied research topics: ' Investigation of MANET unicast and multicast routing protocols in airborne-enabled tactical edge networks to support

streaming data (e.g., video) as well as other applications ' Dynamic configuration and robust adaptation of the network in potentially fragmented and disrupted environments. ' Investigation, development, and demonstration of heterogeneous IP-based airborne networks, first in laboratory and then in small-scale field demonstration using small UAVs.
DTIC
*Communication Networks; Drone Vehicles*

**20080018340** Air War Coll., Maxwell AFB, AL USA
**An Iraq C-130 Aviation Advisor Mission and Lessons for the Future**
Bauer, Michael J; Apr 2007; 94 pp.; In English
Report No.(s): AD-A476930; AU/AFF/NNN/2007-XX; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476930

A Headquarters Air Force integrated product team recently reviewed a Coalition Air Force Transition Team proposal to build Iraqi airpower over the next two years. While the team looked at all aspects of the plan, this paper focused on the establishment of a dedicated predeployment training center for aviation advisors, development of a flying training capability inside Iraq, and implementation of training pipelines for Iraqi pilot candidates and maintenance supervisors. A review of lessons learned from the initial Iraq C-130 advisor mission provided insights into challenges stemming from differences in USA advisors and Iraqi airmen in language, culture, and living environment. It applied these lessons in recommending initial steps the Coalition Air Force Transition Team should take in establishing flying training and technical training pipelines to avoid similar problems. It also reviewed pre-deployment training of general purpose forces and the integrated product team's plan to co-locate a permanent training center with the Air Force's Common Battlefield Airmen Training Center. In the end, the paper recommended the Air Force reconsider the alternative of locating the permanent center at Hurlburt Field, Florida to take advantage of the co-located advisor and cultural training centers of knowledge and greater potential for long-term success.
DTIC
*Armed Forces (United States); Flight Training; Iraq; Military Personnel*

**20080018494** Massachusetts Inst. of Tech., Lexington, MA, USA
**Technical Assessment of the Impact of Decommissioning the TDWR on Terminal Weather Services**
Cho, J. Y. N.; Martin, B. D.; May 23, 2007; 70 pp.; In English
Contract(s)/Grant(s): FA-8721-05-C-0002
Report No.(s): PB2007-109551; ATC-331; No Copyright; Avail.: National Technical Information Service (NTIS)

Details of a technical study that was part of a larger investigation assessing terminal weather services impacts of decommissioning the Terminal Doppler Weather Radar (TDWR) are presented. Effects on two key areas for safety and delay-reduction benefits are examined: Low-altitude wind shear visibility and the Integrated Terminal Weather System (ITWS) Terminals Winds (TWINS) product. It is concluded that the information content provided by the TDWR cannot, in general, be effectively replaced by other candidate radar systems such as the Airport Surveillance Radar (ASR-9) equipped with a Weather Systems Processor (WSP) or the Next Generation Weather Radar (NEXRAD).
NTIS
*Decommissioning; Doppler Effect; Doppler Radar; Air Transportation; Aircraft Safety; Flight Safety; Airports*

**20080018605** Genex Systems, LLC, Hampton, VA, USA
**Aspects of Synthetic Vision Display Systems and the Best Practices of the NASA's SVS Project**
Bailey, Randall E.; Kramer, Lynda J.; Jones, Denise R.; Young, Steven D.; Arthur, Jarvis J.; Prinzel, Lawrence J.; Glaab, Louis J.; Harrah, Steven D.; Parrish, Russell V.; May 2008; 162 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 609866.02.07.07.02
Report No.(s): NASA/TP-2008-215130; L-19422; Copyright; Avail.: CASI: A08, Hardcopy

NASA s Synthetic Vision Systems (SVS) Project conducted research aimed at eliminating visibility-induced errors and low visibility conditions as causal factors in civil aircraft accidents while enabling the operational benefits of clear day flight operations regardless of actual outside visibility. SVS takes advantage of many enabling technologies to achieve this capability including, for example, the Global Positioning System (GPS), data links, radar, imaging sensors, geospatial databases, advanced display media and three dimensional video graphics processors. Integration of these technologies to achieve the SVS

concept provides pilots with high-integrity information that improves situational awareness with respect to terrain, obstacles, traffic, and flight path. This paper attempts to emphasize the system aspects of SVS - true systems, rather than just terrain on a flight display - and to document from an historical viewpoint many of the best practices that evolved during the SVS Project from the perspective of some of the NASA researchers most heavily involved in its execution. The Integrated SVS Concepts are envisagements of what production-grade Synthetic Vision systems might, or perhaps should, be in order to provide the desired functional capabilities that eliminate low visibility as a causal factor to accidents and enable clear-day operational benefits regardless of visibility conditions.

Author

*Display Devices; Situational Awareness; Visibility; Enhanced Vision; Terrain; Imaging Techniques; Flight Paths; Low Visibility; Flight Safety*

**20080018706** Air Univ., Maxwell AFB, AL USA; Air Univ., Maxwell AFB, AL, USA

**The Malacca Dilemma - Countering China's 'String of Pearls' with Land-Based Airpower**

Spinetta, Lawrence; Jun 2006; 121 pp.; In English

Report No.(s): AD-A476931; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476931

China is strengthening diplomatic ties and building naval bases along the sea lanes from the Middle East. This 'String of Pearls' strategy is designed to protect its energy security, negate US influence in the region, and project power overseas. China is rapidly building a blue-water navy, developing advanced missile technology, and stockpiling undersea mines to counter US Navy capabilities, especially in the event of a conflict over Taiwan. To counter China's growing naval power, the USA can exploit a critical vulnerability China's dependence on sea lines of communication. Eighty percent of China's oil imports pass through the Strait of Malacca; the Chinese leadership calls this strategic weakness the 'Malacca Dilemma.' In conjunction with naval forces, land-based airpower offers a promising way to control key maritime checkpoints and trade routes. Land-based airpower proved a decisive maritime force in the war against Japanese shipping during World War II. China, like Japan at the start of WWII, is a rising Asiatic power with similar resource aspirations. Historical evidence suggests land-based airpower can control the littorals and cut China's 'String of Pearls.' Unfortunately, Air Force maritime capabilities have atrophied. Countersea will remain an underdeveloped Air Force mission until it is elevated from a collateral mission. In order for the US armed forces to develop a joint maritime force, the Air Force needs to embrace, fund, and train for maritime operations. Additionally, the USA should strengthen strategic partnerships within the region and create a web of austere, forward-operating bases.

DTIC

*China; Military Operations; Strategy*

**20080018872** Civil Aerospace Medical Inst., Oklahoma City, OK, USA

**Drug Usage in Pilots Involved in Aviation Accidents Compared with Drug Usage in the General Population: From 1990 to 2005**

Botch, Sabra R.; Johnson, Robert D.; April 2008; 11 pp.; In English

Contract(s)/Grant(s): AM-B-05-TOX-204

Report No.(s): DOT/FAA/AM-08/10; No Copyright; Avail.: CASI: A03, Hardcopy

Civil aviation pilots represent a small subsection of the general population. Therefore, one might expect to see the same types of drugs used by pilots that are found in the general population. The purpose of this study was to compare usage of both illegal drugs and abused prescription medications in pilots involved in civil aviation accidents from 1990 to 2005 with that of the general population in the USA. Comparisons included abused drugs routinely screened for by the Federal Aviation Administration (FAA) such as marijuana, cocaine, methamphetamine, and ecstasy, as well as prescription medications-barbiturates, benzodiazepines, opiates, and ketamine. The Civil Aerospace Medical Institute's (CAMI's) Forensic Toxicology Research Laboratory analyzes postmortem specimens collected from pilots involved in civil aviation accidents. Toxicological information for cases in which pilots were found positive for prescription or illicit compounds was obtained from CAMI's ToxFlo (TM) (DiscoverSoft Development, LLC) toxicology database. Statistics on drug usage, trends, and demographics of users in the USA were obtained from National Institute on Drug Abuse, Substance Abuse and Mental Health Services Administration, Office of National Drug Control Policy, Drug Enforcement Administration, and the Drug Abuse Warning Network (DAWN). Trends in illicit and prescription drug use in pilots of civil aviation accidents are comparable to those seen in emergency departments (ED) and community data from major metropolitan areas collected by DAWN and Community Epidemiology Work Group (CEWG). Of the 5,321 pilots involved in aviation accidents during the examined time period, there were 467 occurrences of either illicit drugs or commonly abused prescription drugs accounting for 11% of all pilots that were

involved in aviation accidents. The average age of the pilots that were found positive for the compounds discussed in this study was typically older than that seen in emergency departments or in CEWG communities. Marijuana or its metabolite tetrahydrocannabinol carboxylic acid (THCA) were the most commonly seen compounds detected in pilots involved in civil aviation accidents. These compounds were seen approximately twice as often as all other drugs in the study.
Author
*Aerospace Medicine; Drugs; Civil Aviation; Aircraft Pilots; Aircraft Accidents; Biomedical Data*

**20080018873** Air Force Research Lab., Wright-Patterson AFB, OH, USA
**USAF Enlisted Air Traffic Controller Selection: Examination of the Predictive Validity of the FAA Air Traffic Selection and Training Battery Versus Training Performance**
Carretta, Thomas R.; King, Raymond E.; April 2008; 22 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): AM-HRR-523
Report No.(s): DOT/FAA/AM-08/9; No Copyright; Avail.: CASI: A03, Hardcopy

Over the past decade, the U.S. military has conducted several studies to evaluate determinants of enlisted air traffic controller (ATC) performance. Research has focused on validation of the Armed Services Vocational Aptitude Battery (ASVAB) and has shown it to be a good predictor of training performance. Despite these efforts, enlisted ATC training and post-training attrition is higher than desirable, prompting interest in alternate selection methods to augment current procedures. The current study examined the utility of the FAA Air Traffic Selection and Training (AT-SAT) battery for incrementing the predictiveness of the ASVAB versus several enlisted ATC training criteria. Method: Subjects were 448 USAF enlisted ATC students who were administered the ASVAB and FAA AT-SAT subtests and subsequently graduated or were eliminated from apprentice-level training. Training criteria were a dichotomous graduation/elimination training score, average ATC fundamentals course score, and FAA certified tower operator test score. Results: Results confirmed the predictive validity of the ASVAB and showed that one of the AT-SAT subtests resembling a low-fidelity ATC work sample significantly improved prediction of training performance beyond the ASVAB alone. Discussion: Results suggest training attrition could be reduced by raising the current ASVAB minimum qualifying score. However, this approach may make it difficult to identify sufficient numbers of trainees and lead to adverse impact. Although the AT-SAT ATC work sample subtest showed incremental validity to the ASVAB, its length (95 minutes) may be problematic in operational testing. Recommendations are made for additional studies to address issues affecting operational implementation.
Author
*Air Traffic Controllers (Personnel); Education; Performance Prediction; Military Personnel*

**20080018886** Institute of Aviation, Warsaw, Poland
**IoA Experience on Aerial Delivery**
Krawczyk, Mariusz; Graffstein, Jerzy; Maslowski, Piotr; Oct 1, 2006; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476429; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476429

No abstract available
*Air Cargo; Delivery; Parafoils*

**20080018889** Fokker Space B.V., Leiden, Netherlands
**Precision Airdrop System SPADES**
Wegereef, J W; Jentink, Henk W; Oct 1, 2006; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476458; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476458

No abstract available
*Airdrops; Cargo; Global Positioning System; Parachutes*

## 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.

**20080018578** NASA Glenn Research Center, Cleveland, OH, USA
**Problems With Deployment of Multi-Domained, Multi-Homed Mobile Networks**
Ivancic, William D.; April 2008; 14 pp.; In English; IEEE Aerospace Conference, 1-3 Mar. 2008, Big Sky, MT, USA; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2008-215065; IEEEAC Paper no. 1071, Version 1; E-16286; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018578

This document describes numerous problems associated with deployment of multi-homed mobile platforms consisting of multiple networks and traversing large geographical areas. The purpose of this document is to provide insight to real-world deployment issues and provide information to groups that are addressing many issues related to multi-homing, policy-base routing, route optimization and mobile security - particularly those groups within the Internet Engineering Task Force. Author

*Security; Computer Networks; Internets; Computer Security; Homing; Deployment*

## 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.

**20080018089** Alenia Aeronautica, Turin, Italy
**C-27J Spartan: Paratroops and Loads Airdrop Qualification**
Girolami, Claudio; Quadro, Mauro; Oct 1, 2006; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476403; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476403

No abstract available

*Air Drop Operations; Airdrops; Evaluation; Loads (Forces); Payloads; Qualifications; System Effectiveness; Transport Aircraft*

**20080018109** Office of Air Force History, Washington, DC USA
**USA Air Force in Southeast Asia 1965-1973. Aces and Aerial Victories**
Futrell, R F; Hasselwander, Gerald E; Greenhalgh, William H; Jakob, Robert F; Grubb, Carl; Ravenstein, Charles A; Hanak, Walter; Paszek, Lawrence J; Jan 1976; 203 pp.; In English
Report No.(s): AD-A476450; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476450

During the war in Southeast Asia, U.S. Air Force fighter pilots and crewmen were repeatedly challenged by enemy MIG's in the skies over North Vietnam. The air battles which ensued were unique in American history because U.S. fighter and strike forces operated under stringent rules of engagement. With periodic exceptions, for example, MIG bases could not be struck. The rules generally forbade bombing or strafing of military and industrial targets in and around the enemy's heartland, encompassing the capital of Hanoi and the port city of Haiphong. These restrictions gave the North Vietnamese substantial military advantage. Free from American attack and helped by its Soviet and Chinese allies, the enemy was able to construct one of the most formidable antiaircraft defenses the world has even seen. It included MIG forces, surface-to-air missile (SAM) batteries, heavy concentrations of antiaircraft artillery (AAA) units, and an array of early warning radar systems. These elements sought to interdict and defeat the U.S. bombing campaign against North Vietnam's lines of communication and its military and industrial base. The primary mission of U.S. fighter pilots was to prevent the North Vietnamese MIG's from interfering with U.S. strike operations. This book tells how American airmen-assisted by an armada of other USAF aircraft

whose crews refueled their planes, warned of approaching enemy MIG's and SAM's, and flew rescue missions when they were shot downmanaged to emerge from their aerial battles with both victories and honor.
DTIC
*Armed Forces (United States); Flight Crews; Military Personnel; Pilots; Southeast Asia; United States; Vietnam; Warfare*

**20080018174** Florida Univ., Gainesville, FL USA
**Vision-Based Control of Agile, Autonomous Micro Air Vehicles and Small UAVs in Urban Environments**
Lind, Rick; Ifju, Peter; Dixon, Warren; Kurdila, Andrew; Sharpley, Robert; Kanade, Takeo; Dec 2007; 5 pp.; In English
Report No.(s): AD-A476597; F49620-03-1-0381; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476597

This project investigated technologies to enable autonomous flight of agile vehicles in urban environments. Specifically, technologies were developed that related to vision-based feedback for control. The mission profile under consideration was a single vehicle carrying a video camera while flying below the rooftops of a city with no additional sensors or pre-existing map information. As such, substantial progress was made in the areas of feature-point tracking, state estimation, scene reconstruction, robustness to camera calibration, daisy-chaining navigation, mapping, path planning, and feedback characterization. An integrated approach was used that (be used on multi-disciplinary analysis for decision making and control commands. The project spiraled the maturation of technologies from theory to simulation to flight testing. The simulation relied upon a hardware-in-the-loop simulation facility that allowed the physical camera to record measurements from high-fidelity graphics and thus consider the effects of distortion and nonlinearities.
DTIC
*Autonomous Navigation; Autonomy; Cities; Drone Vehicles; Field of View*

**20080018176** Cambridge Univ., Cambridge, UK
**Understanding Micro-Ramp Control of Supersonic Shock Wave Boundary Layer Interactions**
Babinsky, Holger; May 2007; 17 pp.; In English
Contract(s)/Grant(s): FA9550-06-1-0387
Report No.(s): AD-A476603; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476603

This research investigated the potential of micro-ramp sub-boundary layer vortex generators for flow control of oblique shock boundary layer interactions (SBLIs) which is relevant to supersonic engine inlets. These novel devices can delay shock-induced separation and improve boundary layer health, thus offering the potential to reduce the bleed requirement in intakes. Micro-ramp Experiments have been conducted at Mach 2.5, to determine the nature of flow controlled by micro-ramps and investigate their ability to delay separation in a reflected shock interaction. Various ramp sizes between 30% and 90% of boundary layer thickness were investigated. The details of the vortical flow generated by such devices was identified. The general flow features were found to scale with device height and it is suggested that smaller devices need to be placed closer to the expected adverse pressure gradients. When applied to a separated oblique shock SBLI micro-ramps were not observed to eliminate flow separation, although they were shown to break up separated regions. Other performance indicators across the SBLI were also improved through the application of the devices.
DTIC
*Boundary Layer Separation; Boundary Layers; Separated Flow; Shock Layers; Shock Wave Interaction; Supersonic Boundary Layers; Supersonic Inlets; Vortex Generators*

**20080018194** Naval War Coll., Newport, RI USA
**American Joint Helicopter Command: Addressing a Lack of Operational Control of Rotary Assets**
Marsowicz, Brandon; Nov 6, 2007; 22 pp.; In English
Report No.(s): AD-A476679; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476679

In the current USA joint command and control structure, rotary assets from all services are inadequately involved in integrated planning, integrated operations, and collectively unable to achieve unity of effort. Based on the tenets of operational command and control by Milan Vego, across all services, the USA helicopter forces fare lacking operational command and control. In this paper I provide specific examples of three major failures of our current joint command and control structure, integrated operations, integrated planning, and unity of effort indicating a breakdown in operational command and control.

After identifying these failures, I propose that a new joint command similar to the British Joint Helicopter Command (JHC) is a feasible option to resolve these failures.
DTIC
*Helicopters; Military Operations; Planning; Rotary Wing Aircraft*

**20080018329** Army Research Lab., Aberdeen Proving Ground, MD USA
**Human Robotics Interaction Army Technology Objective Raven Small Unmanned Aerial Vehicle Task Analysis and Modeling**
Pomranky, Regina A; Jan 2006; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-62716AH70
Report No.(s): AD-A476885; ARL-TR-3717; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476885

A Family of Systems (FoS) is being developed that will comprise the Army's Future Combat Systems (FCS). In an effort to determine the most effective and efficient way to integrate the diverse but related new systems within the future force, the U.S. Army Research Laboratory is developing an operator workload model of FCS FoS operations. This development is part of the Human Robotics Interaction Army Technology Objective in which Soldier workload models of individual systems are being developed with the intent of integrating them into one all-encompassing model. This Improved Performance Integration Research Tool (IMPRINT) model will enable the investigation of individual to overall workload and will examine how these Soldier-systems can effectively combine their efforts to more efficiently accomplish a mission. FCS FoS will rely heavily on unmanned systems such as unmanned ground vehicles and unmanned aerial vehicles (UAVs) to assume such roles as intelligence gatherer, perimeter security, vehicle reconnaissance, reconnaissance and surveillance for initial entry forces, call for fire, battle damage assessment, etc. In fact, at least 11 types of UAVs were committed to Operation Iraqi Freedom, demonstrating the current need for the capabilities that UAVs can provide. In order to understand the combination of the capabilities of a UAV with other system capabilities within a commander's arsenal, a model of operator workload was developed for the Raven small UAV (SUAV). This project describes the detailed task analysis used to build an IMPRINT model and the initial model runs for determining the workload associated with operating the Raven SUAV with a two-person team.
DTIC
*Drone Vehicles; Models; Pilotless Aircraft; Robotics; Surveillance; Workloads (Psychophysiology)*

**20080018362** Guided Systems Technologies, McDonough, GA USA
**On-Line Trajectory Optimization for Autonomous Air Vehicles**
Corban, J E; Twigg, Shannon; Ries, Tobias; Yang, Bong-Jun; Johnson, Eric; Calise, Anthony; Jul 31, 2007; 91 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-C-0046; F49620-02-C-0085
Report No.(s): AD-A477019; GST-06-1-F; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA477019

Successful operation of next-generation unmanned air vehicles will demand a high level of autonomy. Autonomous low-level operation in a complex environment dictates a need for onboard, robust, reliable and efficient trajectory optimization. In this report, we develop and demonstrate an innovative combination of traditional analytical and numerical solution procedures to produce efficient, robust and reliable means for nonlinear flight path optimization in the presence of time-varying obstacles and threats. The trajectory generation problem is first formulated as an optimization problem using reduced-order dynamics that result from the natural time-scale separation that exists in the aircraft dynamics. Terrain information is incorporated directly into the formulation of the reduced-order dynamics, which significantly reduces the computational load and leads to a path planning solution that can be implemented in real-time. Various cases of terrain, pop-up obstacles/threats, and targets are simulated. A representative optimal trajectory is generated with in a high fidelity full-order nonlinear aircraft dynamics and compared with a solution obtained from a reduced-order optimization. The developed algorithm is flight demonstrated with a fixed-wing unmanned aircraft test-bed in which a neural network-based adaptive autopilot is integrated with the on-line trajectory optimization algorithm.
DTIC
*Autonomous Navigation; Autonomy; Drone Vehicles; Nonlinear Programming; On-Line Systems; Trajectory Optimization*

**20080018435** Reinhart Boerner Van Deuren S.C., Milwaukee, WI, USA
**System and Method for Altitude Control**
Voss, P. B., Inventor; 9 Sep 04; 23 pp.; In English
Contract(s)/Grant(s): NSF-0137589-0022210000
Patent Info.: Filed Filed 9 Sep 04; US-Patent-Appl-SN-10-937-747
Report No.(s): PB2007-109452; No Copyright; Avail.: CASI: A03, Hardcopy

An differential expansion system and method for balloon buoyancy control which includes a zero-pressure envelope and a superpressure envelope. A gas transfer device is positioned between the envelopes to facilitate the transfer of lift gases that are lighter than air between the envelopes. The superpressure envelope and the gas transfer device can be located inside the zero-pressure envelope. Alternatively, the zero-pressure envelope, the superpressure envelope, and the gas transfer device can be located inside a zero-pressure envelope.
NTIS
*Altitude Control; Balloons; High Altitude; Patent Applications*

**20080018511** Air Force Packaging Technology and Engineering Facility, Wright-Patterson AFB, OH USA
**Development of the MQ-9 Reaper Engine Container, CNU-696/E**
Sullivan, Joel A; Evans, Susan J; Feb 12, 2008; 64 pp.; In English
Contract(s)/Grant(s): Proj-AFPTEF-06-P-104
Report No.(s): AD-A476960; AFPTEF-08-R-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476960

The Air Force Packaging Technology Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the MQ-9 Reaper Engine in March of 2006. The new container is designed to replace the fiberboard box currently used. The current container is not reusable and provides minimal shock protection and no environmental protection against corrosion. Additionally, the fiberboard box can not house the engine in the Quick Engine Change (QEC) configuration. AFPTEF used proven design techniques to meet these design requirements. The CNU-696/E, designed to SAE ARP1967A, is an aluminum, long-life, controlled breathing, reusable shipping and storage container. The new container protects the Engine mechanically and environmentally. The container passed all qualification tests per ASTM D4169. The CNU-696/E container not only meets user requirements but also provides an economic saving for the Air Force. The savings will be thousands of dollars per Engine over the twenty-year life span of the container.
DTIC
*Aircraft Engines; Containers; Performance Tests; Packaging*

**20080018512** Air War Coll., Maxwell AFB, AL USA
**A System as the Enemy: A Doctrinal Approach to Defense Force Modernization**
Drew, Jr, Benjamin A; Jan 2006; 52 pp.; In English
Report No.(s): AD-A477016; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA477016

Force modernization is more like a warfighting campaign than an industrial process. Volatility, uncertainty, complexity, and ambiguity inherent in all its key factors and enablers make modernization as much an operational art as a scientific method. Therefore, modernization, like warfare, would operate more effectively and responsively under an authoritative body of doctrine rather than under layers of detailed prescriptive and legally binding regulations. At the core of a body of doctrine is a foundational doctrine document setting forth broad guidance with fundamental principles to guide planning and execution. This study will consider the following principles as candidates for such a document: (1) Objective, (2) Stable Program Inputs, (3) Risk Management, (4) Simplicity of Command, (5) Economy of Effort, (6) Initiative, (7) Credibility, (8) Synergy, (9) Tempo, and (10) Synchronization. Together, these are the fundamental underlying doctrinal principles for an effective and efficient force modernization program. These principles can guide modernization process improvement efforts as well as modernization programs to shorten program timelines and still deliver a quality product. Force modernization includes the Joint Capabilities Integration and Development System (JCIDS), formerly the Requirements Generation System, and the U.S. Department of Defense (DoD) acquisition process. With respect to JCIDS, this paper is concerned only with material solutions feeding into the acquisition system. The analysis does not include doctrine, operations, training, leadership and education, personnel, and facilities solutions to documented needs.
DTIC
*F-22 Aircraft; V-22 Aircraft; Defense Program; Project Management*

**20080018680** Dayton Univ., OH USA
**Estimating Flaw Size Distributions From Service Inspection Results (Preprint)**
Hovey, Peter W; Knopp, Jeremy; Dec 2006; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-4349
Report No.(s): AD-A476910; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476910

A key component of risk analyses of aging aircraft is the distribution of flaw sizes that are present in the aircraft. This distribution can be derived from teardown inspections of retired aircraft; however it is more cost effective to use the results of service inspections. Using the sizes of found cracks can be misleading however because nondestructive inspections are not perfect so some cracks are missed. Furthermore, the likelihood that an individual crack is detected is a function of the size of the crack when inspected and the crack size distribution is related to the number of flight hours the aircraft has experienced. An approach for estimating flaw size distributions from inspection results is derived and illustrated from data and simulation results. Problems with estimating both the POD function and the crack size distribution are discussed and a method for setting the reset crack size after an inspection based on the sizes of detected cracks is suggested.
DTIC
*Aircraft; Cracks; Defects; Estimating; Inspection; Size Distribution*

**20080018831** NASA Dryden Flight Research Center, Edwards, CA, USA
**NASA Global Hawk Project Overview**
Delfrate, John; April 15, 2008; 13 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018831

This joint NASA/NGSC study was conducted with the expectation that the Global Hawk Advanced Concept Technology Demonstration Phase was nearing completion. (final ACTD flight was in Aug 06) This study convinced the 303d that the 2 available ACTD aircraft should be transferred to NASA Dryden. Global Hawk is the only available system capable of simultaneously meeting the requirements for high altitude (65K ft), long endurance (>31 hours), power (10 KVA), and a large payload capacity (2000 lbs). There are important NASA and NOAA science data gathering and satellite validation requirements that can only be met with the combination of capabilities provided by the Global Hawk system. NASA Global Hawk Missions: Unmanned Aerial System AURA Validation Experiment. (UAS AVE) April-May 2009 is the target date. Flights will cover the Pacific Ocean region south of Hawaii. 10-15 NASA and NOAA sponsored instruments. Data will be used for satellite validation. Next planning meeting for UAS AVE is at Dryden in April. Unmanned Aerial System Synthetic Aperture Radar. (UAS SAR) Flights to begin in mid to late 2009. The SAR instrument, developed by JPL, is contained in a pod and is being flown on Dryden s G-III. Northrop Grumman is conducting a feasibility study on adding wing pods to the NASA Global Hawk aircraft. Hurricane and Severe Storm Research. Hurricane missions in 2010 and 2013. Planning workshop at Dryden in June.
Derived from text
*Pilotless Aircraft; Synthetic Aperture Radar; High Altitude; Payloads*

**20080018887** Duits-Nederlandse Windtunnel, Brunswick, Germany
**Capabilities of Deployment Tests at DNW-NWB**
Loeser, Thomas; Bergmann, Andreas; Oct 1, 2006; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476432; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476432

No abstract available
*Deployment; Jettisoning; Transport Aircraft; Wind Tunnel Tests*

**20080018888** Naval Surface Warfare Center, Bethesda, MD USA
**Use of Seaplanes and Integration within a Sea Base**
Odedra, Jessaji; Hope, Geoff; Kennell, Colen; Sep 2004; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N0002401-WX-20594
Report No.(s): AD-A476447; NSWCCD-20-TR-2004/08; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476447

A study to investigate the utility of seaplanes to support an offshore military Sea Base has been undertaken by the Center

For Innovation In Ship Design. The potential use and importance of seaplanes for future sea-based military missions are discussed. The research outlines the history of seaplane development, their different modes of operation and associated enabling technologies. Parametric data collected on seaplanes has been populated into a database, presented and analyzed, leading to defining initial seaplane sizing requirements. Current technology boundaries and technical issues that need further research, including those related to integrating seaplanes within a Sea Base environment have also been identified. Issues such as rough water operations, mooring and beaching have been considered, along with new methods to take advantage of existing technology to operate in high sea states. Potential seaplane design concepts are presented, with recommendations for investment in particular seaplane technologies, such as lightweight materials, spray reduction designs, and novel landing/ beaching gear.
DTIC
*Marine Technology; Mooring; Seaplanes; Seas*

**20080018933** Air Force Research Lab., Wright-Patterson AFB, OH USA
**Ultrasonic Plate Waves for Fatigue Crack Detection in Multi-Layered Metallic Structures (Preprint)**
Lindgren, Eric; Aldrin, John C; Jata, Kumar; Scholes, Brett; Knopp, Jeremy; Dec 2006; 14 pp.; In English
Contract(s)/Grant(s): Proj-4349
Report No.(s): AD-A476881; AFRL-RX-WP-TP-2008-4044; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476881

A representative area of concern for fatigue crack growth in aircraft occurs in multi-layered metallic structures. Ultrasonic plate waves are currently being investigated by multiple initiatives to detect these types of flaws with a minimal number of sensors to enable Structural Health Monitoring (SHM). Previous work has focused on structures with one or two layers, coupled with modeling of the wave propagation within these representative samples. However, it is common for multi-layered structures to have more than two layers in many areas of interest. Therefore, this study investigates ultrasonic wave propagation and flaw detection in a multi-layered samples. The flaws in this study are electric discharge machined (EDM) notches. Preliminary measurements show that EDM notches can be detected by the guided ultrasonic waves, but that the sensitivity to EDM notch location is dependent on the boundary conditions of each layer. The experimental results are supplemented by modeling of the guided wave propagation within the structure using the Finite Element Method. The results of this investigation establish some guidelines for the use of guided waves in multi-layered structures, plus challenges that exist for their use in SHM applications and strategies to address these challenges.
DTIC
*Airframes; Cracks; Detection; Fatigue (Materials); Health; Ultrasonic Radiation; Wave Propagation*

## 06
## AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also 04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics; and 35 Instrumentation and Photography.

**20080018929** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Next Generation Advanced Video Guidance Sensor**
Lee, Jimmy; Spencer, Susan; Bryan, Tom; Johnson, Jimmie; Robertson, Bryan; March 2008; 1 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; No Copyright; Avail.: Other Sources; Abstract Only

The first autonomous rendezvous and docking in the history of the U.S. Space Program was successfully accomplished by Orbital Express, using the Advanced Video Guidance Sensor (AVGS) as the primary docking sensor. The USA now has a mature and flight proven sensor technology for supporting Crew Exploration Vehicles (CEV) and Commercial Orbital Transport. Systems (COTS) Automated Rendezvous and Docking (AR&D). AVGS has a proven pedigree, based on extensive ground testing and flight demonstrations. The AVGS on the Demonstration of Autonomous Rendezvous Technology (DART)mission operated successfully in ‘spot mode’ out to 2 km. The first generation rendezvous and docking sensor, the Video Guidance Sensor (VGS), was developed and successfully flown on Space Shuttle flights in 1997 and 1998. Parts obsolescence issues prevent the construction of more AVGS. units, and the next generation sensor must be updated to support the CEV and COTS programs. The flight proven AR&D sensor is being redesigned to update parts and add additional. capabilities for CEV and COTS with the development of the Next, Generation AVGS (NGAVGS) at the Marshall Space Flight

Center. The obsolete imager and processor are being replaced with new radiation tolerant parts. In addition, new capabilities might include greater sensor range, auto ranging, and real-time video output. This paper presents an approach to sensor hardware trades, use of highly integrated laser components, and addresses the needs of future vehicles that may rendezvous and dock with the International Space Station (ISS) and other Constellation vehicles. It will also discuss approaches for upgrading AVGS to address parts obsolescence, and concepts for minimizing the sensor footprint, weight, and power requirements. In addition, parts selection and test plans for the NGAVGS will be addressed to provide a highly reliable flight qualified sensor. Expanded capabilities through innovative use of existing capabilities will also be discussed.
Author
*Guidance Sensors; Video Communication; Crew Exploration Vehicle; Rendezvous Spacecraft; Autonomous Docking; Avionics*

## 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.

**20080018167** Massachusetts Inst. of Tech., Cambridge, MA USA
**Advanced and Adaptable Military Propulsion**
Epstein, Alan H; Tan, Choon S; Jan 22, 2008; 31 pp.; In English
Contract(s)/Grant(s): FA9550-05-1-0466
Report No.(s): AD-A476584; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476584

Analyses and calculations were carried out to quantify the gain in performance (as measured in terms of thrust specific fuel consumption and range productivity) in aircraft turbine engines incorporating adaptability/variability. A 5-10% variability in (turbine and propelling) nozzle areas would allow the compression system to have an operating point for subsonic loiter identical to that for supersonic flight to destination, resulting in a 20% improvement in thrust specific fuel consumption. Zero spillage engines (engines in which the inlet and the engine capture the full streamtube, at constant area over flight Mach number ranging from 0.8 to 2.5) are shown to be feasible. Progress toward low fuel consumption (i.e. fuel efficient engine technology) can be achieved through engineering very high pressure ratio (-hundreds) compression system with high polytropic efficiency compressor components. Enablers that include the variable area swirling turbine, flow aspiration, compressor rim cooling and intercooling are suggested for realizing the required engine variability, zero spillage engines and fuel-efficient propulsion systems. While these technology enablers are technically challenging in practice, they are sure to pay off handsomely (such as significantly broadening the scope and flexibility of missions presently not accessible with engines of fixed geometry).
DTIC
*Military Operations; Propulsion; Propulsion System Configurations; Propulsion System Performance; Turbines*

**20080018487** Jagtiani and Guttag, Fairfax, VA, USA
**Thermal Barrier Coatings with High Fracture Toughness Underlayer for Improved Impact Resistance**
Spitsberg, I., Inventor; Boutwell, B. A., Inventor; Bruce, R. W., Inventor; Jul. 26, 2004; 10 pp.; In English
Contract(s)/Grant(s): JSF-N00019-96-C-0176
Patent Info.: Filed Filed 26 Jul 04; US-Patent-Appl-SN-10-809 776
Report No.(s): PB2007-111842; No Copyright; Avail.: CASI: A02, Hardcopy

A reduced thermal conductivity thermal barrier coating having improved impact resistance for an underlying substrate of articles that operate at, or are exposed to, high temperatures. This coating comprises an inner high fracture toughness layer nearest to the underlying substrate and having a thickness up to about 5 mils (127 microns) sufficient to impart impact resistance to the thermal barrier coating, and comprises a zirconia-containing ceramic composition having a c/a ratio of the zirconia lattice in the range of from about 1.011 to about 1.016 and stabilized in the tetragonal phase by a stabilizing amount of a stabilizing 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. The thermal barrier coating further includes an outer thermal insulating layer adjacent to and overlaying the inner layer and comprising a ceramic thermal barrier coating material. The thermal barrier can be used to provide a thermally protected article having a substrate (e.g., metal substrate) and optionally a bond coat layer adjacent to and overlaying the substrate. The thermal barrier coating

can be prepared by forming the inner high fracture toughness layer, followed by forming on the inner layer the outer thermal insulating layer.
NTIS
*Fracture Strength; Impact Resistance; Patent Applications; Spallation; Thermal Conductivity; Thermal Control Coatings*

**20080018622** Thorp, Reed and Armstrong, LLP., Pittsburgh, PA, USA
**Determination of Damping in Bladed Disk Systems Using The Fundamental Mistuning Model**
Griffin, J. H., Inventor; Feiner, D. M., Inventor; 24 Feb 05; 54 pp.; In English
Contract(s)/Grant(s): AFRL-F33615-01-C-2186
Patent Info.: Filed Filed 24 Feb 05; US-Patent-Appl-SN-11-064-893
Report No.(s): PB2007-109435; No Copyright; Avail.: CASI: A04, Hardcopy

An extended version of a reduced order model called the Fundamental Mistuning Model (FMM) accurately predicts vibratory response and damping in a bladed disk system. The extended FMM software may describe the normal modes and natural frequencies of a mistuned bladed disk as well as damping in the disk using complex-valued inputs of its tuned system frequencies and the frequency mistuning of each blade/disk sector (i.e., the sector frequencies). The extended FMM system identification methods--basic and advanced extended FMM ID methods--also use complex mistuned modes and complex frequencies of the mistuned bladed disk as inputs. As a result, in extended FMM ID calculations, the tuned system frequencies and the mistuning frequency ratios are complex numbers. The real parts of frequencies relate to sector frequencies as well as tuned system frequencies. However, the imaginary part can be related to system damping. Thus, extended FMM ID methodology may be used to identify not only the frequencies of the individual sectors of the bladed disk, but also to identify damping in the bladed disk system. The extended FMM may predict how much the bladed disk will vibrate under the operating (rotating) conditions. Field calibration and testing of the blades may be performed using traveling wave analysis and extended FMM ID methods. The extended FMM model can be generated completely from experimental data. Because of extended FMM's simplicity, no special interfaces are required for extended FMM to be compatible with a finite element model. Because of the rules governing abstracts, this abstract should not be used to construe the claims.
NTIS
*Damping; Patent Applications; Tuning; Turbine Blades; Vibration Damping*

## 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*.

**20080018188** RAND Corp., Santa Monica, CA USA
**Guidelines and Metrics for Assessing Space System Cost Estimates**
Fox, Bernard; Brancato, Kevin; Alkire, Brien; Jan 2008; 267 pp.; In English
Contract(s)/Grant(s): F49642-01-C-0003
Report No.(s): AD-A476642; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476642

This handbook is designed to help analysts assess cost estimates of space systems. It assumes that the reader understands common cost analysis methodologies but has limited experience with space systems. Its objective is to give the analyst tasked with reviewing an estimate information to help accomplish the following tasks: Plan the review. Identify the key programmatic, technical, and cost data needed, along with suggested sources. Highlight common issues to investigate. Provide typical cost ranges for components of relevant historical space programs. This handbook also supplements the AFCAA s spacecraft training course by focusing on cost analysis implications of the systems and processes covered in the course.
DTIC
*Aerospace Systems; Astronautics; Cost Estimates; Space Missions*

**20080018538** National Defense Univ., Washington, DC USA
**Using Space Forces as Military Flexible Deterrent Options**
Johnson, David C; Jan 2001; 17 pp.; In English
Report No.(s): AD-A476758; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476758

The deployment and employment of space systems has had a profound affect on the current and future conduct of warfare by the armed forces of the USA. Although the origins of U.S. space forces date back to the early 1960s, exploitation of these systems has been limited to force enhancement of terrestrial combat forces. The USA does not possess an ability to apply force from space, however current and future space platforms can support National Military Strategy in ways other than force enhancement. This paper examines the use of space forces as flexible deterrent options (FDO) to coerce the behavior of a potential adversary. Space forces, due to their inherent flexibility and combat enhancing functions, could prove an effective contributing FDO in conjunction with other diplomatic, economic, informational or military options. These space force FDOs should be include in future joint warfighting doctrine and made applicable to current and future joint operations. Military strategy is the art and science of employing the armed forces of a nation to secure the objectives of national policy by application of force or the threat of force. As a nation, we looked to the threat of force as an effective deterrent to potential aggressors;however, we also possess the military might to accomplish the stated objectives should deterrence fail. Deterrence, across all mediums of conflict, is a psychological communication to a potential adversary allowing them to conclude that aggressive action will fail and the consequences outweigh the benefits. Military forces contribute significantly to deterrence by presenting visible evidence of their ability to defeat aggression, including the ability to act globally, rapidly, and decisively in conjunction with indigenous military forces.
DTIC
*Aerospace Systems; Deployment; Space Platforms*

## 13
## ASTRODYNAMICS

Includes powered and free flight trajectories; orbital and launching dynamics.

**20080018136** Italian Aerospace Research Center, Capua, Italy
**Flight Test Experiments Foreseen for USV**
Ruso, G; De Matteis, P P; Pastena, M; Marino, G; Oct 2005; 39 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476525; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476525

No abstract available
*Atmospheric Entry; Flight Tests; Maneuverable Reentry Bodies; Test Stands*

**20080018334** Centre National de la Recherche Scientifique, Paris, France
**Detailed and Simplified Kinetic Schemes for High Enthalpy Air Flows and Their Influence on Catalycity Studies**
Bourdon, Anne; Bultel, Arnaud; Feb 8, 2006; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476906; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476906

No abstract available
*Air Flow; Atmospheric Entry; Boundary Layer Flow; Enthalpy; Oxygen; Reaction Kinetics; Thermochemistry*

## 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*.

**20080018119** CSA Engineering, Inc., Mountain View, CA USA
**Whole-Spacecraft Vibration Isolation on Small Launch Vehicles**
Wilke, Paul S; Johnson, Conor D; Grosserode, Patrick J; Sciulli, Dino; Jan 2000; 13 pp.; In English
Report No.(s): AD-A476485; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476485

Small launch vehicles historically provide a very rough ride to spacecraft during launch, This is particularly true of

solid-fueled launch vehicles, In order for the spacecraft to survive such a trip to orbit, one of two choices must be made: (1) design all structure, payloads, and systems on the spacecraft to be strong enough to survive the high launch loads, or (2) reduce the magnitude of the high launch loads, The former is not a good choice because it typically requires additional cost schedule, and weight. The latter is the preferred choice because it allows the focus of the spacecraft design to be primarily for on-orbit performance rather that for launch survival. Under a number of contracts from the Air Force Research Laboratory, Space Vehicles Directorate, whole spacecraft vibration isolation systems have been in development since 1993, This work has resulted in two whole-spacecraft isolation systems (SoftRide) that have been flown on Taurus launch vehicles, the first in February 1998 with the GFO spacecraft and the second in October 1998 with the STEX spacecraft. Both of these isolation systems were designed primarily to reduce axial dynamic responses on the spacecraft due to resonant burn excitations from the motors of the solid-fueled booster. Full coupled-loads analyses were used to predict the performance of the SoftRide systems. Using the isolation requirements derived from these analyses, hardware having the correct damping and stiffness was designed to implement the isolation system. All isolation system components were extensively tested and characterized. Typical results show 85% attenuation (i.e., only 15% of original) for the worst case resonant burn condition and 59% attenuation for a combination of static plus worst case resonant burn condition in the axial spacecraft c.g. location. No detrimental effects from the SoftRide system were observed. Limited flight data from the two flights agree with the predictions.
DTIC
*Launch Vehicles; Vibration Isolators*

**20080018121** European Aeronautic Defence and Space Co., Les Mureaux, France
**Re-entry Flight Experiments Lessons Learned - The Atmospheric Reentry Demonstrator ARD**
Paulat, J C; Boukhobza, P; Jun 1, 2007; 47 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476493; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476493
No abstract available
*Atmospheric Entry; Lessons Learned; Proving; Reentry; Reentry Vehicles*

**20080018129** Naval Research Lab., Bay Saint Louis, MS USA
**Sensitivity of Satellite Altimetry Data Assimilation on a Weapon Acoustic Preset Using MODAS**
Chu, Peter; Mancini, Steven; Gottshall, Eric; Cwalina, David; Barron, Charlie N; Apr 2007; 17 pp.; In English
Report No.(s): AD-A476510; NRL/JA/7320-04-5012; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476510
The purpose of this research is to assess the benefit of assimilating satellite altimeter data for naval undersea warfare. To accomplish this, sensitivity of the weapon acoustic preset program (WAPP) for the Mk 48 variant torpedo to changes in the sound/speed profile (SSP) is analyzed with SSP derived from the modular ocean data assimilation system (MODAS). The MODAS fields differ in that one uses altimeter data assimilated from three satellites while the other uses no altimeter data: The metric used to compare the two sets of outputs is the relative difference in acoustic coverage area generated by WAPP. Output presets are created for five different scenarios, two anti surface warfare (ASTJW) scenarios, and three antisubmarine warfare (ASW) scenarios, in each of three regions: the East China Sea, Sea of Japan, and an area south of Japan that includes the Kuroshlo currents. Analysis of the output reveals that, in some situations, WAPP output is very sensitive to the inclusion of the altimeter data because of the resulting differences in the subsurface predictions. The change in weapon presets can be so large that the effectiveness of the weapon may be affected.
DTIC
*Altimeters; Antisubmarine Warfare; Artificial Satellites; Assimilation; Satellite Altimetry; Sensitivity; Warfare*

**20080018156** Naval Research Lab., Bay Saint Louis, MS USA
**Water and Bottom Properties of a Coastal Environment Derived from Hyperion Data Measured from the EO-1 Spacecraft Platform**
Lee, ZhongPing; Casey, Brandon; Arnone, Robert A; Weidemann, Alan D; Parsons, Arthur R; Montes, Marcos J; Gao, Bo-Cai; Goode, Wesley A; Davis, Curtiss O; Dye, Julie; Dec 26, 2007; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476565; NRL/JA/7330-07-7071; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476565
Hyperion is a hyperspectral sensor on board NASA's EO-1 satellite with a spatial resolution of approximately 30 m and a swath width of about 7km. It was originally designed for land applications, but its unique spectral configuration and high

spatial resolution make it attractive for studying complex coastal ecosystems, which require such a sensor for accurate retrieval of environmental properties. In this paper, Hyperion data over an area of the Florida Keys is used to develop and test algorithms for atmospheric correction and for retrieval of subsurface properties. Remote-sensing reflectance derived from Hyperion data is compared with those from in situ measurements. Furthermore, water's absorption coefficients and bathymetry derived from Hyperion imagery are compared with sample measurements and LIDAR survey, respectively. For a depth range of approx. 1-25 m, the Hyperion bathymetry match LIDAR data very well; while the absorption coefficients differ by approx. 16.5% on average. More importantly, in this top-to-bottom processing of Hyperion imagery, there is no use of any a priori or ground truth information. The results demonstrate the usefulness of such spaceborne hyperspectral data and the techniques developed for effective and repetitive observation of complex coastal regions.
DTIC
*Coastal Water; Coasts; Hyperion; Measurement; Ocean Bottom; Space Platforms; Water*

**20080018280** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
**Navigation Using Orthogonal Frequency Division Multiplexed Signals of Opportunity**
Velotta, Jamie S; Sep 2007; 87 pp.; In English
Report No.(s): AD-A476762; AFIT/GE/ENG/07-31; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476762

The global positioning system (GPS) provides high-accuracy position measurements anywhere in the world. However, a limitation of this system is that a line of sight to multiple satellites is required; therefore, it is unsuitable to use indoors or in urban canyons. Also, in the presence of radio-frequency interference or jamming, GPS may be unavailable. Alternative methods of navigation and positioning are need to either compliment GPS as a backup or for use in areas unreachable by satellites. This research analyzes a feature-based correlation approach for determining reception differences between two Orthogonal Frequency Division receivers for the purpose of TDOA calculations. Multicarrier signals have a very defined signal structure which allows for non-cooperative symbol detection techniques. Simulations are conducted with different correlation windows sizes, SNR values, and eight different statistical features. Out of the eight features tested the symbol mean and average symbol phase proved to be the most promising because they are able to achieve accurate symbol difference estimations at SNR values below 0 dB.
DTIC
*Code Division Multiple Access; Coding; Frequencies; Frequency Division Multiplexing; Global Positioning System; Inertial Navigation; Jamming; Multiplexing; Navigation; Radio Frequency Interference; Time Response*

**20080018689** NASA Johnson Space Center, Houston, TX, USA
**NASA Experience with Pogo in Human Spaceflight Vehicles**
Larsen, Curtis E.; May 05, 2008; 23 pp.; In English; NATO RTO Symposium ATV-152 on Limit-Cycle Oscillations and Other Amplitude-Limited, Self-Excited Vibrations, 5-8 May 2008, Norway, Norway; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 510505.01.07.01.01
Report No.(s): RTO-MP-AVT-152; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018689

An overview of more than 45 years of NASA human spaceflight experience is presented with respect to the thrust axis vibration response of liquid fueled rockets known as pogo. A coupled structure and propulsion system instability, pogo can result in the impairment of the astronaut crew, an unplanned engine shutdown, loss of mission, or structural failure. The NASA history begins with the Gemini Program and adaptation of the USAF Titan II ballistic missile as a spacecraft launch vehicle. It continues with the pogo experienced on several Apollo-Saturn flights in both the first and second stages of flight. The defining moment for NASA s subsequent treatment of pogo occurred with the near failure of the second stage on the ascent of the Apollo 13 mission. Since that time NASA has had a strict 'no pogo' philosophy that was applied to the development of the Space Shuttle. The 'no pogo' philosophy lead to the first vehicle designed to be pogo-free from the beginning and the first development of an engine with an integral pogo suppression system. Now, more than 30 years later, NASA is developing two new launch vehicles, the Ares I crew launch vehicle propelling the Orion crew excursion vehicle, and the Ares V cargo launch vehicle. A new generation of engineers must again exercise NASA s system engineering method for pogo mitigation during design, development and verification.
Author
*Launch Vehicles; Ares 5 Cargo Launch Vehicle; Ares 1 Launch Vehicle; Crew Exploration Vehicle; Systems Engineering; Spacecraft Launching; Space Shuttles; Thrust; Vibration; Structural Failure*

## 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*.

**20080018468** Air War Coll., Maxwell AFB, AL USA
**GPS & Galileo. Friendly Foes?**
Constantine, Roftiel; Apr 2007; 75 pp.; In English
Report No.(s): AD-A476927; AU/AF-FELLOWS/NNN/2007-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476927

The European Union's global navigation satellite system, Galileo, poses concern for the USA Global Positioning System. Areas of exploration include a brief history of satellite navigation and the Global Positioning System program, followed by an in-depth overview of the Galileo system, highlighting its multifaceted justification, expected economic benefits and revenue streams, and its four-year frequency battle with the Global Positioning System. Critical to this discussion is understanding Galileo as an expression of European sovereignty and the USA corresponding reaction, the importance of the significant international interest in and cooperation with Galileo, and the strategic implications of China's evolving satellite navigation system. Five distinct actions by the USA government are necessary to protect its industrial, military, and national security interests: acknowledge the existing situation; ensure fair competition for satellite navigation hardware manufacturers; compel allied militaries to adopt GPS now; drive home the fact that, counter to European claims, the availability and precision of GPS will be on par with or better than Galileo; and secure China's cooperation in satellite navigation.
DTIC
*Galileo Spacecraft; Global Positioning System*

**20080018572** NASA Glenn Research Center, Cleveland, OH, USA
**K-Band TWTA for the NASA Lunar Reconnaissance Orbiter**
Force, Dale A.; Simons, Rainee N.; Peterson, Todd T.; Rodriguez-Arroy, Adan; Visalsawat, Jirasak; Spitsen, Paul C.; Menninger, William L.; Robbins, Neal R.; Dibb, Daniel R.; Todd, Phillip C.; April 2008; 9 pp.; In English; Ninth IEEE International Vacuum Electronics Conference, 22-24 Apr. 2008, Monterey, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 342556.06.01.10.01.02
Report No.(s): NASA/TM-2008-215217; E-16506; Copyright; Avail.: CASI: A02, Hardcopy

This paper presents the K-Band traveling wave tube amplifier (TWTA) developed for the Lunar Reconnaissance Orbiter and discusses the new capabilities it provides.
Author
*Telecommunication; Microwave Amplifiers; Traveling Wave Amplifiers; Microwave Tubes; Superhigh Frequencies; Lunar Orbiter*

**20080018575** NASA Glenn Research Center, Cleveland, OH, USA
**Regionalized Lunar South Pole Surface Navigation System Analysis**
Welch, Bryan W.; April 2008; 14 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 439432.07.04.03.01
Report No.(s): NASA/TP-2008-214950; E-16180; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018575

Apollo missions utilized Earth-based assets for navigation because the landings took place at lunar locations in constant view from the Earth. The new exploration campaign to the lunar south pole region will have limited Earth visibility, but the extent to which a navigation system comprised solely of Earth-based tracking stations will provide adequate navigation solutions in this region is unknown. This report presents a dilution-of-precision (DoP)-based, stationary surface navigation analysis of the performance of multiple lunar satellite constellations, Earth-based deep space network assets, and combinations thereof. Results show that kinematic and integrated solutions cannot be provided by the Earth-based deep space network stations. Also, the stationary surface navigation system needs to be operated either as a two-way navigation system or as a one-way navigation system with local terrain information, while the position solution is integrated over a short duration of time with navigation signals being provided by a lunar satellite constellation.
Author
*Surface Navigation; Lunar Surface; Lunar Satellites; Satellite Constellations; Tracking Stations*

**20080018577** NASA Glenn Research Center, Cleveland, OH, USA

**Parameter Analysis of Lunar Surface Navigation Utilizing Dilution-of-Precision Methodology With Lunar Orbiters**

Welch, Bryan W.; April 2008; 59 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 439432.07.04.03.01

Report No.(s): NASA/TP-2008-215001; E-16179; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018577

With the NASA Vision for Space Exploration focusing on the return of astronauts to the Moon and eventually to Mars, architectures for new navigation concepts must be derived and analyzed. One such concept, developed by the Space Communications Architecture Working Group (SCAWG), is to place a constellation of satellites around the Moon. Previously completed analyses examined the performance of multiple satellite constellations and recommended a constellation oriented as a Walker polar 6/2/1 with a semimajor axis (SMA) of 9250 km. One requirement of the constellations that were examined was that they have continuous access to any location on the lunar surface. In this report, the polar 6/2/1 and polar 8/2/1, with equal SMAs, are examined in greater detail. The dilution-of-precision (DoP) methodology is utilized to examine the effects of longitude surface points, latitude surface points, elevation requirements, and modified failure modes for these two constellations with regard to system availability. Longitude study results show that points along a meridian closely approximate the results of a global set of data points. Latitude study results show that previous assumptions with regard to latitude spacing are adequate to simulate global system availability. Elevation study results show that global system availability curves follow a reverse sigmoid function. Modified failure mode study results show that the benefits of reorienting a failure mode constellation depend on the type of navigation system and the length of the integration period being used. Author

*Surface Navigation; Satellite Constellations; Dilution; Lunar Surface; Position (Location); Lunar Orbiter; Space Communication*

## 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*.

**20080018459** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Qualifying Spirit and Opportunity to Martian Landing Loads with Centrifuge Testing**

Coleman, Michelle R.; Davis, Greg; June 22, 2004; 17 pp.; In English; Spacecraft and Launch Vehicle Dynamic Environments Workshop, 22-24 Jun. 2004, El Segundo, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40734

This viewgraph presentation reviews the drop test used to test the Mars lander. The objective of the test was to demonstrate the structural and functional integrity of the development test Model (DTM). Rover Basepetal when subjected to the landing event. The test module was instrumented with accelerometers to measure the kinematic response of the test article during impact.

CASI

*Centrifuges; Drop Tests; Mars Landing*

**20080018469** Ohio Aerospace Inst., Brook Park, OH, USA; NASA Glenn Research Center, Cleveland, OH, USA

**Estimation of the Unsteady Aerodynamic Load on Space Shuttle External Tank Protuberances from a Component Wind Tunnel Test**

Panda, Jayatana; Martin, Fred W.; Sutliff, Daniel L.; April 2008; 25 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06AA05A; NNC07ZA08A; WBS 510505.04.03.01

Report No.(s): NASA/TM--2008-215155; AIAA Paper 2008-0232; E-16380; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018469

At the wake of the Columbia (STS-107) accident it was decided to remove the Protuberance Aerodynamic Load (PAL) Ramp that was originally intended to protect various protuberances outside of the Space Shuttle External Tank from high buffet

load induced by cross-flows at transonic speed. In order to establish the buffet load without the PAL ramp, a wind tunnel test was conducted where segments of the protuberances were instrumented with dynamic pressure transducers; and power-spectra of sectional lift and drag forces at various span-wise locations between two adjacent support brackets were measured under different cross flow angles, Mach number and other conditions. Additionally, frequency-dependent spatial correlations between the sectional forces were also established. The sectional forces were then adjusted by the correlation length to establish span-averaged spectra of normal and lateral forces that can be suitably 'added' to various other unsteady forces encountered by the protuberance. This paper describes the methodology used for calculating the correlation-adjusted power spectrum of the buffet load. A second part of the paper describes wind-tunnel results on the difference in the buffet load on the protuberances with and without the PAL ramp. In general when the ramp height is the same as that of the protuberance height, such as that found on the liquid Oxygen part of the tank, the ramp is found to cause significant reduction of the unsteady aerodynamic load. However, on the liquid Hydrogen part of the tank, where the Oxygen feed-line is far larger in diameter than the height of the PAL ramp, little protection is found to be available to all but the Cable Tray.
Author
*Wind Tunnel Tests; Space Shuttles; Dynamic Pressure; Loads (Forces); Protuberances; External Tanks; Mach Number; Aerodynamic Loads; Unsteady Aerodynamics*

**20080018471** Channel Islands Acoustics, Camarillo, CA, USA; NASA Glenn Research Center, Cleveland, OH, USA
**Vibration Analysis of the Space Shuttle External Tank Cable Tray Flight Data With and Without PAL Ramp**
Walker, Bruce E.; Panda, Jayanta; Sutliff, Daniel L.; March 2008; 24 pp.; In English; 46th Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): LB0435; WBS 510.505.04.03.01
Report No.(s): NASA/TM--2008-215156; AIAA Paper 2008-312; E-16379; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018471

External Tank Cable Tray vibration data for three successive Space Shuttle flights were analyzed to assess response to buffet and the effect of removal of the Protuberance Air Loads (PAL) ramp. Waveform integration, spectral analysis, cross-correlation analysis and wavelet analysis were employed to estimate vibration modes and temporal development of vibration motion from a sparse array of accelerometers and an on-board system that acquired 16 channels of data for approximately the first 2 min of each flight. The flight data indicated that PAL ramp removal had minimal effect on the fluctuating loads on the cable tray. The measured vibration frequencies and modes agreed well with predicted structural response.
Author
*Dynamic Structural Analysis; Vibration; Space Shuttles; Protuberances; Aerodynamic Loads; Cross Correlation; Spectrum Analysis*

**20080018587** NASA Glenn Research Center, Cleveland, OH, USA
**The Use of a Vehicle Acceleration Exposure Limit Model and a Finite Element Crash Test Dummy Model to Evaluate the Risk of Injuries During Orion Crew Module Landings**
Lawrence, Charles; Fasanella, Edwin L.; Tabiei, Ala; Brinkley, James W.; Shemwell, David M.; April 2008; 42 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 843515.02.01.03.05.08.04
Report No.(s): NASA/TM--2008-215198; E-16469; Copyright; Avail.: CASI: A03, Hardcopy

A review of astronaut whole body impact tolerance is discussed for land or water landings of the next generation manned space capsule named Orion. LS-DYNA simulations of Orion capsule landings are performed to produce a low, moderate, and high probability of injury. The paper evaluates finite element (FE) seat and occupant simulations for assessing injury risk for the Orion crew and compares these simulations to whole body injury models commonly referred to as the Brinkley criteria. The FE seat and crash dummy models allow for varying the occupant restraint systems, cushion materials, side constraints, flailing of limbs, and detailed seat/occupant interactions to minimize landing injuries to the crew. The FE crash test dummies used in conjunction with the Brinkley criteria provides a useful set of tools for predicting potential crew injuries during vehicle landings.
Author
*Spacecraft Modules; Impact Tolerances; Astronauts; Risk; Water Landing; Exposure; Probability Theory; Space Capsules*

**20080018653** National Inst. of Aerospace, Hampton, VA, USA; NASA Langley Research Center, Hampton, VA, USA

**Deflection Analysis of the Space Shuttle External Tank Door Drive Mechanism**

Tosto, Michael A.; Trieu, Bo C.; Evernden, Brent A.; Hope, Drew J.; Wong, Kenneth A.; Lindberg, Robert E.; May 07, 2008; 13 pp.; In English; 39th Aerospace Mechanisms Symposium, 7-9 May 2008, Huntsville, AL, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018653

Upon observing an abnormal closure of the Space Shuttle s External Tank Doors (ETD), a dynamic model was created in MSC/ADAMS to conduct deflection analyses for assessing whether the Door Drive Mechanism (DDM) was subjected to excessive additional stress, and more importantly, to evaluate the magnitude of the induced step or gap with respect to shuttle s body tiles. To model the flexibility of the DDM, a lumped parameter approximation was used to capture the compliance of individual parts within the drive linkage. These stiffness approximations were then validated using FEA and iteratively updated in the model to converge on the actual distributed parameter equivalent stiffnesses. The goal of the analyses is to determine the deflections in the mechanism and whether or not the deflections are in the region of elastic or plastic deformation. Plastic deformation may affect proper closure of the ETD and would impact aero-heating during re-entry.

Author

*External Tanks; Deflection; Plastic Deformation; Dynamic Models; Iteration; Aerodynamic Heating*

**20080018707** NASA Langley Research Center, Hampton, VA, USA

**Limit Cycle Analysis Applied to the Oscillations of Decelerating Blunt-Body Entry Vehicles**

Schoenenberger, Mark; Queen, Eric M.; May 05, 2008; 24 pp.; In English; NATO RTO Symposium AVT-152 on Limit-Cycle Oscillations and Other Amplitude-Limited, Self-Excited Vibrations, 5-8 May 2008, Norway, Norway; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 857464.02.07.08

Report No.(s): RTO-MP-AVT-152; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018707

Many blunt-body entry vehicles have nonlinear dynamic stability characteristics that produce self-limiting oscillations in flight. Several different test techniques can be used to extract dynamic aerodynamic coefficients to predict this oscillatory behavior for planetary entry mission design and analysis. Most of these test techniques impose boundary conditions that alter the oscillatory behavior from that seen in flight. Three sets of test conditions, representing three commonly used test techniques, are presented to highlight these effects. Analytical solutions to the constant-coefficient planar equations-of-motion for each case are developed to show how the same blunt body behaves differently depending on the imposed test conditions. The energy equation is applied to further illustrate the governing dynamics. Then, the mean value theorem is applied to the energy rate equation to find the effective damping for an example blunt body with nonlinear, self-limiting dynamic characteristics. This approach is used to predict constant-energy oscillatory behavior and the equilibrium oscillation amplitudes for the various test conditions. These predictions are verified with planar simulations. The analysis presented provides an overview of dynamic stability test techniques and illustrates the effects of dynamic stability, static aerodynamics and test conditions on observed dynamic motions. It is proposed that these effects may be leveraged to develop new test techniques and refine test matrices in future tests to better define the nonlinear functional forms of blunt body dynamic stability curves.

Author

*Blunt Bodies; Stability Tests; Equations of Motion; Dynamic Stability; Atmospheric Entry; Aerospace Vehicles; Oscillations; Dynamic Characteristics; Boundary Conditions; Aerodynamics*

**20080018927** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Models for Galactic Cosmic Ray and Solar Energetic Particles and their Application to Spacecraft Design**

Adams, James H., Jr.; March 17, 2008; 4 pp.; In English; GOMARCTech-08, 33rd Annual Government Microcircuit Applications and Critical Technology Conference, 17-20 Mar. 2008, Las Vegas, NV, USA; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018927

The effects of radiation environment in interplanetary space must be taken into account for spacecraft design. This is done by modeling this environment and propagating it to the electronic parts of interest within the spacecraft then calculating the effects of this radiation on these parts. This talk will present a survey of the existing models for the interplanetary radiation

environment and the results of comparing them with measurements. It will also include a survey of radiation transport methods and methods for estimating the effects of this radiation on spacecraft.
Author
*Galactic Cosmic Rays; Spacecraft Design; Energetic Particles; Mathematical Models; Space Missions; Avionics*

## 19
## SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also *06 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

**20080018562** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**GeoSTAR - A Microwave Sounder for Geostationary Satellites**
Lambrigtsen, Bjorn; Wilson, William; Tanner, Alan; Gaier, Todd; Ruf, Chris; Piepmeier, Jeff; September 20, 2004; 4 pp.; In English; IEEE International Topical Meeting on Geoscience and Remote Sensing Symposium, IGARSS '04, 20-24 Sep. 2004, Anchorage, AK, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40732

GeoSTAR represents a new approach to microwave atmospheric sounding that is now under development. It has capabilities similar to sensors currently operating on low earth orbiting weather satellites but is intended for deployment in geostationary orbit - where it will complement future infrared sounders and enable all-weather temperature and humidity soundings and rain mapping. The required spatial resolution of 50 km or better dictates an aperture of 4 meters or more at a sounding frequency of 50 GHz, which is difficult to achieve with a real aperture system - this is the reason why it has until now not been possible to put a microwave sounder on a geostationary platform. GeoSTAR is instead based on a synthetic aperture imaging approach. Among the advantages of such a system are that there are no moving parts, and the size of the aperture is easily expandable to meet future needs. A ground based prototype of GeoSTAR is currently under development in an effort led by the Jet Propulsion Laboratory.
Author
*Atmospheric Sounding; Geosynchronous Orbits; Microwave Sounding*

## 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*.

**20080018610** NASA Glenn Research Center, Cleveland, OH, USA
**NASA Propulsion Investments for Exploration and Science**
Smith, Bryan K.; Free, James M.; Klem, Mark D.; Priskos, Alex S.; Kynard, Michael H.; May 05, 2008; 12 pp.; In English; Space Propulsion 2008, 5-9 May 2008, Crete, Germany; Original contains color illustrations
Contract(s)/Grant(s): WBS 510505.01.03.01.06; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018610

The National Aeronautics and Space Administration (NASA) invests in chemical and electric propulsion systems to achieve future mission objectives for both human exploration and robotic science. Propulsion system requirements for human missions are derived from the exploration architecture being implemented in the Constellation Program. The Constellation Program first develops a system consisting of the Ares I launch vehicle and Orion spacecraft to access the Space Station, then builds on this initial system with the heavy-lift Ares V launch vehicle, Earth departure stage, and lunar module to enable missions to the lunar surface. A variety of chemical engines for all mission phases including primary propulsion, reaction control, abort, lunar ascent, and lunar descent are under development or are in early risk reduction to meet the specific requirements of the Ares I and V launch vehicles, Orion crew and service modules, and Altair lunar module. Exploration propulsion systems draw from Apollo, space shuttle, and commercial heritage and are applied across the Constellation architecture vehicles. Selection of these launch systems and engines is driven by numerous factors including development cost, existing infrastructure, operations cost, and reliability. Incorporation of green systems for sustained operations and

extensibility into future systems is an additional consideration for system design. Science missions will directly benefit from the development of Constellation launch systems, and are making advancements in electric and chemical propulsion systems for challenging deep space, rendezvous, and sample return missions. Both Hall effect and ion electric propulsion systems are in development or qualification to address the range of NASA s Heliophysics, Planetary Science, and Astrophysics mission requirements. These address the spectrum of potential requirements from cost-capped missions to enabling challenging high delta-v, long-life missions. Additionally, a high specific impulse chemical engine is in development that will add additional capability to performance-demanding space science missions. In summary, the paper provides a survey of current NASA development and risk reduction propulsion investments for exploration and science.
Author
*Propulsion System Configurations; Electric Propulsion; Systems Engineering; Propulsion System Performance; NASA Programs; Ion Propulsion; Hall Effect; Sample Return Missions; Space Rendezvous; Ares 1 Launch Vehicle*

## 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*.

**20080018331** Perugia Univ., Perugia, Italy
**Theory and Computing of Gas Phase Chemical Reactions: From Exact Quantum to Approximates Dynamical Treatments**
Lagana, A; Feb 8, 2006; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-499/97-2000
Report No.(s): AD-A476900; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476900
No abstract available
*Chemical Reactions; Gas Flow; Vapor Phases*

**20080018436** Lawrence Livermore National Lab., Livermore, CA USA; California Univ., Berkeley, CA, USA
**Method of Preparation of Bonded Polyimide Fuel Cell Package**
Morse, J. D., Inventor; Jankowski, A., Inventor; Graff, R. T., Inventor; Bettencourt, K., Inventor; 14 Jun 05; 14 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-48
Patent Info.: Filed Filed 14 Jun 05; US-Patent-Appl-SN-11-153-586
Report No.(s): PB2007-109451; No Copyright; Avail.: CASI: A03, Hardcopy
Described herein are processes for fabricating microfluidic fuel cell systems with embedded components in which micron-scale features are formed by bonding layers of DuPont Kapton(Trade Name) polyimide laminate. A microfluidic fuel cell system fabricated using this process is also described.
NTIS
*Fuel Cells; Heaters; Patent Applications; Polyimides*

**20080018438** Bacon and Thomas, PPLC, Alexandria, VA, USA
**Volume Phase Transition to Induce Gel Movement**
Yeghiazarian, L. L., Inventor; Wiesner, U., Inventor; Montemagno, C. D., Inventor; 1 Jul 04; 11 pp.; In English
Contract(s)/Grant(s): AGG-2001-35102-09871
Patent Info.: Filed Filed 1 Jul 04; US-Patent-Appl-SN-10-880-602
Report No.(s): PB2007-109448; No Copyright; Avail.: CASI: A03, Hardcopy
Movement of a gel structure is propagated by successively applying external stimuli to cause volume phase transition in the gel structure by alternately causing the gel structure to collapse and swell to move the center of mass of the gel structure in the direction of successive stimuli application. The movement is mediated by confining structure for the gel and anchoring--the starting side of the gel in the swelling cycle.
NTIS
*Biotechnology; Gels; Patent Applications; Phase Transformations*

**20080018473** NASA Glenn Research Center, Cleveland, OH, USA

**A Stereo Imaging Velocimetry Technique for Analyzing Structure of Flame Balls at Low Lewis-Number (SOFBALL) Data**

McDowell, Mark; Gray, Elizabeth; April 2008; 25 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.16.02

Report No.(s): NASA/TM-2008-215162; E-16404; Copyright; Avail.: CASI: A03, Hardcopy

Stereo Imaging Velocimetry (SIV) is a NASA Glenn Research Center (GRC) developed fluid physics technique for measuring threedimensional (3-D) velocities in any optically transparent fluid that can be seeded with tracer particles. SIV provides a means to measure 3-D fluid velocities quantitatively and qualitatively at many points. This technique provides full-field 3-D analysis of any optically clear fluid or gas experiment using standard off-the-shelf CCD cameras to provide accurate and reproducible 3-D velocity profiles for experiments that require 3-D analysis. A flame ball is a steady flame in a premixed combustible atmosphere which, due to the transport properties (low Lewis-number) of the mixture, does not propagate but is instead supplied by diffusive transport of the reactants, forming a premixed flame. This flame geometry presents a unique environment for testing combustion theory. We present our analysis of flame ball phenomena utilizing SIV technology in order to accurately calculate the 3-D position of a flame ball(s) during an experiment, which can be used as a direct comparison of numerical simulations.

Author

*Velocity Measurement; Imaging Techniques; CCD Cameras; Fluid Dynamics; Pattern Recognition; Combustion; Velocity Distribution*

**20080018476** Bacon and Thomas, PPLC, Alexandria, VA, USA

**Volume Phase Transition to Induce Gel Movement**

Yeghiazarian, L. L., Inventor; Wiesner, U., Inventor; Montemagno, C. D., Inventor; Jun. 27, 20005; 13 pp.; In English

Contract(s)/Grant(s): AG-2001-35102-09871

Patent Info.: Filed Filed 27 Jun 05; US-Patent-Appl-SN-11-166-164

Report No.(s): PB2007-109444; No Copyright; Avail.: CASI: A03, Hardcopy

Movement of a gel structure is propagated by successively applying external stimuli to cause volume phase transition in the gel structure by alternately causing the gel structure to collapse and swell to move the center of mass of the gel structure in the direction of successive stimuli application. The movement is mediated by confining structure for the gel and anchoring the starting side of the gel in the swelling cycle.

NTIS

*Biotechnology; Gels; Patent Applications; Phase Transformations*

**20080018478** Yale Univ., New Haven, CT, USA

**Methods of Treatment with Drug Loaded Polymeric Materials**

Saltzman, W. M., Inventor; Fahmy, T., Inventor; Fong, P., Inventor; Jun. 03, 2005; 27 pp.; In English

Contract(s)/Grant(s): NIH-EB00487; NIH-CA52857

Patent Info.: Filed Filed 3 Jun 05; US-Patent-Appl-SN-11-170-803

Report No.(s): PB2007-109465; No Copyright; Avail.: CASI: A03, Hardcopy

Polymeric microparticles have been developed which encapsulate therapeutic compounds such as drugs, cellular materials or components, and antigens, and can have targeting ligands directly bound to the microparticle surface. Preferred applications include use in tissue engineering matrices, wound dressings, bone repair or regeneration materials, and other applications where the microparticles are retained at the site of application or implantation. Another preferred application is in the use of microparticles to deliver anti-proliferative agents to the lining of blood vessels following angioplasty, transplantation or bypass surgery to prevent or decrease restenosis, and in cancer therapy. In still another application, the microparticles are used to treat or prevent macular degeneration when administered to the eye, where agents such as complement inhibitors are administered.

NTIS

*Drugs; Microparticles; Patent Applications*

**20080018495** Knobbe Martens Olson and Bear, LLP, Irvine, CA, USA

**Water-Resistant Vegetable Protein Adhesive Dispersion Compositions**

Wescott, J. M., Inventor; Frihart, C. R., Inventor; Apr. 04, 2005; 23 pp.; In English

Patent Info.: Filed Filed 4 Apr 05; US-Patent-Appl-SN-11-099-175

Report No.(s): PB2007-109439; No Copyright; Avail.: CASI: A03, Hardcopy

Water-resistant, protein-based adhesive dispersion compositions and methods for preparing them are provided. The adhesive dispersions are prepared by copolymerizing a denatured vegetable protein, such as soy flour, that has been functionalized with methylol groups with one or more reactive comonomers, and preparing an acidic dispersion of the adhesive. The adhesive dispersions exhibit superior water resistance, and can be used to bond wood substrates, such as panels or laminate, or in the preparation of composite materials.

NTIS

*Adhesives; Patent Applications; Proteins; Vegetables; Water*

**20080018498** Rohm and Haas Co., Philadelphia, PA, USA; Department of Agriculture, Washington, DC, USA; Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

**New Sustainable Chemistry for Adhesives, Elastomers and Foams**

Mar. 30, 2007; 13 pp.; In English

Contract(s)/Grant(s): DE-FG36-04GO14317

Report No.(s): DE2007-903394; No Copyright; Avail.: Department of Energy Information Bridge

The goal of the project was to research and develop a biorefinery technology platform for adhesives, elastomers and foams. The program developed new bio-based products which can replace petrochemical-based polyurethane technology in film laminating and other adhesive, sealant and elastomer applications. The technology provides faster cure, lower energy consumption and safety enhancements versus incumbent urethane technology.

NTIS

*Adhesives; Elastomers; Foams*

**20080018545** NASA Johnson Space Center, Houston, TX, USA

**Test 1 Data Analysis: Burn Lengths and Flame Resistance of Kydex, Royal Blue Cotton, Silicone, Raychem Electrical Wire**

Beeson, Harold D.; Hirsch, David; [January 2005]; 6 pp.; In English; NASA/JAXA Technical Interchange Meeting, 4-8 Apr. 2005, Tsukuba, Japan; Copyright; Avail.: Other Sources

This document reports on test results from four different labs on the flame resistance of Kydex, Royal Blue Cotton, Silicone, and Raychem Electrical Wire.

CASI

*Flame Retardants; Flammability; Combustion Control; Flame Propagation; Materials Selection*

**20080018585** NASA Glenn Research Center, Cleveland, OH, USA

**Review of End-of-Life Thermal Control Coating Performance**

Jaworske, Donald A.; Kline, Sara E.; April 2008; 18 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 463169.04.03.05.05

Report No.(s): NASA/TM-2008-215173; E-16416; Copyright; Avail.: CASI: A03, Hardcopy

White thermal control coatings capable of long term performance are needed for Fission Surface Power (FSP) where heat from a nuclear reactor placed on the surface of the Moon must be rejected to the environment. The threats to thermal control coating durability on the lunar surface are electrons, protons, and ultraviolet radiation. The anticipated damage to the coating is a gradual darkening over time. The increase in solar absorptance would, in essence, add a cyclic heat load to the radiator. The greater the darkening, the greater the added heat load. The cyclic heat load could ultimately impart a cyclic influence on FSP system performance. No significant change in emittance is anticipated. Optical properties degradation data were found in the open literature for the Z-93 series of thermal control paints. Additional optical properties degradation data were found from the Lunar Orbiter V mission, the Optical Properties Monitor, and the Materials International Space Station Experiment. Anticipated end-of-life thermal control coating performance for a FSP installation is postulated. With the FSP installation

located away from landing and launching areas, and out of line-of-sight, lunar dust from human activity may not be a threat. The benefits of investing in next generation thermal control paint chemistry are explored.
Author
*Thermal Control Coatings; Solar Energy Absorbers; Emittance; Fission; Ultraviolet Radiation; Electrons; Protons; Damage*

**20080018668** Mirick, OConnell, DeMallie, and Lougee, LLP, Westborough, MA, USA
**Polymer Gel Containing Hyaluronic Acid and Collagen, and Its Use in Joints**
Prescott, A. G., Inventor; Jul. 14, 2005; 6 pp.; In English
Contract(s)/Grant(s): NIH-R43DE14504-01A2
Patent Info.: Filed Filed 14 Jul 05; US-Patent-Appl-SN-11-181-107
Report No.(s): PB2007-108838; No Copyright; Avail.: CASI: A02, Hardcopy

Formulations and methods for treating joints, such as temporomandibular joint disorders, osteoarthritis of the knee, hip and other types of inflammatory joint diseases. The method involves identifying specific matrix metalloproteinases (MMPs) that may be responsible for degrading the soft tissues of the joint in question, identifying the specific component of the joint the MMP(s) are targeting, and injecting a polymer gel with the component the MMP(s) seek to destroy, thus preserving the joint and allowing time to heal. These formulations typically require a mixture of glycosoaminoglycans and collagen proteins. One formulation in particular includes both hyaluronic acid and at least type I collagen.
NTIS
*Collagens; Diseases; Gels; Joints (Anatomy); Patent Applications*

**20080018674** Pennsylvania State Univ., University Park, PA, USA
**Multiscale Modeling of Polymeric Materials. Final Project Report**
Maranas, J. K.; Jan. 01, 2007; 6 pp.; In English
Report No.(s): DE2007-907964; No Copyright; Avail.: National Technical Information Service (NTIS)

Our overall objective for the three-year duration of this project is to design an adaptive, learning, simulation technique for polymers covering the range from atoms to coarse-grained chains, and apply the technique to the description of nanofilled polymers. Accomplishing this objective requires four activities, with the first two corresponding to the first two project years, and the second two to take place in the third project year. (1) Generalize and expand on existing methods to generate coarse-grained (CG) potentials (i.e. those where a single bead represents between ten and thirty atoms) from atomistic simulation results and potentials. (2) Develop protocols for overlaying atomistic structures on coarse-grained chains. (3) Use the results from Tasks 1 and 2 to embed the two levels of modeling in a single simulation, with communication between the two levels. (4) Verify the dynamic multi-scale simulation on a polymer melt, and use it in initial studies of nanoparticles in a polymer matrix.
NTIS
*Simulation; Polymer Chemistry; Polymer Blends; Grain Size*

## 24
## COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

**20080018422** Reinhart Boerner Van Deuren S.C., Milwaukee, WI, USA; Northwestern Univ., Evanston, IL USA
**Polymeric Compositions and Related Methods of Use**
Messersmith, P. B., Inventor; Dalsin, J., Inventor; Lin, L., Inventor; Lee, B. P., Inventor; Huang, K., Inventor; 28 Feb 05; 70 pp.; In English
Contract(s)/Grant(s): NIH-ES-0573; NIH-ES-505703
Patent Info.: Filed Filed 28 Feb 05; US-Patent-Appl-SN-11-068 298
Report No.(s): PB2007-109490; No Copyright; Avail.: CASI: A04, Hardcopy

Adhesive polymeric compositions which can comprise dihydroxyphenyl moieties and derivatives thereof, and related methods of use.
NTIS
*Polymers; Polymer Chemistry; Molecular Structure*

**20080018541** Alliant Techsystems, Inc., Edina, MN USA

**Polybenzoxazole-filled nitrile butadiene rubber compositions**

Gajiwala, Himansu M., Inventor; Guillot, David G., Inventor; April 15, 2008; 10 pp.; In English

Contract(s)/Grant(s): NAS8-97238

Patent Info.: Filed August 18, 2005; US-Patent-7,358,314; US-Patent-Appl-SN-11/207,855; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018541

An insulation composition that comprises at least one nitrile butadiene rubber (NBR) having an acrylonitrile content that ranges from approximately 26% by weight to approximately 35% by weight and polybenzoxazole (PBO) fibers. The NBR may be a copolymer of acrylonitrile and butadiene and may be present in the insulation composition in a range of from approximately 45% by weight to approximately 56% by weight of a total weight of the insulation composition. The PBO fibers may be present in a range of from approximately 3% by weight to approximately 10% by weight of a total weight of the insulation composition. A rocket motor including the insulation composition and a method of insulating a rocket motor are also disclosed.

Official Gazette of the U.S. Patent and Trademark Office

*Insulation; Synthetic Rubbers; Composite Materials*

**20080018573** NASA Glenn Research Center, Cleveland, OH, USA

**Effects of High-Temperature Annealing in Air on Hi-Nicalon Fiber-Reinforced Celsian Matrix Composites**

Bansal, Narottam P.; April 2008; 23 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.03.02.02.02

Report No.(s): NASA/TM-2008-215221; E-16511; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018573

BN/SiC-coated Hi-Nicalon fiber-reinforced celsian matrix composites (CMC) were annealed for 100 h in air at various temperatures to 1200 C, followed by flexural strength measurements at room temperature. Values of yield stress and strain, ultimate strength, and composite modulus remain almost unchanged for samples annealed up to 1100 C. A thin porous layer formed on the surface of the 1100 C annealed sample and its density decreased from 3.09 to 2.90 g/cu cm. The specimen annealed at 1200 C gained 0.43 wt%, was severely deformed, and was covered with a porous layer of thick shiny glaze which could be easily peeled off. Some gas bubbles were also present on the surface. This surface layer consisted of elongated crystals of monoclinic celsian and some amorphous phase(s). The fibers in this surface ply of the CMC had broken into small pieces. The fiber-matrix interface strength was characterized through fiber push-in technique. Values of debond stress, alpha(sub d), and frictional sliding stress, tau(sub f), for the as-fabricated CMC were 0.31+/-0.14 GPa and 10.4+/-3.1 MPa, respectively. These values compared with 0.53+/-0.47 GPa and 8.33+/-1.72 MPa for the fibers in the interior of the 1200 C annealed sample, indicating hardly any change in fiber-matrix interface strength. The effects of thermal aging on microstructure were investigated using scanning electron microscopy. Only the surface ply of the 1200 C annealed specimens had degraded from oxidation whereas the bulk interior part of the CMC was unaffected. A mechanism is proposed explaining the various steps involved during the degradation of the CMC on annealing in air at 1200 C.

Author

*Ceramic Matrix Composites; Oxidation; Microstructure; Silicon Carbides; Fiber-Matrix Interfaces; Scanning Electron Microscopy*

**20080018608** NASA Glenn Research Center, Cleveland, OH, USA

**Oxidation Through Coating Cracks of SiC-Protected Carbon/Carbon**

Jacobson, Nathan S.; Roth, Don J.; Rauser, Richard W.; Cawley, James D.; Curry, Donald M.; [2008]; 20 pp.; In English

Contract(s)/Grant(s): WBS 377816.06.03.02.08; Copyright; Avail.: CASI: A03, Hardcopy

The oxidation of SiC-protected carbon/carbon through machined slots and naturally occurring craze cracks in the SiC was studied. The slot and crack geometries were characterized, and the subsurface oxidation of the carbon/carbon substrate at temperatures of 1000 to 1300 C in air was assessed using weight change, x-ray computed tomography, and optical microscopy of sections. Rate constants were derived from these measurements and compared with a two-step diffusion control model of carbon oxidation. Oxidation kinetic measurements on both the specimens with machined slots and with naturally occurring craze cracks showed good agreement with the model.

Author

*Carbon-Carbon Composites; Silicon Carbides; Reaction Kinetics; Surface Cracks; X Ray Optics; Coating*

**20080018713** National Research Council, Sweden

**Characterization of Fatigue Damage for Bonded Composite Skin/Stringer Configurations**

Paris, Isabelle; Cvitkovich, Michael; Krueger, Ronald; May 08, 2008; 40 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.07.03.03

Report No.(s): NASA/TM-2008-215308; L-19468; Copyright; Avail.: CASI: A03, Hardcopy

The fatigue damage was characterized in specimens which consisted of a tapered composite flange bonded onto a composite skin. Quasi-static tension tests were performed first to determine the failure load. Subsequently, tension fatigue tests were performed at 40%, 50%, 60% and 70% of the failure load to evaluate the debonding mechanisms. For four specimens, the cycling loading was stopped at intervals. Photographs of the polished specimen edges were taken under a light microscope to document the damage. At two diagonally opposite corners of the flange, a delamination appeared to initiate at the flange tip from a matrix crack in the top 45deg skin ply and propagated at the top 45deg/-45deg skin ply interface. At the other two diagonally opposite corners, a delamination running in the bondline initiated from a matrix crack in the adhesive pocket. In addition, two specimens were cut longitudinally into several sections. Micrographs revealed a more complex pattern inside the specimen where the two delamination patterns observed at the edges are present simultaneously across most of the width of the specimen. The observations suggest that a more sophisticated nondestructive evaluation technique is required to capture the complex damage pattern of matrix cracking and multi-level delaminations.

Author

*Fatigue (Materials); Delaminating; Bonded Joints; Nondestructive Tests; Static Tests; Damage; Fatigue Tests; Loads (Forces)*

**20080018769** Pearl, Cohen and Zedek, LLP, New York, NY, USA

**Field-Responsive Superparamagnetic Composite Nanofibers and Methods of Use Thereof**

Hatton, T. A., Inventor; Rutledge, G. C., Inventor; Singh, H., Inventor; Wang, M., Inventor; Jun. 01, 2005; 26 pp.; In English

Contract(s)/Grant(s): DAAD-19-02-D0002

Patent Info.: Filed Filed 1 Jun 05; US-Patent-Appl-SN-11-141 205

Report No.(s): PB2007-108840; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention relates to magnetic field-responsive fibers, which comprise magnetite particles and a polymeric matrix. The invention also provides methods of producing the same, in particular via electrospinning of a stably dispersed or monodispersed polymer solution, either aqueous or organic, comprising the magnetite particles, and applications thereof.

NTIS

*Patent Applications; Magnetic Fields; Magnetite*

**20080018811** NASA, Washington, DC USA

**Toughened uni-piece, fibrous, reinforced, oxidization-resistant composite**

Stewart, David A., Inventor; Leiser, Daniel B., Inventor; January 1, 2008; 16 pp.; In English

Patent Info.: Filed July 27, 2004; US-Patent-7,314,648; US-Patent-Appl-SN-10/911,747; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018811

A composite thermal protection structure, for applications such as atmospheric re-entry vehicles, that can withstand temperatures as high as 3600.degree. F. The structure includes an exposed surface cap having a specially formulated coating, an insulator base adjacent to the cap with another specially formulated coating, and one or more pins that extend from the cap through the insulator base to tie the cap and base together, through ceramic bonding and mechanical attachment. The cap and insulator base have corresponding depressions and projections that mate and allow for differences in thermal expansion of the cap and base. A thin coating of a reaction cured glass formulation is optionally provided on the structure to allow reduce oxidization and/or to reduce catalytic efficiency.

Official Gazette of the U.S. Patent and Trademark Office

*Composite Structures; Thermal Protection; Ceramic Bonding; Insulators; Thermal Expansion*

**20080018932** 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; Dec 2006; 10 pp.; In English

Contract(s)/Grant(s): F33615-03-C-5219; Proj-4349

Report No.(s): AD-A476878; AFRL-RX-WP-TP-2008-4043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476878

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; Thermal Mapping; Thermoelasticity*

**20080018936** Troutman Sanders , LLP, Atlanta, GA, USA; Georgia Tech Research Inst., Atlanta, GA, USA

**High-Aspect-Ratio Metal-Polymer Composite Structures for Nano Interconnects**

Aggarwal, A., Inventor; Markondeya, P., Inventor; Tummala, R. R., Inventor; 10 Jan 05; 15 pp.; In English

Contract(s)/Grant(s): NSF-EEC-9402723

Patent Info.: Filed Filed 10 Jan 05; US-Patent-Appl-SN-11-032 301

Report No.(s): PB2007-111916; No Copyright; Avail.: CASI: A03, Hardcopy

A low-temperature process that combines high-aspect-ratio polymer structures with electroless copper plating to create laterally compliant MEMS structures. These structures can be used as IC-package interconnects that can lead to reliable, low-cost and high-performance nano wafer-level packaging. High-aspect-ratio low CTE polyimide structures with low stress, high toughness and strength were fabricated using plasma etching. The dry etching process was tuned to yield a wall angle above 80 degrees leading to an aspect ratio higher than 4. The etching process also leads to roughened sidewalls for selective electroless plating on the sidewalls of the polymer structures. These fabricated structures show reduction in the stresses at the interfaces and superior reliability as IC-package nano interconnects. Metal-coated polymer structures from MEMS fabrication techniques can provide low-cost high-performance solutions for wafer-level-packaging.

NTIS

*Composite Materials; Composite Structures; High Aspect Ratio; Metals; Microelectromechanical Systems; Patent Applications*

**20080018939** Rutgers - The State Univ., Piscataway, NJ, USA

**Geopolymer Coating Demonstration Project for Route I-295 Scenic Overlook**

Balaguru, P. N.; Arafa, M.; Aug. 2006; 13 pp.; In English

Report No.(s): PB2007-111692; No Copyright; Avail.: National Technical Information Service (NTIS)

This report presents the background information, application procedure, and final outcome of a demonstration project carried out to prove the viability of coating an existing 300 ft. parapet wall with inorganic (Geopolymer) coating. This wall, located at the Scenic Overlook on I-295 South near Trenton, N.J. (mile post 58.5), was coated with Geopolymer tinted with pigments. The wall surface was pressure washed before applying the coating. This was the only surface preparation that was needed before the application. Before the coating was applied, a number of small patch applications on the backside of the wall were made to gain approval by NJDOT. The oldest patch was more than 18 months old when the wall was coated. Self cleaning and de-polluting characteristics of the coating are being investigated under a project funded by the National Science Foundation.

NTIS

*Coating; Routes; Polymers*

## 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*.

**20080018133** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA
**Velocity Profile Characterization for the 5-CM Agent Fate Wind Tunnels**
Weber, Daniel J; Scudder, Mary K; Moury, Clayton S; Shuely, Wendel J; Molnar, John W; Danberg, James E; Miller, Miles C; Jan 2008; 120 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476518; ECBC-TR-567; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476518

This report describes the velocity profile characterization of the 5-cm Agent Fate Wind Tunnel. This facility, which fits in a standard chemical fume hood, is used to measure the release and retention of chemical warfare agents from various materials under simulated environmental conditions. The tunnel creates specified vertical velocity profiles representing the lower portion of the velocity profile produced by a wind-induced, atmospheric boundary layer. Characterization refers to the measurement of the velocity profiles over the length and width of the test section under various test conditions. The report summarizes the instrumentation employed, the characterization procedure, and resulting velocity profiles measured in the Version 3 and Version 3, Mod 1 configurations of the 5-cm Wind Tunnel as employed for the HD on glass (tunnel validation) and the HD on sand test phases of the Agent Fate Program.
DTIC
*Characterization; Chemical Warfare; Velocity Distribution; Wind Tunnels*

**20080018144** Technische Hochschule, Stuttgart, Germany
**Advanced Integrated TPS and Non Equilibrium Chemistry Instrumentation**
Auweter-Kurtz, Monika; Fertig, Markus; Herdrich, Georg; Winter, Michael; Jun 1, 2007; 51 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476534; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476534

No abstract available
*Chemical Equilibrium; Thermodynamic Properties*

**20080018153** Naval Research Lab., Bay Saint Louis, MS USA
**The Influence of Marine Microfouling on the Corrosion Behaviour of Passive Materials and Copper Alloys**
Little, Brenda J; Lee, Jason S; Ray, Richard I; Jan 2, 2008; 9 pp.; In English
Report No.(s): AD-A476548; NRL/PP/7303-07-7139; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476548

The influence of marine biofilms on corrosion varies with alloy composition. At temperatures below 60 C, resistance to crevice corrosion is the limiting factor for selecting alloys for seawater service and is the most problematic issue affecting the performance of passive alloys in seawater. Several investigators have documented the tendency for biofilms to cause a noble shift, or an ennoblement, in open-circuit potential (OCP) of passive alloys exposed in marine environments. Ennoblement in marine waters has been ascribed to depolarization of the oxygen reduction reaction due to organometallic catalysis, acidification of the electrode surface, the combined effects of elevated H2O2 and decreased pH and the production of passivating siderophores. The alloys tested include, but are not limited to: UNS S30400, S30403, S31600, S31603, S31703, S31803, N08904, N08367, S44660, S20910, S44735, N10276, N06625, platinum, gold, palladium, chromium, titanium, and nickel. Theoretically, potential ennoblement should increase the probability for pitting and crevice corrosion initiation and propagation, especially for alloys with pitting potentials within 300 mV of the OCP. The relationship between passive alloy composition and ennoblement will be discussed. The well-known toxicity of cuprous ions toward living organisms does not mean that the copper-based alloys are immune to microbial colonization and microbiologically influenced corrosion (MIC). It does mean, however, that only those organisms with a high tolerance for copper are likely to have a substantial effect. Most of the reported cases of MIC of copper alloys in marine environments are not related to ennoblement of OCP, but are caused by the reduction of sulfate (concentration > 2 gm/L) to hydrogen sulfide.
DTIC
*Biofilms; Copper Alloys; Corrosion; Fouling; Microorganisms; Sea Water*

**20080018155** Ulm Univ., Germany
**Introduction to Theoretical Surface Science**
Gross, Axel; Jul 1, 2007; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476564; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476564
No abstract available
*Chemical Reactions; Surface Reactions*

**20080018183** Army Research Lab., Aberdeen Proving Ground, MD USA
**Spin-Polarized Tunneling at Interfaces Between Oxides and Metals or Semiconductors**
Strand, Douglas J; Sep 2006; 50 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476621; ARL-TR-3925; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476621
Spin-polarized tunneling is a way to create a new type of electric current whose two driving forces are spin momenta rather than opposite charges. Much research has been done with this idea and that research has been reviewed and developed to propose an experimental program to use this new type of current to devise such electronic devices as the Datta-Das spin field-effect transistor (SFET), the magnetic bipolar transistor, the hot-electron spin transistor, and the spin-valve photo-diode. This report includes a short history of spin-polarized transport and then outlines the developed theory. The experimental methods and materials of the field are also discussed. This research proposes to use electron paramagnetic resonance (EPR) and Barkhausen Noise Analysis (BNA) with other standard methods of materials science and engineering to examine the feasibility and develop an experimental plan to make spin-polarized transport effective for the manufacture of the above named devices. Some materials will be effective for spin-polarized transport devices and some will not. The quest for the effective materials is a major part of this research. Half-Heusler and full-Heusler alloys are studied as possible candidates for the devices. The term spintronics, an acronym for spin electronics, is used almost synonymously with spin polarization transport devices.
DTIC
*Electric Current; Metals; Oxides; Particle Spin; Quantum Numbers; Semiconductors (Materials)*

**20080018268** BAE Systems, Leicestershire, UK
**Characterisation**
El-Fatatry, Ayman; Mar 1, 2007; 74 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476727; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476727
No abstract available
*Characterization; Chemical Analysis; Metrology; Nanotechnology*

**20080018269** Ulm Univ., Germany
**Simulation of Gas-Surface Dynamical Interactions**
Gross, Axel; Jul 1, 2007; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476734; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476734
No abstract available
*Gas-Solid Interactions; Simulation; Surface Reactions*

**20080018327** Naval Surface Warfare Center, Silver Spring, MD USA
**Naval Surface Warfare Center Electrochemistry Branch**
Feb 16, 1985; 30 pp.; In English
Report No.(s): AD-A476880; NSWC-MP-87-258; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476880
The Electrochemistry Branch of the Naval Surface Warfare Center includes research and development in the areas of advanced electrochemical power sources and corrosion. The Branch is organizationally located in the Materials Division of

NSWC's Research and Technology Department at White Oak, Maryland. This publication is an overview of the Electrochemistry Branch and includes descriptions of the resources, capabilities and technology available.
DTIC
*Electrochemistry; Navy; Warfare*

**20080018328** Naval Surface Weapons Center, Silver Spring, MD USA
**Development of the Cathode Fall in a Planar Discharge in Helium**
Chen, H C; Phelps, A V; Jun 1986; 38 pp.; In English
Report No.(s): AD-A476882; NSWC-MP-86-222; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476882

The time and spatial evolution of the cathode region of a planar discharge in helium has been modeled using numerical solutions of the electron and positive ion continuity equations and Poisson's equations. Single step ionization, electron and ion drift and diffusion, and electron-positive ion recombination are included using rate and transport coefficients based on experiment. The model is applied to high pressure, high current discharges such as found in electron-beam or photon initiated lasers. The cathode fall is found to approach steady-state voltage drop and sheath thickness are compared with experiment and previous theory using appropriate scaling laws.
DTIC
*Cathodes; Helium; Ionization; Planar Structures; Poisson Equation*

**20080018332** Perugia Univ., Perugia, Italy
**Theoretical Estimates of Reaction Observables vis-a-vis Modern Experiments**
Lagana, A; Feb 8, 2006; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476902; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476902

No abstract available
*Chemical Reactions; Estimates; Molecular Interactions*

**20080018354** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
**Macromolecular Carriers in Nanomedicine and Nanodevices**
Riffle, Judy S; Feb 5, 2008; 10 pp.; In English
Contract(s)/Grant(s): FA9550-06-1-0378
Report No.(s): AD-A476967; 4-30204; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476967

Magnetic nano- and micro spheres coated with polymers that have the right combination of characteristics have enormous potential for applications in drug delivery, biological sensor technologies, pathogen diagnostics, antibody-antigen and intracellular targeting, and more recently, for nano-motors and other nano-devices. For in-vivo use in all of these applications, the surface properties of the macromolecular nanospheres or microspheres must be tailored to: 1) disperse them in physiological media, and 2) avoid immune response. Moreover, surfaces that can target specific cell populations or pathogens are also of great interest. This DARPA-AFOSR project has helped to address macromolecular concepts relative to tailoring the surface properties of biodegradable nanospheres and micro spheres for in-vivo blood-contacting applications. The project goals have been to define relationships among chemical composition, processing parameters, nanosphere sizes and size distributions, and surface structure. Our accomplishments include 1) a facile method for achieving magnetite-polylactide nanospheres that can be dispersed in aqueous media; 2) methods for functionalizing the termini of the hydrophilic brushes on the nanospheres in order to conjugate targeting moieties; 3) development of a nanosphere processing approach that yields nanospheres in the desired size range with a narrow distribution of sizes; and 4) maintenance of all of these characteristics with up to approximately 60 weight percent of magnetite incorporated into the nanospheres.
DTIC
*Detectors; Drugs; Macromolecules; Microparticles; Nanostructures (Devices)*

**20080018434** Myers Bigel Sibley and Sajovec, Raleigh, NC, USA

**Boron Complexation Strategy for Use in Manipulating 1-Acyldipyrromethanes**

Lindsey, J. S., Inventor; Murthukumaran, K., Inventor; Ptaszek, M., Inventor; Huma, H. Z. S., Inventor; 18 Jun 04; 26 pp.; In English

Contract(s)/Grant(s): NIH-GM36238

Patent Info.: Filed Filed 18 Jun 04; US-Patent-Appl-SN-10-872-321

Report No.(s): PB2007-109454; No Copyright; Avail.: CASI: A03, Hardcopy

A method of making a metal complex comprises combining a 1-monoacyldipyrromethane with a compound of the formula R(sup 1)R(sup 2)MX, wherein M is boron, R(sup 1) and R(sup 2) are each independently organic substituents; and X is an anion leaving group; to produce a metal complex of the formula DMR(sup 1)R(sup 2) wherein DH is a 1-monoacyldipyrromethane. The methods and complexes are useful for the purification and synthesis of dipyrromethanes and porphyrins.

NTIS

*Patent Applications; Porphyrins; Synthesis (Chemistry)*

**20080018439** Kepler [Keith D.], Belmont, CA, USA

**Combinatorial Method and Apparatus for Screening Electrochemical Materials**

Keplar, K. D., Inventor; Wang, Y., Inventor; 5 Jul 05; 11 pp.; In English

Contract(s)/Grant(s): DE-FG02-03ER83656

Patent Info.: Filed Filed 5 Jul 05; US-Patent-Appl-SN-11-175-555

Report No.(s): PB2007-109446; No Copyright; Avail.: CASI: A03, Hardcopy

A high throughput combinatorial screening method and apparatus for the evaluation of electrochemical materials using a single voltage source (2) is disclosed wherein temperature changes arising from the application of an electrical load to a cell array (1) are used to evaluate the relative electrochemical efficiency of the materials comprising the array. The apparatus may include an array of electrochemical cells (1) that are connected to each other in parallel or in series, an electronic load (2) for applying a voltage or current to the electrochemical cells (1), and a device (3), external to the cells, for monitoring the relative temperature of each cell when the load is applied.

NTIS

*Combinatorial Analysis; Patent Applications*

**20080018479** Geological Survey, Reston, VA USA; Department of the Navy, Washington, DC, USA

**Nitrogen Species in Soil, Sediment, and Ground Water at a Former Sewage-Treatment Wastewater Lagoon: Naval Air Station Whidbey Island, Island County, Washington**

Cox, S. E.; Dinicola, R. S.; Huffman, R. L.; Jan. 01, 2007; 22 pp.; In English

Report No.(s): PB2007-112174; USGS-SIR-2007-5075; No Copyright; Avail.: National Technical Information Service (NTIS)

The potential for contamination of ground water from remnant sewage sludge in re-graded sediments of a deconstructed sewage-treatment lagoon was evaluated. Ground-water levels were measured in temporary drive-point wells, and ground-water samples were collected and analyzed for nutrients and other water-quality characteristics. Composite soil and sediment samples were collected and analyzed for organic carbon and nitrogen species. Multiple lines of evidence, including lack of appreciable organic matter in sediments of the former lagoon, agronomic analysis of nitrogen, the sequestration of nitrogen in the developing soils at the former lagoon, and likely occurrence of peat deposits within the aquifer material, suggest that the potential for substantial additions of nitrogen to ground water beneath the former sewage lagoon resulting from remnant sewage sludge not removed from the former lagoon are small. Concentrations of nitrogen species measured in ground-water samples were small and did not exceed the established U.S. Environmental Protection Agencys maximum contaminant levels for nitrate.

NTIS

*Contamination; Ground Water; Lagoons; Nitrogen; Sewage; Sewage Treatment; Sludge; Washington; Waste Water*

**20080018484** Geological Survey, Reston, VA USA

**Proceedings of the U.S. Geological Survey 2004 Mercury Workshop: Mercury Research and its Relation to Department of the Interior Resource Management**

Jan. 01, 2007; 38 pp.; In English

Report No.(s): PB2007-112153; USGS-OFR-2007-1026; No Copyright; Avail.: CASI: A03, Hardcopy

As part of the Department of the Interior (DOI) program Science on the DOI Landscape Initiative, the U.S. Geological

Survey (USGS), Eastern Region, held a workshop during August 1718, 2004, in Reston, VA, on mercury in the environment as it relates to DOI resource management. DOI bureaus manage millions of acres of land and offshore resources subject to mercury deposition and to the effects of mercury on ecosystems and human health. The goals of the workshop were to (1) summarize information on mercury sources and cycling on DOI lands in the eastern USA, (2) learn the perspectives of the DOI bureaus regarding mercury on DOI lands, (3) provide information to DOI land managers about monitoring mercury and minimizing mercury accumulation in wildlife and humans, and (4) consider future directions for mercury monitoring and research on DOI lands. The workshop focused on mercury research as it relates to DOI resource-management issues primarily in the eastern part of the USA (east of the Mississippi River). Topics included the influence of ecosystem setting on mercury biogeochemical transformation, land- and air-management practices as they affect mercury in the environment, mercury source issues, and effects of mercury on humans and wildlife. Mercury research topics were addressed by 24 invited oral presentations and 30 contributed posters. The perspectives of the DOI bureaus and land managers were addressed through a panel of scientists from the DOI resource-management bureaus and a Chippewa Indian Tribe of Minnesota. Discussion at the conclusion of the workshop was directed toward goals and long-term strategies for mercury research that will benefit DOI resource management.
NTIS
*Conferences; Geological Surveys; Resources Management; Mercury (Metal)*

**20080018485** Chemimage Corp., Pittsburgh, PA, USA
**Spectroscopic Methods for Component Particle Analysis**
Nelson, M. P., Inventor; Treado, P., Inventor; Attanucci, J., Inventor; Mar. 28, 2005; 85 pp.; In English
Contract(s)/Grant(s): NIST-70NANB8H4021
Patent Info.: Filed Filed 28 Mar 05; US-Patent-Appl-SN-11-091 126
Report No.(s): PB2007-111870; No Copyright; Avail.: CASI: A05, Hardcopy

The invention relates to methods of assessing one or more geometric properties of a particle of a substance using an infrared spectroscopic property of the substance. The method is useful, for example, for assessing particle sizes and size distributions in mixtures containing both particles of the substance and other materials.
NTIS
*Patent Applications; Spectroscopy; Infrared Spectroscopy*

**20080018488** Steptoe and Johnson LLP, Washington, DC, USA
**Microspheres Including Nanoparticles**
Chan, Y. T., Inventor; Zimmer, J. P., Inventor; Bawendi, M. G., Inventor; Jul. 26, 2004; 20 pp.; In English
Contract(s)/Grant(s): NSF-DMR-98-1328; NSF-CRC-CHE-020898
Patent Info.: Filed Filed 26 Jul 04; US-Patent-Appl-SN-10-898 554
Report No.(s): PB2007-111841; No Copyright; Avail.: CASI: A03, Hardcopy

A microparticle can include a central region and a peripheral region. The peripheral region can include a nanoparticle, such as a metal nanoparticle, a metal oxide nanoparticle, or a semiconductor nanocrystal. The microparticle can be a member of a monodisperse population of particles.
NTIS
*Chromophores; Microparticles; Nanoparticles; Nanostructure (Characteristics)*

**20080018496** Department of Energy, Aiken, SC, USA
**Baseline Membrane Selection and Characterization for an SDE**
Colon-Mercado, H. R.; Hobbs, D. T.; Apr. 01, 2007; 26 pp.; In English
Report No.(s): DE2007-907767; WSRC-STI-2007-00172; No Copyright; Avail.: National Technical Information Service (NTIS)

Thermochemical processes are being developed to provide global-scale quantities of hydrogen. A variant on sulfur-based thermochemical cycles is the Hybrid Sulfur (HyS) Process which uses a sulfur dioxide depolarized electrolyzer (SDE) to produce the hydrogen. In FY05 and FY06, testing at the Savannah River National Laboratory (SRNL) explored a low temperature fuel cell design concept for the SDE. The advantages of this design concept include high electrochemical efficiency and small footprint that are crucial for successful implementation on a commercial scale.
NTIS
*Characterization; Electrolysis; Membranes; Sulfur Dioxides*

**20080018500** Wisconsin Univ., Madison, WI, USA

**Catalysis Science Initiative: From First Principles Design to Realization of Bimetallic Catalysts for Enhanced Selectivity**

Mavrikakis, M.; Dumesic, J. A.; Jan. 01, 2006; 18 pp.; In English

Contract(s)/Grant(s): DE-FG02-03ER15469

Report No.(s): DE2007-902903; No Copyright; Avail.: Department of Energy Information Bridge

In this project, we have integrated state-of-the-art Density Functional Theory (DFT) models of heterogeneous catalytic processes with high-throughput screening of bimetallic catalytic candidates for important industrial problems. We have studied a new class of alloys characterized by a surface composition different from the bulk composition, and investigated their stability and activity for the water-gas shift reaction and the oxygen reduction reaction. The former reaction is an essential part of hydrogen production; the latter is the rate-limiting step in low temperature H2 fuel cells. We have identified alloys that have remarkable stability and activity, while having a much lower material cost for both of these reactions.

NTIS

*Bimetals; Catalysis; Catalysts; Chemical Composition*

**20080018537** Massachusetts Univ., Boston, MA USA

**Crystalline Membranes**

Tsapatsis, Michael, Inventor; Lai, Zhiping, Inventor; April 15, 2008; 25 pp.; In English

Contract(s)/Grant(s): NAG8-1697

Patent Info.: Filed March 5, 2004; US-Patent-7,357,836; US-Patent-Appl-SN-10/794,483; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018537

In certain aspects, the invention features methods for forming crystalline membranes (e.g., a membrane of a framework material, such as a zeolite) by inducing secondary growth in a layer of oriented seed crystals. The rate of growth of the seed crystals in the plane of the substrate is controlled to be comparable to the rate of growth out of the plane. As a result, a crystalline membrane can form a substantially continuous layer including grains of uniform crystallographic orientation that extend through the depth of the layer.

Official Gazette of the U.S. Patent and Trademark Office

*Membrane Structures; Crystal Growth; Zeolites*

**20080018602** Department of Energy, Washington, DC USA

**Combinatorial Approach for the Discovery of New Scintillating Materials. SBIR Phase I**

January 2006; 21 pp.; In English

Report No.(s): DE2007-889816; DOE/ER/84310; No Copyright; Avail.: Department of Energy Information Bridge

The combinatorial approach for the discovery of new scintillating materials has been investigated using the wet-chemical (sol-gel) synthesis methods. Known scintillating compounds Lu2SiO5 (LSO) and (LuAl)O3 (LAO) and solid solutions in the systems of Lu2O3-Y2O3--SiO2 (CeO2-doped) (LYSO) and Lu2O3 -Y2O3--Al2O3 (CeO2 doped) (LYAO) were synthesized from sol-gel precursors. Sol-gel precursors were formulated from alkoxides and nitrates and acetates of the cations. Sol-gel solution precursors were formulated for the printing of microdot arrays of different compositions in the above oxide systems. Microdot arrays were successfully printed on C-cut and R-cut sapphire substrates using Biodot printer at Los Alamos National Laboratory (LANL). The microdot arrays were adherent and stable after heat-treating at 1665 degrees C and had an average thickness of around 2 micron. X-ray fluorescence elemental mapping showed the arrays to be of the correct chemical composition. Sintered microdots were found to be highly crystalline by microscopic observation and X-ray diffraction. Scintillation was not clearly detectable by visual observation under UV illumination and by video observation under the scanning electron beam of an SEM. The microdots were either poorly scintillating or not scintillating under the present synthesis and testing conditions.

NTIS

*Combinatorial Analysis; Doped Crystals; Scintillation; Sol-Gel Processes*

**20080018667** Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA

**Antimicrobial Mesoporous Silica Nanoparticles**

Shang-Yi Lin, V., Inventor; Trewyn, B. G., Inventor; Hub, S., Inventor; Whitman, C. M., Inventor; Sep. 20, 2004; 22 pp.; In English

Contract(s)/Grant(s): NSF-CHE-0239570

Patent Info.: Filed Filed 20 Sep 04; US-Patent-Appl-SN-10-945 545
Report No.(s): PB2007-108839; No Copyright; Avail.: CASI: A03, Hardcopy

Methods for preparing a series of mesoporous silicates, such as room-temperature ionic liquid (RTIL)-templated mesoporous silicate particles, with various particle morphologies are provided. Methods for preparing silicate particles with antimicrobial agents within the MSN pores is also provided. The particles can be used as controlled-release nanodevices to deliver antimicrobial agents.

NTIS

*Antibiotics; Antiinfectives and Antibacterials; Nanoparticles; Silicates; Silicon Dioxide*

**20080018670** Townsend and Townsend and Crew, LLP, San Francisco, CA, USA; California Inst. of Tech., Pasadena, CA, USA

**Microfluidic Protein Crystallography**

Hansen, C. L., Inventor; Sommer, M., Inventor; Quake, S. R., Inventor; Dec. 06, 2004; 123 pp.; In English
Contract(s)/Grant(s): NIH-CA-77373; NSF-CTS-0088649
Patent Info.: Filed Filed 6 Dec 04; US-Patent-Appl-SN-11-006 522
Report No.(s): PB2007-104800; No Copyright; Avail.: CASI: A06, Hardcopy

The use of microfluidic structures enables high throughput screening of protein crystallization. In one embodiment, an integrated combinatoric mixing chip allows for precise metering of reagents to rapidly create a large number of potential crystallization conditions, with possible crystal formations observed on chip. In an alternative embodiment, the microfluidic structures may be utilized to explore phase space conditions of a particular protein crystallizing agent combination, thereby identifying promising conditions and allowing for subsequent focused attempts to obtain crystal growth.

NTIS

*Crystallography; Microfluidic Devices; Patent Applications; Proteins*

**20080018703**

**Modeling Pitting and Corrosion Phenomena By Eddy-Current Volume-Integral Equations (Postprint)**

Sabbagh, Harold A; Sabbagh, Elias H; Murphy, R K; Aldrin, John C; Lindgren, Eric; Knopp, Jeremy S; Mar 2007; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476940; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476940

A wide variety of problem in computational electromagnetics has been successfully solved using a volume-integral approach along with conjugate-gradient methods. In the arena of quantitative nondestructive evaluation (NDE) of nuclear-power and aerospace structures, the problem of modeling pitting and corrosion phenomena is particularly challenging. Based on real corrosion pits in heat-exchanger tubes in nuclear power plants, and manufactured pits in aircraft structures, we develop general models that are suitable for the analysis using VIC-3D , a proprietary volume-integral code. Based on these models, we develop the notion of model-based inversion, and apply it to the NDE of corrosion and pitting phenomena.

DTIC

*Corrosion; Eddy Currents; Integral Equations; Nondestructive Tests; Pitting*

**20080018814** NASA, Washington, DC USA

**Oxidation-reduction catalyst and its process of use**

Jordan, Jeffrey D., Inventor; Watkins, Anthony Neal, Inventor; Schryer, Jacqueline L., Inventor; Oglesby, Donald M., Inventor; January 15, 2008; 8 pp.; In English
Patent Info.: Filed January 13, 2003; US-Patent-7,318,915; US-Patent-Appl-SN-10/342,660; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018814

This invention relates generally to a ruthenium stabilized oxidation-reduction catalyst useful for oxidizing carbon monoxide, and volatile organic compounds, and reducing nitrogen oxide species in oxidizing environments, substantially without the formation of toxic and volatile ruthenium oxide species upon said oxidizing environment being at high temperatures.

Official Gazette of the U.S. Patent and Trademark Office

*Carbon Monoxide; Oxidation; Ruthenium; Volatile Organic Compounds*

**20080018890** Centre National de la Recherche Scientifique, France
**Interaction of Reactive Gas Flows and Ceramics at High Temperature - Experimental Methods for the Measurement of Species Recombination during Planetary Entry**
Balat-Pichelin, Marianne; Feb 2006; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476461; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476461
No abstract available
*Atmospheric Entry; Ceramics; Gas Flow; High Temperature; Reactivity; Surface Reactions; Thermochemistry*

**20080018935** Kushman (Brooks), P.C., Southfield, MI, USA
**Isoreticular Metal-Organic Frameworks, Process for Forming the Same, and Systematic Design of Pore Size and Functionality Therein, with Application for Gas Storage**
Yaghi, O. M., Inventor; Eddaoudi, M., Inventor; Li, H., Inventor; Kim, J., Inventor; Rosi, N., Inventor; 2 May 05; 72 pp.; In English
Contract(s)/Grant(s): NSF-DMR-9980469; DE-FG02-99ER15000
Patent Info.: Filed Filed 2 May 05; US-Patent-Appl-SN-11-119 563
Report No.(s): PB2007-111917; No Copyright; Avail.: CASI: A04, Hardcopy
The ability to design and construct solid-state materials with pre-determined structures is a grand challenge in chemistry. An inventive strategy based on reticulating metal ions and organic carboxylate links into extended networks has been advanced to a point that has allowed the design of porous structures in which pore size and functionality can be varied systematically. MOF-5, a prototype of a new class of porous materials and one that is constructed from octahedral Zn--O--C clusters and benzene links, was used to demonstrate that its 3-D porous system can be functionalized with the organic groups, --Br, --NH2, --OC(sub 3)H(sub 7), --OC(sub 5)H(sub 11), --H(sub 4)C(sub 2), and --H(sub 4)C(sub 4), and its pore size expanded with the long molecular struts biphenyl, tetrahydropyrene, pyrene, and terphenyl. The ability to direct the formation of the octahedral clusters in the presence of a desired carboxylate link is an essential feature of this strategy, which resulted in the design of an isoreticular (having the same framework topology) series of sixteen well-defined materials whose crystals have open space representing up to 91.1% of the crystal volume, and homogeneous periodic pores that can be incrementally varied from 3.8 to 28.8 angstroms.
NTIS
*Organometallic Compounds; Patent Applications; Porosity; Porous Materials*

## 26
## METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

**20080018179** Pennsylvania State Univ., University Park, PA USA
**Development of Ceramics with Highly Organized Microstructures**
Messing, Gary; Trolier-McKinstry, Susan; Mar 2007; 32 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0185
Report No.(s): AD-A476608; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476608
Enhanced spatial control of microstructure development during sintering allows for access to finely engineered properties in ceramics. Predominately single phase ceramics with highly organized microstructures have been fabricated in two different systems: Al(2)O(3) and BaTiO(3). In the Al(2)O(3) system, samples were processed with a focus on spatial control of microstructure development. Distinct regions of different grain sizes, degree of texture, and single crystal were fabricated in situ within single samples. The size scale (down to approx. 5 m), morphology, periodicity, and connectivity of these regions were controlled during fabrication using conventional ceramic processing techniques. In the BaTiO(3) system, a different approach was taken. Patterned microstructures were obtained using two different photolithography based techniques. Grain growth enhancing dopants were patterned on the surface and subsequent heat treatments result in periodic regions of randomly oriented large grains. For the other approach, a patterned single crystal was used as local templates for solid state conversion

of the polycrystal. In this experiment, significant growth of the single crystal regions (more than 0.5 mm in depth) was achieved in the presence of modest matrix coarsening.
DTIC
*Ceramics; Microstructure*

**20080018193** Texas Univ., Austin, TX USA
**Physics and Cyber-Enabled Manufacturing Process Control**
Casey, P J; Booth, Cameron; Beaman, Joseph; Mok, Al; Feb 2008; 3 pp.; In English
Contract(s)/Grant(s): N00014-07-1-1133
Report No.(s): AD-A476674; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476674

The objective of the project is to be able to predict welding failures in real time and correct them as quickly as possible. This will be a drastic shift from the current statistically controlled manufacturing to dynamic model based manufacturing control.
DTIC
*Arc Welding; Manufacturing; Physics; Predictions; Welding*

**20080018256** Southwest Research Inst., San Antonio, TX USA
**DoD Coalescer Qualifications to MIL-F-52308F and MIL-F-8901E**
Bessee, Gary B; Dec 2007; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAE-07-99-C-L053; Proj-SWRI-08.03227.44
Report No.(s): AD-A476690; TFLRF-390; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476690

Candidate DoD aviation fuel filters were qualified per MIL-F-8901E and MIL-F-52308F. The specifications were revised due to materials no longer being produced. The candidate elements failed the qualification.
DTIC
*Aircraft Fuels; Coalescing; Contaminants; Fluid Filters; Performance Tests; Qualifications; Separators; Water*

**20080018324** Naval Surface Weapons Center, Silver Spring, MD USA
**Investigation of the Reaction of Aluminum-Lithium Alloy With Water by the Exploding Wire Technique**
Lee, Woong-Moo; Ford, Richard D; Dec 1, 1986; 36 pp.; In English
Report No.(s): AD-A476876; NSWC-TR-86-78; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476876

The chemical reactivity of an aluminum-lithium alloy with water was studied by the exploding wire technique. The reactivity was measured by the amount of hydrogen gas product vs the dissipated energy (heat) through the alloy wire. The results show that a small concentration of Li (2.5 weight%) in the alloy has a profound effect on the reactivity. The amount of the dissipated energy through wire was controlled by using crowbar switch current interruptor. The higher reactivity of the alloy wire was observed in the following aspects: The alloy wire with an input energy of 4 kj/gm, reacts with the water almost completely, whereas aluminum wire requires an input energy of 10 kj/gm to complete the reaction. The alloy wire exploded at a lower temperature than aluminum wire provided that their initial heating rates were the same. The input energy that contributes to the chemical conversion of the wire material was supplied through heating during a very short time span, approximately 15 microseconds for the alloy wire and 30 microseconds for aluminum wire.
DTIC
*Aluminum; Aluminum-Lithium Alloys; Exploding Wires; Hydrogen; Lithium Alloys; Water*

**20080018571** NASA Glenn Research Center, Cleveland, OH, USA
**Moisture-Induced Delamination Video of an Oxidized Thermal Barrier Coating**
Smialek, James L.; Zhu, Dongming; Cuy, Michael D.; April 2008; 15 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.16.02
Report No.(s): NASA/TM-2008-215210; E-16484; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018571

PVD TBC coatings were thermally cycled to near-failure at 1150 C. Normal failure occurred after 200 to 300 1-hr cycles

with only moderate weight gains (0.5 mg/sq cm). Delamination and buckling was often delayed until well after cooldown (desktop spallation), but could be instantly induced by the application of water drops, as shown in a video clip which can be viewed by clicking on figure 2 of this report. Moisture therefore plays a primary role in delayed desktop TBC failure. Hydrogen embrittlement is proposed as the underlying mechanism.
Author
*Thermal Control Coatings; Oxidation; Heat Resistant Alloys; Hydrogen Embrittlement; Moisture; Delaminating*

**20080018598** Oak Ridge National Lab., TN USA; Pennsylvania State Univ., University Park, PA, USA
**Effect of Impurities on the Processing of Aluminum Alloys. Report for September 15, 2002 to September 14, 2006**
Jul. 2006; 75 pp.; In English
Contract(s)/Grant(s): DE-AC36-02ID14403
Report No.(s): DE2007-902504; No Copyright; Avail.: National Technical Information Service (NTIS)

For this Aluminum Industry of the Future (IOF) project, the effect of impurities on the processing of aluminum alloys was systematically investigated. The work was carried out as a collaborative effort between the Pennsylvania State University and Oak Ridge National Laboratory. Industrial support was provided by ALCOA and ThermoCalc, Inc. The achievements described below were made. A method that combines first-principles calculation and calculation of phase diagrams (CALPHAD) was used to develop the multicomponent database Al-Ca-K-Li-Mg-Na. This method was extensively used in this project for the development of a thermodynamic database. The first-principles approach provided some thermodynamic property data that are not available in the open literature. These calculated results were used in the thermodynamic modeling as experimental data. Some of the thermodynamic property data are difficult, if not impossible, to measure. The method developed and used in this project allows the estimation of these data for thermodynamic database development. The multicomponent database Al-Ca-K-Li-Mg-Na was developed. Elements such as Ca, Li, Na, and K are impurities that strongly affect the formability and corrosion behavior of aluminum alloys. However, these impurity elements are not included in the commercial aluminum alloy database. The process of thermodynamic modeling began from Al-Na, Ca-Li, Li-Na, K-Na, and Li-K sub-binary systems. Then ternary and higher systems were extrapolated because of the lack of experimental information. Databases for five binary alloy systems and two ternary systems were developed.
NTIS
*Aluminum Alloys; Impurities; Temperature Measurement*

**20080018599** Michigan Technological Univ., Houghton, MI, USA
**Microwave Assisted Electrolyte Cell for Primary Aluminum Production. Report for September 2002 through March 2006**
Apr. 18, 2007; 71 pp.; In English
Contract(s)/Grant(s): DE-FC36-02ID14402
Report No.(s): DE2007-902390; No Copyright; Avail.: National Technical Information Service (NTIS)

This research addresses the high priority research need for developing inert anode and wetted cathode technology, as defined in the Aluminum Industry Technology Roadmap and Inert Anode Roadmap, with the performance targets: (a) significantly reducing the energy intensity of aluminum production, (b) ultimately eliminating anode-related CO2 emissions, and (c) reducing aluminum production costs. This research intended to develop a new electrometallurgical extraction technology by introducing microwave irradiation into the current electrolytic cells for primary aluminum production. This technology aimed at accelerating the alumina electrolysis reduction rate and lowering the aluminum production temperature, coupled with the uses of nickel based superalloy inert anode, nickel based superalloy wetted cathode, and modified salt electrolyte. Michigan Technological University, collaborating with Cober Electronic and Century Aluminum, conducted bench-scale research for evaluation of this technology. This research included three sub-topics: (a) fluoride microwave absorption; (b) microwave assisted electrolytic cell design and fabrication; and (c) aluminum electrowinning tests using the microwave assisted electrolytic cell.
NTIS
*Aluminum; Electrolytic Cells; Microwaves; Anodes; Metallurgy*

**20080018756** Virginia Tech Intellectual Properties, Inc., Blacksburg, VA USA
**Endohedral Metallofullerene Derivatives**
Dorn, Harry C., Inventor; Iezzi, Erick B., Inventor; Duchamp, James, Inventor; April 15, 2008; 8 pp.; In English
Contract(s)/Grant(s): NCC1-01044

Patent Info.: Filed September 17, 2002; US-Patent-7,358,343; US-Patent-Appl-SN-10/244,747; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018756

Trimetallic nitride endohedral metallofullerene derivatives and their preparation are described. The trimetallic nitride endohedral metallofullerene derivatives have the general formula A(sub 3-n)X(sub n)\@C(sub m)(R) where n ranges from 0 to 3, A and X may be trivalent metals and may be either rare earth metal or group IIIB metals, m is between about 60 and about 200, and R is preferably an organic group. Derivatives where the R group forms cyclized derivatives with the fullerene cage are also described.
Official Gazette of the U.S. Patent and Trademark Office
*Fullerenes; Metal Nitrides*

**20080018821** Iowa State Univ. Research Foundation, Inc., Ames, IA USA
**Cobalt ferrite based magnetostrictive materials for magnetic stress sensor and actuator applications**
Jiles, David C., Inventor; Paulsen, Jason A., Inventor; Snyder, John E., Inventor; Lo, Chester C. H., Inventor; Ring, Andrew P., Inventor; Bormann, Keith A., Inventor; February 5, 2008; 18 pp.; In English
Contract(s)/Grant(s): NAG1-02098
Patent Info.: Filed July 23, 2004; US-Patent-7,326,360; US-Patent-Appl-SN-10/527,660; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018821

Magnetostrictive material based on cobalt ferrite is described. The cobalt ferrite is substituted with transition metals (such manganese (Mn), chromium (Cr), zinc (Zn) and copper (Cu) or mixtures thereof) by substituting the transition metals for iron or cobalt to form substituted cobalt ferrite that provides mechanical properties that make the substituted cobalt ferrite material effective for use as sensors and actuators. The substitution of transition metals lowers the Curie temperature of the material (as compared to cobalt ferrite) while maintaining a suitable magnetostriction for stress sensing applications.
Official Gazette of the U.S. Patent and Trademark Office
*Cobalt; Ferrites; Magnetic Materials; Magnetostriction; Transition Metals; Mechanical Properties*

**20080018857** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
**Magnetic Clutter Reduction Efficiency in Humanitarian Demining**
Schoolderman, A. J.; Rieter-Barrel, Y.; February 2008; 86 pp.; In English; Original contains color and black and white illustrations
Report No.(s): TD2008-0021; TNO-DV 2008 A064; Copyright; Avail.: Other Sources

The aim of the project was to quantify the efficiency increase obtained by using hand-held permanent magnets (- tools) to remove metallic clutter from the top layer of the ground in the ‘close-in’ detection phase of humanitarian demining operations. Therefore, three successive trials were executed in live demining operations in Cambodia and Angola. Four magnet(-tools) were chosen for the trials: a ring magnets and a block magnet and two rakes with magnets, one with rigid and one with flexible tines. The local deminers acted as operators of the magnet(-tools). The cleared area per day per deminer was compared for deminers working with and without magnet(-tools). The ring magnet is the most popular tool among the deminers due to its strength and is believed to increase the efficiency of humanitarian demining and make demining easier. However, the data did not show an efficiency increase. The deminers in the reference group cleared a larger area than the deminers using the magnet(-tool) but also found less metallic clutter. This effect may either be caused by inhomogeneous metal distributions in the demining lanes. It is also possible the deminers in the reference group did not find and clear all metallic clutter from their demining lanes.
Author
*Clutter; Magnets; Mines (Ordnance)*

**20080018904** Massachusetts Univ., USA
**Anomalies in the Thermophysical Properties of Undercooled Glass-Forming Alloys**
Hyers, Robert W.; Rogers, Jan R.; Kelton, Kenneth F.; Gangopadhyay, Anup; February 09, 2008; 1 pp.; In English; The Minerals, Metals and Materials Society, 2008 Annual Meeting, 9-13 Mar. 2008, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

The surface tension, viscosity, and density of several bulk metallic glass-forming alloys have been measured using noncontact techniques in the electrostatic levitation facility (ESL) at NASA Marshall Space Flight Center. All three properties

show unexpected behavior in the undercooled regime. Similar deviations were previously observed in titanium-based quasicrystal-forming alloys,but the deviations in the properties of the glass-forming alloys are much more pronounced. New results for anomalous thermophysical properties in undercooled glass-forming alloys will be presented and discussed.
Author
*Anomalies; Metallic Glasses; Thermophysical Properties; Alloys; Supercooling*

## 27
## 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*.

**20080018172** Michigan Univ., Ann Arbor, MI USA
**High Reynolds Number Micro-Bubble and Polymer Drag Reduction Experiments**
Ceccio, Steven L; Dowling, David R; Perlin, Marc; Solomon, Michael; Jan 2008; 183 pp.; In English
Contract(s)/Grant(s): HR0011-04-1-001
Report No.(s): AD-A476591; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476591

This effort was a continuation of the joint ONR and DARPA programs of the PI and Co-PI's, initiated as part of the DARPA Friction Drag Reduction Program (ATO/TTO). The purpose of the investigation was to examine the physics and engineering of friction drag reduction methods for turbulent boundary layers (TBL) found in hydrodynamic flows. Three methods of friction drag reduction (FDR) were examined: * Polymer Drag Reduction * Micro-bubble Drag Reduction * Air Layer Drag Reduction.
DTIC
*Bubbles; Drag Reduction; Friction Drag; High Reynolds Number; Polymers; Reynolds Number*

**20080018173** Michigan Univ., Ann Arbor, MI USA
**Influence of Surface Roughness on Polymer Drag Reduction**
Ceccio, Steven L; Dowling, David R; Perlin, Marc; Solomon, Michael; Nov 30, 2007; 25 pp.; In English
Contract(s)/Grant(s): HR0011-06-1-0057
Report No.(s): AD-A476592; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476592

This effort accompanied the DARPA Friction Drag Reduction Program (ATO/TTO) effort at the University of Michigan funded under contract HR-0011-04-1-001 'High Reynolds Number Micro-bubble and Polymer Drag Reduction Experiments' for flows over smooth surfaces. The details of that effort can be found in the final technical report for that project. The purpose of the additional investigation was to examine the physics and engineering of friction drag reduction methods for turbulent boundary layers (TBL) found in hydrodynamic flows over rough surfaces. Two methods of friction drag reduction (FDR) were examined: * Polymer Drag Reduction * Air Layer Drag Reduction.
DTIC
*Drag Reduction; Friction Drag; Polymers; Surface Roughness*

**20080018259** Army Engineer Research and Development Center, Vicksburg, MS USA
**Implementation of Discontinuous Galerkin Methods for the Level Set Equation on Unstructured Meshes**
Farthing, Matthew W; Kees, Christopher E; Jan 2008; 15 pp.; In English
Report No.(s): AD-A476699; ERDC/CHL-CHETN-XIII-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476699

Level set methods are often used to capture interface behavior in two-phase, incompressible flow models. While level set techniques for structured computational grids have been widely investigated, approaches for unstructured meshes are less mature. This report details the formulation and implementation of a discontinuous Galerkin-based approach that is suitable for unstructured meshes and offers potential gains in accuracy and efficiency over more traditional level set techniques.
DTIC
*Equations; Galerkin Method; Navier-Stokes Equation; Unstructured Grids (Mathematics)*

**20080018418** Department of the Navy, Washington, DC USA
**Activation Energy Measurement Method**
Ramotowski, Thomas S, Inventor; Jan 30, 2008; 9 pp.; In English
Report No.(s): AD-D020321; No Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/100.2/ADD020321

A method for computing activation energy of diffusion for a material in a liquid is provided. At least two identical samples of the material are submerged in the liquid at different temperatures. The time required for each sample to reach a goal weight percentage is measured. A reaction acceleration factor is computed for the two samples from the resulting times and temperatures. Activation energy of diffusion is computed from the reaction acceleration factor and the temperatures. Additional samples can be used to give an error estimate.
DTIC
*Activation Energy; Coatings; Diffusion; Energy Methods; Liquids; Polymers*

**20080018477** General Electric Co., Arlington, VA, USA
**High Integrity Protective Coatings**
Kim, T. W., Inventor; Yan, M., Inventor; Heller, C. M. A., Inventor; Schaepkens, M., Inventor; Gorczyca, T. B., Inventor; Nov. 15, 2004; 20 pp.; In English
Contract(s)/Grant(s): DOD-RFPD1-63GE
Patent Info.: Filed Filed 15 Nov 04; US-Patent-Appl-SN-10 988 481
Report No.(s): PB2007-109443; No Copyright; Avail.: CASI: A03, Hardcopy

A composite article with at least one high integrity protective coating, the high integrity protective coating having at least one planarizing layer and at least one organic-inorganic composition barrier coating layer. A method for depositing a high integrity protective coating.
NTIS
*Patent Applications; Protective Coatings*

**20080018507** Defence Science and Technology Organisation, Edinburgh, Australia
**Constitutive Modelling of the Shock Behaviour of a Highly Porous Material**
Resnyansky, A D; Jul 2007; 44 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476590; DSTO-TR-2026; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476590

The report studies the constitutive behaviour of highly porous materials. This study is driven by efforts for the development and validation of a multi-phase modelling capability in DSTO, which aims at an enhanced evaluation of blast mitigation by porous materials. A two-phase model is employed for the description of a porous material, for which experimental shock velocity data are widely available in literature. The method deriving Hugoniots from the shock velocity data is critically approached. The importance of the non-equilibrium behaviour analysis is demonstrated, and it is shown that the stress or velocity profiles need to be considered, using relevant experiments% and constitutive modelling. It is argued that the apparent anomalous behaviour of the Hugoniots of a highly porous material might be caused by misinterpretation of the experimental data.
DTIC
*Porous Materials; Stress Distribution; Velocity Distribution*

**20080018669** Fulbright and Jaworski, LLP, Austin, TX, USA; Iowa Univ., Iowa City, IA, USA; Department of Veterans Affairs, Washington, DC, USA
**Gallium Inhibits Biofilm Formation**
Britigan, B. E., Inventor; Singh, P. K., Inventor; Dec. 03, 2004; 23 pp.; In English
Contract(s)/Grant(s): NIH-R01-A1-34954; NIH-KO8HL-041173
Patent Info.: Filed Filed 3 Dec 04; US-Patent-Appl-SN-11-004 049
Report No.(s): PB2007-108837; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention provides a gallium-containing composition for coating/impregnating a device or device surface to

prevent biofilm growth formation. The present invention also provides a method of preventing or inhibiting biofilm growth formation. The present invention also provides methods for killing established biofilms.
NTIS
*Bacteria; Biofilms; Gallium; Inhibitors; Patent Applications*

**20080018690** NASA Langley Research Center, Hampton, VA, USA
**Commercialization of LARC(TradeMark)-SI Polyimide Technology**
Bryant, Robert G.; May 04, 2008; 3 pp.; In English; POLYCOM 2008, 4-7 May 2008, Galveston, TX, USA
Contract(s)/Grant(s): WBS 877868.02.07.07.05; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018690

LARC(TradeMark)-SI, Langley Research Center-Soluble Imide, was developed in 1992. This new polyimide won a 1995 Research and Development 100 Award, with the first patent issuing in 1997 and subsequent issued patents in 1998 and 2000. Currently, this polymer has been successfully licensed by NASA, and has generated revenues in excess of 1.4 million dollars. This might seem insignificant in comparison to industrially developed technology, where the customer is understood, technologies that use a novel assembly of commercial off the shelf (COTS) components, or software patents and 'method based' innovations that do not require any material beyond labor, as examples. However, consider that LARC(TradeMark)-SI competes in areas currently dominated by traditional materials at a cost disadvantage ($350/lb) and that the physical-mechanical properties of LARC(TradeMark)-SI are similar to other high performance polymers. Indeed the success of this particular polymer was due to many factors and many lessons learned to the point that the invention was the most important, but least significant part in the commercialization of this material. This brief paper outlines the significant factors that occurred to make this technology available for the public access and application development that led to the licensing success of this material.
Author (revised)
*Polyimides; Research and Development; Commercialization*

**20080018712** National Inst. of Aerospace, Hampton, VA, USA
**State of the Art Assessment of Simulation in Advanced Materials Development**
Wise, Kristopher E.; May 2008; 23 pp.; In English
Contract(s)/Grant(s): WBS 561581.02.08.07.15.02
Report No.(s): NASA/TM-2008-215118; L-19457; Copyright; Avail.: CASI: A03, Hardcopy

Advances in both the underlying theory and in the practical implementation of molecular modeling techniques have increased their value in the advanced materials development process. The objective is to accelerate the maturation of emerging materials by tightly integrating modeling with the other critical processes: synthesis, processing, and characterization. The aims of this report are to summarize the state of the art of existing modeling tools and to highlight a number of areas in which additional development is required. In an effort to maintain focus and limit length, this survey is restricted to classical simulation techniques including molecular dynamics and Monte Carlo simulations.
Author
*Molecular Dynamics; Monte Carlo Method; Simulation; Polymers; Nanocomposites*

## 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*.

**20080018116** Pennsylvania State Univ., University Park, PA USA
**Advanced Thermally Stable Coal-Based Jet Fuels**
Schobert, Harold; Feb 2008; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-99-1-0290
Report No.(s): AD-A476475; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476475

This report summarizes briefly the key results of a project for the development of coal based jet fuel. The initial focus of the project was the development of a high heat sink fuel, JP 900, that could be used for thermal management as well as

for propulsion energy. In the last year the focus shifted to development of a coal-based drop-in replacement for JP-8. Prototype fuel from hydrogenation of a mixture of light cycle oil and refined chemical oil met or exceeded all but four JP-8 specifications. The fuel has excellent low-temperature viscosity behavior and 0-ring seal swell comparable to JP-8. Deposition from thermal stressing of the fuel in various reactors was invariably lower than JP-8 or JP-8+1OO. Mechanisms of oxidative deposit formation for both jet and diesel fuels are proposed to account for the fact that the chemistry involved in both storage and thermal oxidative deposit formation in middle distillates is similar. The fuel was successfully tested in a T63 turboshaft engine, with emissions only slightly greater than JP-8. Well over a hundred publications resulted from the seven-year project period.
DTIC
*Coal; Combustion; Detonation; Jet Engine Fuels; Thermal Stability*

**20080018339** Air Univ., Maxwell AFB, AL USA
**Department of Defense and Energy Independence: Optimism Meets Reality**
Blackwell, Kristine E; Apr 2007; 73 pp.; In English
Report No.(s): AD-A476926; AU/AFF/NNN/2007-04; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476926

The Department of Defense (DOD) is at the center of the nation's discussion about national energy security. DOD, the largest single consumer of fuel in the USA, recognizes that it plays a central role in national efforts to reduce the use of and reliance on fossil fuel. Aviation fuel makes up the largest portion of fossil fuel consumed by DOD and therefore represents the area of greatest potential savings. This report examines DOD s use of aviation fuel, presents options available to reduce that use, discusses relevant issues, and concludes with an analysis of the challenges DOD and the Air Force faces in becoming less reliant on fossil fuel. Reducing DOD's consumption of aviation fuel could by itself significantly reduce the department's overall reliance on fossil fuel. In Fiscal Year 2005, DOD consumed roughly 125 million barrels of oil approximately 1.2% of the nation's total. About 74% of that was used to power mobility vehicles Air Force aircraft, Navy ships, and Army ground vehicles. Over half roughly 52% was aviation fuel. There are several ways in which DOD can reduce its use of fossil-based aviation fuel. Each has advantages and disadvantages and no single option provides the perfect solution. Advanced technologies, such as synthetic fuels, offer potential alternatives but further development and study are required before DOD can employ them on a large scale. DOD can also take measures to decrease its use of fuel. Possible options include upgrading aircraft engines and modifying operational procedures. Many of these measures, however, are costly and must compete for funding with other operational priorities. DOD has expended significant resources in the past year to address its reliance on fossil fuels but risks jeopardizing its progress due to the lack of centralized leadership and a comprehensive corporate strategy.
DTIC
*Aircraft Fuels; Defense Program; Fossil Fuels; Fuel Cells; Fuel Consumption; Security; Synthetic Fuels*

**20080018472** NASA Glenn Research Center, Cleveland, OH, USA
**Alternate Fuels for Use in Commercial Aircraft**
Daggett, David L.; Hendricks, Robert C.; Walther, Rainer; Corporan, Edwin; April 2008; 21 pp.; In English; 18th ISABE Conference (ISABE 2007), 2-9 Sept. 2007, Beijing, China; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.16.03
Report No.(s): NASA/TM--2008-214833; ISABE-2007-1196; E-16044-1; Copyright; Avail.: CASI: A03, Hardcopy

The engine and aircraft Research and Development (R&D) communities have been investigating alternative fueling in near-term, midterm, and far-term aircraft. A drop in jet fuel replacement, consisting of a kerosene (Jet-A) and synthetic fuel blend, will be possible for use in existing and near-term aircraft. Future midterm aircraft may use a biojet and synthetic fuel blend in ultra-efficient airplane designs. Future far-term engines and aircraft in 50-plus years may be specifically designed to use a low- or zero-carbon fuel. Synthetic jet fuels from coal, natural gas, or other hydrocarbon feedstocks are very similar in performance to conventional jet fuel, yet the additional CO2 produced during the manufacturing needs to be permanently sequestered. Biojet fuels need to be developed specifically for jet aircraft without displacing food production. Envisioned as midterm aircraft fuel, if the performance and cost liabilities can be overcome, biofuel blends with synthetic jet or Jet-A fuels have near-term potential in terms of global climatic concerns. Long-term solutions address dramatic emissions reductions through use of alternate aircraft fuels such as liquid hydrogen or liquid methane. Either of these new aircraft fuels will require an enormous change in infrastructure and thus engine and airplane design. Life-cycle environmental questions need to be addressed.
Author
*Synthetic Fuels; Aircraft Engines; Commercial Aircraft; Jet Aircraft; Methane; Hydrocarbons; Liquid Hydrogen; Jet Engine Fuels*

**20080018613** NASA Glenn Research Center, Cleveland, OH, USA
**Alternate-Fueled Flight: Halophytes, Algae, Bio-, and Synthetic Fuels**
Hendricks, R. C.; October 18, 2007; 23 pp.; In English; Workshop on Alternate Fueling Sustainable Supply, 18-19 Oct. 2007, Twinsburg, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.16.03; Copyright; Avail.: CASI: A03, Hardcopy

Synthetic and biomass fueling are now considered to be near-term aviation alternate fueling. The major impediment is a secure sustainable supply of these fuels at reasonable cost. However, biomass fueling raises major concerns related to uses of common food crops and grasses (some also called 'weeds') for processing into aviation fuels. These issues are addressed, and then halophytes and algae are shown to be better suited as sources of aerospace fuels and transportation fueling in general. Some of the history related to alternate fuels use is provided as a guideline for current and planned alternate fuels testing (ground and flight) with emphasis on biofuel blends. It is also noted that lessons learned from terrestrial fueling are applicable to space missions. These materials represent an update and additions to the Workshop on Alternate Fueling Sustainable Supply and Halophyte Summit at Twinsburg, OH, Oct. 17 to 18, 2007 (ref. 1).
Author
*Synthetic Fuels; Aircraft Fuels; Refueling; Farm Crops*

**20080018926** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Metallic Hydrogen - Potentially a High Energy Rocket Propellant**
Cole, John; Silvera, Ike; October 26, 2007; 26 pp.; In English; Tennessee Valley Emerging Technology Conference, 26-28 Mar. 2008, Huntsville, AL, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018926

Pure metallic hydrogen is predicted to have a specific impulse (Isp) of 1700 seconds, but the reaction temperature is too high for current engine materials. Diluting metallic hydrogen with liquid hydrogen can reduce the reaction temperature to levels compatible with current material limits and still provide an Isp greater than 900 s. Metallic hydrogen has not yet been produced on earth, but experimental techniques exist that may change this situation. This paper will provide a brief description of metallic hydrogen and the status of experiments that may soon produce detectable quantities of this material in the lab. Also provided are some characteristics for diluted metallic hydrogen engines and launch vehicles.
Author
*High Energy Propellants; Metallic Hydrogen; Single Stage to Orbit Vehicles; Technology Utilization; Launch Vehicles*

## 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*.

**20080018097** CSA Engineering, Inc., Mountain View, CA USA
**Experimental Centrifuge Testing and Analytical Studies of Particle Damping Behavior**
Flint, Eric M; Ruhl, Eric; Olson, Steven E; Jan 2000; 9 pp.; In English
Contract(s)/Grant(s): F33615-98-C-2885
Report No.(s): AD-A476421; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476421

In this paper, analytical and experimental studies of particle damping behavior are discussed. These studies have focused on the development of an analytical model to predict particle damping behavior and on determination of the effects of centrifugal loading on the behavior. An analytical model, based on the particle dynamics method, has been developed and is being correlated with results from experimental testing. A novel test facility is being established which enables laboratory based evaluation of the damping effectiveness of blade-like objects under centrifugal loading. Depending on the test article, this facility will be capable of exposing test specimens to centrifugal accelerations of up to 124,000 G's.
DTIC
*Centrifugal Force; Centrifuges; Damping; Test Facilities*

**20080018127** Department of Defence, Canberra, Australia
**Australian Defence Simulation - Status**
McFarlane, Darren; Kruzins, E; Nov 1, 2006; 47 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476505; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476505
No abstract available
*Australia; Organizations; Simulation*

**20080018138** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium
**Experimental Studies on Hypersonic Stagnation Point Chemical Environment**
Chazot, O; Feb 2006; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476527; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476527
No abstract available
*Boundary Layers; Bow Waves; Heat Transfer; Hypersonic Flight; Hypersonics; Research Facilities; Shock Waves; Stagnation Point*

**20080018349** Army Cold Regions Research and Engineering Lab., Hanover, NH USA
**A Reconnaissance Snow Survey across Northwest Territories and Nunavut, Canada, April 2007**
Sturm, Matthew; Derksen, Chris; Liston, Glen; Silis, Arvids; Solie, Daniel; Holmgren, Jon; Huntington, Henry; Feb 2008; 88 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NSF-ARC-0700233; NSF-ARC-0632131
Report No.(s): AD-A476959; ERDC/CRREL-TR-08-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476959
During April 2007, a coordinated series of snow measurements were made across the Northwest Territories and Nunavut, Canada, during a 4200-km snowmobile traverse from Fairbanks, Alaska, to Baker Lake, Nunavut. While detailed, local snow measurements have been made as part of ongoing studies at tundra field sites in this region (Daring Lake and Trail Valley Creek in the Northwest Territories), systematic measurements at the regional scale have not been previously collected across this region. Consistent with observations of tundra snow in Alaska and northern Manitoba, the snow cover consisted of depth hoar and wind slab with small and ephemeral fractions of new, recent, and icy snow. The snow was shallow (less than 40 cm deep), usually with less than six layers. Where deposited on lake and river ice, the snow was shallower, denser, and more metamorphosed than where deposited on tundra. The snow characteristics were highly variable at a local scale, but no longitudinal gradients in snow distribution, magnitude, or structure were detected. Lakes and lake ice confounded passive microwave remote sensing of the snow cover in this area because the lake signal overwhelmed the snow signal. Consequently, challenges remain in developing methods to monitor this snow cover by satellite. Appendixes present near-infrared images, snow depths, soot measurements, mercury measurements, ion measurements, and isotope measurements.
DTIC
*Canada; Lakes; Measurement; Northwest Territories; Reconnaissance; Rivers; Snow; Surveys; Tundra*

**20080018621** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA; Kentucky Univ., Lexington, KY, USA
**In-Plant Testing of High-Efficiency Hydraulic Separators. Final Project Report July 21, 2003-June 30, 2006**
Luttrell, G. H.; Honaker, R. Q.; Bratton, R. C.; Westerfield, T. C.; Kohmuench, J. N.; Oct. 30, 2006; 109 pp.; In English
Report No.(s): DE2007-907775; No Copyright; Avail.: National Technical Information Service (NTIS)
Hydraulic separators are commonly used for particle size classification and gravity concentration of minerals and coal. Unfortunately, the efficiency of these processes can be quite low due to poor equipment design and variations in feed consistency. To help alleviate these problems, an industry-driven R&D program has been undertaken to develop a new generation of hydraulic separators that are more efficient and less costly to operate and maintain. These units, which are commercially called the CrossFlow separator and HydroFloat separator, have the potential to improve performance (separation efficiency and throughput) and reduce operating costs (power consumption, water and reagent usage). In Phase I of this project, laboratory and pilot-scale test units were evaluated at various industrial sites in both the coal and mineral industries. Based on promising results obtained from Phase I, full-scale prototypes were purchased and installed by a major U.S. phosphate

producer and a large eastern U.S. coal company. The test data obtained from these sites demonstrate that significant performance improvements can be realized through the application of these high-efficiency separators.
NTIS
*Fluid Flow; Separators; Hydraulics*

**20080018701** Iowa State Univ. of Science and Technology, Ames, IA USA
**Toward a Viable Strategy for Estimating Vibrothermographic Probability of Detection (Preprint)**
Holland, Stephen D; Uhl, Christopher; Renshaw, Jeremy; Jul 2007; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-C-5228; Proj-3153
Report No.(s): AD-A476923; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476923

Vibrothermography is a technique for finding cracks and delaminations through infrared imaging of vibration-induced heating. While vibrothermography has shown remarkable promise, it has been plagued by persistent questions about its reproducibility and reliability. Fundamentally, the crack heating is caused by the vibration, and therefore to understand the heating process we must first understand the vibration process. We lay out the problem and begin the first steps toward relating detectability to the local motion around a crack as well as the crack size. A particular mode, the third-order free-free flexural resonance, turns out to be particularly insensitive to the presence of clamping and transducer contact. When this mode is excited in a simple bar geometry the motions of the part follow theoretical calculations quite closely, and a single point laser vibrometer measurement is sufficient to evaluate the motion everywhere. Simple calculations estimate stress and strain anywhere in the bar, and these can then be related to observed crack heating.
DTIC
*Crack Propagation; Detection; Estimating; Nondestructive Tests; Probability Theory; Vibration; Vibration Meters*

**20080018714** NASA Goddard Space Flight Center, Greenbelt, MD, USA
**The NASA Engineering and Safety Center (NESC) GN and C Technical Discipline Team (TDT): Its Purpose, Practices and Experiences**
Dennehy, Cornelius J.; May 2008; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 510505.06.07.03.99
Report No.(s): NASA/TM-2008-215128; L-19471; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018714

This paper will briefly define the vision, mission, and purpose of the NESC organization. The role of the GN&C TDT will then be described in detail along with an overview of how this team operates and engages in its objective engineering and safety assessments of critical NASA projects. This paper will then describe key issues and findings from several of the recent GN&C-related independent assessments and consultations performed and/or supported by the NESC GN&C TDT. Among the examples of the GN&C TDT s work that will be addressed in this paper are the following: the Space Shuttle Orbiter Repair Maneuver (ORM) assessment, the ISS CMG failure root cause assessment, the Demonstration of Autonomous Rendezvous Technologies (DART) spacecraft mishap consultation, the Phoenix Mars lander thruster-based controllability consultation, the NASA in-house Crew Exploration Vehicle (CEV) Smart Buyer assessment and the assessment of key engineering considerations for the Design, Development, Test & Evaluation (DDT&E) of robust and reliable GN&C systems for human-rated spacecraft.
Author
*NASA Programs; Product Development; Technology Assessment; Safety*

**20080018820** NASA, Washington, DC USA
**Devices and methods of operation thereof for providing stable flow for centrifugal compressors**
Skoch, Gary J., Inventor; Stevens, Mark A., Inventor; Jett, Thomas A., Inventor; February 5, 2008; 26 pp.; In English
Patent Info.: Filed May 25, 2004; US-Patent-7,326,027; US-Patent-Appl-SN-10/856,361; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018820

Centrifugal compressor flow stabilizing devices and methods of operation thereof are disclosed that act upon the flow field discharging from the impeller of a centrifugal compressor and modify the flow field ahead of the diffuser vanes such that flow conditions contributing to rotating stall and surge are reduced or even eliminated. In some embodiments, shaped rods and

methods of operation thereof are disclosed, whereas in other embodiments reverse-tangent air injection devices and methods are disclosed.
Official Gazette of the U.S. Patent and Trademark Office
*Centrifugal Compressors; Flow Distribution; Stabilization*

**20080018880** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Balanced Flow Measurement and Conditioning Technology (Balanced Orifice Plate 7,051,765 B1) for NASA Inventions and Contributions Board Invention of the Year Evaluation**
Kelley, Anthony R.; May 16, 2008; 15 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018880

This viewgraph document reviews the Balanced Flow Measurement (BFM) and Conditioning Technology, and makes the case for this as the NASA Invention of the Year. The BFM technology makes use of a thin, multi-hole orifice plate with holes sized and placed per a unique set of equations. It produces mass flow, volumetric flow,kinelic energy,or momentum BALANCE across the face of the plate. The flow is proportional.to the square root of upstream to downstream differential pressure. Multiple holes lead to smoother pressure measurement. Measures and conditions or can limit fluid flow. This innovation has many uses in and out of NASA.
CASI
*Flow Measurement; Fluid Flow; Holes (Mechanics); Mass Flow; Orifices; Perforated Plates*

**20080018907** Dayton Univ. Research Inst., OH USA
**Resonant Frequency Eddy Current Liftoff Measurements for Shot Peening Intensity Assessment in Materials (Preprint)**
Ko, Ray T; Blodgett, Mark P; Sathish, Shamachary; Boehnlein, Thomas R; Jul 2007; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-03-C-5219; Proj-4349
Report No.(s): AD-A476901; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476901

The shot peening intensity of nickel base materials has been examined with an innovative eddy current measurement. The goal is to provide a nondestructive tool to quantitatively evaluate the surface conditions after shot peening. Traditionally, the residual stress caused by the shot peening process can be examined by X-ray diffraction. Recent eddy current works have shown promising results in evaluating the small conductivity variation due to the residual stress. This study explores the feasibility of utilizing the cable which connects to a network analyzer and a conventional eddy current probe to monitor the surface conditions due to the shot peening.
DTIC
*Eddy Currents; Measurement; Resonant Frequencies; Shot Peening*

## 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*.

**20080018094** Naval War Coll., Newport, RI USA
**To Integrate or to Deconlict, that is the Question: An Examination of Contemporary Challenges in Conventional and Special Operations Forces Command and Control**
Cooling, Norman L; Nov 6, 2007; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476417; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476417

Evidence from recent operations suggests that current joint and USSOCOM doctrine are producing command and control (C2) arrangements between conventional forces (CF) and special operations forces (SOF) that are dysfunctional at the tactical level and counter-productive in achieving operational objectives. Operations Restore Hope, Enduring Freedom, and Iraqi Freedom each reveal the dangers of attempting to integrate C2 between SOF and CF at the operational level, but failing to

do so at the tactical level. To address current threats effectively, the U.S. military would be wise to reverse this approach. In the global campaign against ideological extremist insurgency, SOF best leverage their counter-terrorism, foreign internal defense, special reconnaissance, and unconventional warfare skills by focusing on Phase 0 shaping operations in the arc of instability. In counterinsurgency environments such as Afghanistan and Iraq, priority of mission should go to CF efforts, and joint force commanders should integrate SOF with CF at the tactical level to prevent compromising this effort. The Joint Staff and USSOCOM can facilitate this by modifying joint doctrine to permit SOF and CF C2 integration at the tactical level and revising joint education curricula and training opportunities to include exercising this integration. Until USSOCOM does so, it will exacerbate rather than resolve one of the primary problems that led to its creation: parochial interests compromising unity of effort while in the pursuit of national security objectives.
DTIC
*Command and Control; Military Personnel; Warfare*

**20080018095** Office of the Under Secretary of Defense (Acquisitions and Technology), Washington, DC USA
**Report of the Defense Science Board Task Force on the Creation and Dissemination of All Forms of Information in Support of Psychological Operations (PSYOP) in Time of Military Conflict**
May 2000; 64 pp.; In English
Report No.(s): AD-A476419; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476419

The Defense Science Board (DSB) Task Force on the Creation and Dissemination of All Forms of Information in Support of Psychological Operations (PSYOP) in Time of Military Conflict was charged with reviewing PSYOP activities within the Department of Defense (DoD). The purpose of the review was to: (1) assess the capability of the USA Armed Forces to develop programming and to broadcast factual information to a large segment of the general public; (2) assess the potential of various airborne and land-based mechanisms to deliver such information; and (3) assess other issues in the creation and dissemination of all forms of information in times of conflict, including satellite broadcasts and the use of emerging mobile communication technologies.
DTIC
*Defense Program; Information Dissemination; Telecommunication; Time*

**20080018096** General Accounting Office, Washington, DC USA
**Military Operations. Recent Campaigns Benefited from Improved Communications and Technology, but Barriers to Continued Progress Remain**
Jun 2004; 56 pp.; In English
Report No.(s): AD-A476420; GAO-04-547; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476420

Improvements in force networking and in the use of precision weapons are clearly primary reasons for the overwhelming combat power demonstrated in recent operations. However, the full extent to which operations have been speeded up or otherwise affected is unclear because DOD does not have detailed measures of these effects. The emerging concept of networked operations, referred to by DOD as network-centric operations, involves developing communications and other linkages among all elements of the force to create a shared awareness of operations. Technological enhancements to these network-centric systems include improved sensors and other intelligence, surveillance, and reconnaissance mechanisms for observing targets on the battlefield; more integrated command and control centers for analyzing targeting data and approving attacks; and improvements in precision weapons. The improved ability to share a broad view of the battlefield and communicate quickly with all elements of the force has compressed the time required for analysis and decision making in bombing operations, thus increasing lethality. However, DOD recognizes that the full extent to which operations have been speeded up or otherwise affected is unclear because of the absence of detailed measures of these effects. As a result, DOD's Office of Force Transformation is conducting a series of case studies of training exercises and combat operations in Afghanistan and Iraq to better understand the effects of networked operations. Advances in force networking have been enhanced by improvements in the use of precision guided weapons and associated technologies, providing military commanders with greatly increased flexibility and accuracy in bombing operations. For example, the introduction of laser-guided and Global created by poor weather and visibility and allowed bombing operations to be conducted from higher and safer altitudes.
DTIC
*Military Operations; Telecommunication*

**20080018104** Naval War Coll., Newport, RI USA
**Operational Seam: The Command and Control of Conventional and Special Operations Forces**
Bright, James M; Nov 6, 2007; 22 pp.; In English
Report No.(s): AD-A476433; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476433

Twenty years after the Nunn-Cohen Amendment, an operational seam has been identified in regards to the and control of SOF and conventional forces when operating in shared battle space. In today's joint operational environment, this operational seam is adversely impacting both forces in achieving their tactical and operational objectives. At the tactical level, unity of command is required between forces to prevent diverging focus on the objectives, to minimize fratricide, and to leverage all capabilities to accomplish goals. Given the divergent focus on objectives between SOF and conventional forces, the supported / supporting command relationship may not adequately achieve sufficient level of unity of effort.
DTIC
*Command and Control; Military Personnel*

**20080018182** Naval War Coll., Newport, RI USA
**U.S. Navy Command and Control in the Aftermath of the Falkland Islands Campaign of 1982**
Neary, Stephen M; Jun 2007; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476618; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476618

In analyzing the development of USA Naval Command and Control (C2) doctrine in the aftermath of the Falkland Islands Campaign, it is evident that the US Navy saw fit to incorporate at least four of the main lessons learned by the protagonists, namely the need for simplicity in command structure, the best location for the commander, the need for unity of comand/effort and the means to manage information. The analysis was broken down into two main areas: (1) the flawed British command and control with U.S. Navy lessons learned from Naval Doctrinal Publication (NDP) 6 incorporated and (2) where the U.S. Navy is considering these lessons learned with command and control doctrine in the 21st Century. The analysis concludes the following: (1) the U.S. Navy took advantage of the British C2 lessons learned from the Falklands Campaign, (2) the U.S. Navy is moving in the right direction in the 21st Century with the writing of new C2 doctrine, focusing on the operational level of war and the creation of the Maritime Operations Center (MOC), and (3) the senior leadership of the U.S. Navy is faced with the challenge of implementing the new doctrine.
DTIC
*Command and Control; Islands; Military Operations; Navy*

**20080018195** Library of Congress, Washington, DC USA
**Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress**
O'Rourke, Ronald; Aug 4, 2004; 7 pp.; In English
Report No.(s): AD-A476680; CRS-RS20557; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476680

Network-centric warfare (NCW) is a key element of defense transformation. Key programs for implementing NCW in the Navy include the Cooperative Engagement Capability (CEC), the Naval Fires Network (NFN), the IT-21 program, and ForceNet. A related program is the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some of these programs, particularly NMCI.
DTIC
*Navy; Warfare*

**20080018257** Naval War Coll., Newport, RI USA
**Cyberspace Coercion in Phase 0/I: How to Deter Armed Conflict**
Mathers, Russell F; Nov 6, 2007; 25 pp.; In English
Report No.(s): AD-A476693; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476693

Cyberspace is a war fighting domain and can be used by joint force commanders (JFC) in Phase 0 (Shape) and Phase 1 (Deter) of their operation to prevent escalation to armed conflict. This paper outlines Byman and Waxman's four coercion mechanisms of power base erosion, civil unrest, decapitation and denial and uses them and Boyd's OODA Loop as a framework to examine how a JFC can use cyberspace capabilities to prevent the use of armed force. The paper also evaluates

how Russia and China have used cyberspace operations to coerce their adversaries and place themselves in a position of strength to deter their future adversaries in cyberspace. The paper closes with recommendations to develop joint doctrine for the cyberspace domain, options to move China from a position of coercive strength and the need for the interagency to provide for unity of effort in cyberspace.
DTIC
*Electronic Warfare; Internets*

**20080018258** Naval War Coll., Newport, RI USA
**The Organization is Flat: An Integrated Model for Strategic Communication within the Combatant Command**
Perry, Robert L; Nov 5, 2007; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476698; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476698

The 2006 Quadrennial Defense Review (QDR) for the first time acknowledged the critical importance of strategic communication (SC) as a primary strategic concern for the Department of Defense (DoD). The subsequent guidance in the QDR Execution Roadmap for Strategic Communication laid out the basic objectives for DoD strategic communications and placed primary responsibility for executing SC in the field with the Combatant Commanders (CCDR). However, the guidance did not discuss how the CCDRs should reorganize their commands to address SC. During the past two years, the CCDRs have established various SC organizations with various degrees of satisfaction and success. To help the CCDRs structure their SC processes more effectively, this paper reviews the advantages and disadvantages of four standard organizational models. It compares these to the current practices of the current CCDRs and the planned Africa-based combatant command. Finally, it proposes for the CCDRs consideration an integrated organizational model based on the most relevant elements of the core competency, matrixed, and process/horizontal models. It concludes with several recommendations that discuss how the CCDRs can maximize the proposed model's effectiveness.
DTIC
*Models; Organizations*

**20080018262** Naval War Coll., Newport, RI USA
**Adapting to a Changing World: The USA, Climate Change, and the Arctic Maritime Commons**
Schlauder, W E; Nov 5, 2007; 32 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476708; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476708

A new Arctic maritime commons is opening as a tangible reality of climate change. In the next two decades, portions of the Arctic will be largely ice free for many months of the summer. With the retreat of the Arctic ice, new direct shipping routes between the Atlantic and Pacific will open. Additionally, this will bring access to a wealth of untapped natural resources, including 25% of the world's remaining undiscovered reserves of oil and natural gas. Changes in the Arctic have already brought a growing surge of maritime claims and commercial activity. The neighboring nations of Canada, Denmark, Norway, and Russia seek to extend their claims beyond the traditional 200 nautical mile limit. The USA must answer two questions in determining how it will adapt in a changing Arctic. First, what strategic interests does the USA have in the region and what role will the country take in an ice-free Arctic? Second, what is the nature of the command and control organization required for the USA to operate in this emerging maritime commons? The Arctic Ocean is a region of vital national interest to the USA. With its rich natural resources, commercial shipping interests, and conflicting maritime claims it represents a new maritime domain that is also a potential hot bed of dispute and conflict. For the USA to exert a leadership position in the Arctic, it must participate in international treaties that provide mechanisms for resolving conflicts over maritime claims. The USA is the sole Arctic nation not to have signed the United Nations Convention on the Law of the Sea (UNCLOS). Furthermore, the demands of the Arctic require a unique command and control structure capable of dealing with the remote, hostile environment and multi-national character of the region.
DTIC
*Arctic Regions; Climate Change; Command and Control; Conventions; International Law; Seas; United Nations; United States*

**20080018423** Research and Technology Organization, Neuilly-sur-Seine, France
**Advanced Radar Systems, Signal and Data Processing**
August 2007; In English; See also 20080018424 - 20080018432
Report No.(s): RTO-EN-SET-086bis; AC/323(SET-086)TP/185; Copyright; Avail.: CASI: C01, CD-ROM

Topics covered include: Fundamentals of Signal Processing for Phased Array Radar; Advanced Target Tracking

Techniques; Introduction to Synthetic Aperture Radar (SAR); Bi- and Multistatic Radar; Principles of Adaptive Array Processing; Space-Time Adaptive Processing: Fundamentals; Space-Time Adaptive Processing: Algorithms; Very High Resolution and Multichannel SAR/MTI; and Tracking and Data Fusion Applications.
Derived from text
*Synthetic Aperture Radar; Radar Data; Tracking (Position); Multistatic Radar; Antenna Arrays; Signal Processing; Phased Arrays*

**20080018424** Research Establishment for Applied Science (FGAN), Wachtberg, Germany
**Tracking and Data Fusion Applications**
Koch, Wolfgang; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 9-1 - 9-36; In English; See also 20080018423; Original contains color and black and white illustrations
Report No.(s): Paper 9; 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); Multisensor Fusion; Surveillance; Navigation; Radar Targets*

**20080018425** Research Establishment for Applied Science (FGAN), Wachtberg, Germany
**Principles of Adaptive Array Processing**
Nickel, Ulrich; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 5-1 - 5-20; In English; See also 20080018423; Original contains color illustrations
Report No.(s): Paper 5; 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; Augmentation*

**20080018426** Research Establishment for Applied Science (FGAN), Wachtberg, Germany
**Fundamentals of Signal Processing for Phased Array Radar**
Nickel, Ulrich; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 1-1 - 1-22; In English; See also 20080018423; Original contains color and black and white illustrations
Report No.(s): Paper 1; 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
*Radar Detection; Parameter Identification; Signal Processing; Phased Arrays; Beamforming*

**20080018427** Research Establishment for Applied Science (FGAN), Wachtberg, Germany
**Space-Time Adaptive Processing: Fundamentals**
Buerger, Wolfram; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 6-1 - 6-14; In English; See also 20080018423; Original contains color and black and white illustrations
Report No.(s): Paper 6; 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; Radar Targets; Beamforming*

**20080018428** Research Establishment for Applied Science (FGAN), Wachtberg, Germany
**Advanced Target Tracking Techniques**
Koch, Wolfgang; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 2-1 - 2-34; In English; See also 20080018423; Original contains color and black and white illustrations
Report No.(s): Paper 2; 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 advanced target tracking techniques characteristic problems occurring in typical radar applications are presented; key ideas relevant for their solution are discussed.
Author
*Tracking (Position); Radar Targets; Navigation; Surveillance; Tracking Problem; Signal Processing; Statistical Distributions*

**20080018429** Research Establishment for Applied Science (FGAN), Wachtberg, Germany
**Space-Time Adaptive Processing: Algorithms**
Buerger, Wolfram; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 7-1 - 7-12; In English; See also 20080018423; Original contains color and black and white illustrations
Report No.(s): Paper 7; 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
*Space-Time Adaptive Processing; Algorithms; Radar Targets; Airborne Radar*

**20080018430** Research Establishment for Applied Science (FGAN), Wachtberg, Germany

**Very High Resolution and Multichannel SAR/MTI**

Berens, Patrick; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 8-1 - 8-14; In English; See also 20080018423; Original contains color and black and white illustrations

Report No.(s): Paper 8; 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 limitations 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

*Synthetic Aperture Radar; High Resolution; Antenna Design; Bandwidth; Surveillance; Earth Observations (From Space)*

**20080018431** Research Establishment for Applied Science (FGAN), Wachtberg, Germany

**Introduction to Synthetic Aperture Radar (SAR)**

Berens, Patrick; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 3-1 - 3-16; In English; See also 20080018423; Original contains black and white illustrations

Report No.(s): Paper 3; 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 proven 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 systems1. 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 quit 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; Digital Systems; Optical Equipment; Signal Processing; Apertures; Algorithms*

**20080018432** Norwegian Defence Research Establishment, Kjeller, Norway

**Bi- and Multistatic Radar**

Johnsen, Terje; Olsen, Karl Erik; Advanced Radar Systems, Signal and Data Processing; August 2007, pp. 4-1 - 4-34; In English; See also 20080018423; Original contains color and black and white illustrations

Report No.(s): Paper 4; 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; Tracking Radar; Jamming; Radar Data; Radar Range; Transmitter Receivers; Extraction*

**20080018433** Daly, Crowley, Mofford & Durkee, LLP, Canton, MA, USA
**Differential and Single Ended Elliptical Antennas**
Powell, J. D., Inventor; Chandraksan, A., Inventor; 22 Jun 05; 17 pp.; In English
Contract(s)/Grant(s): NSF-ANI-0335256
Patent Info.: Filed Filed 22 Jun 05; US-Patent-Appl-SN-11-158-905
Report No.(s): PB2007-109455; No Copyright; Avail.: CASI: A03, Hardcopy

An antenna element includes a radiating antenna element having an elliptical shape disposed on a first surface of a substrate. A dielectric clearance region having an elliptical shape is disposed about the radiating antenna element to space the radiating antenna element from a ground plane. The clearance region is shaped such that a portion of the radiating element in which an antenna feed is disposed is proximate the ground plane. The antenna can also be provided having an elliptically shaped tuning region disposed within the radiating antenna element. The antenna is suitable for use in single-ended or differential ultra wide band (UWB) transmitting and/or receiving systems.
NTIS
*Broadband; Patent Applications; Antenna Feeds; Antenna Components; Clearances*

**20080018466** NASA Glenn Research Center, Cleveland, OH, USA
**Application of Ruze Equation for Inflatable Aperture Antennas**
Welch, Bryan W.; April 2008; 36 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 439432.04.04.01
Report No.(s): NASA/TP--2008-214953; E-16182; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018466

Inflatable aperture reflector antennas are an emerging technology that NASA is investigating for potential uses in science and exploration missions. As inflatable aperture antennas have not been proven fully qualified for space missions, they must be characterized properly so that the behavior of the antennas can be known in advance. To properly characterize the inflatable aperture antenna, testing must be performed in a relevant environment, such as a vacuum chamber. Since the capability of having a radiofrequency (RF) test facility inside a vacuum chamber did not exist at NASA Glenn Research Center, a different methodology had to be utilized. The proposal to test an inflatable aperture antenna in a vacuum chamber entailed performing a photogrammetry study of the antenna surface by using laser ranging measurements. A root-mean-square (rms) error term was derived from the photogrammetry study to calculate the antenna surface loss as described by the Ruze equation. However, initial testing showed that problems existed in using the Ruze equation to calculate the loss due to errors on the antenna surface. This study utilized RF measurements obtained in a near-field antenna range and photogrammetry data taken from a laser range scanner to compare the expected performance of the test antenna (via the Ruze equation) with the actual RF patterns and directivity measurements. Results showed that the Ruze equation overstated the degradation in the directivity calculation. Therefore, when the photogrammetry study is performed on the test antennas in the vacuum chamber, a more complex equation must be used in light of the fact that the Ruze theory overstates the loss in directivity for inflatable aperture reflector antennas.
Author
*Reflector Antennas; Vacuum Chambers; Photogrammetry; Laser Ranging; Root-Mean-Square Errors; Radio Frequencies; Apertures; Inflatable Structures*

**20080018483** Geological Survey, Reston, VA USA; National Science and Technology Council, Washington, DC, USA
**Reducing Loss of Life and Property from Disasters: A Societal Benefit Area of the Strategic Plan for U.S. Integrated Earth Observation System (IEOS)**
Helz, R. L.; Gaynor, J. E.; Jan. 01, 2007; 65 pp.; In English
Report No.(s): PB2007-112151; USGS-OFR-2007-1147; No Copyright; Avail.: CASI: A04, Hardcopy

Natural and technological disasters, such as hurricanes and other extreme weather events, earthquakes, volcanic eruptions, landslides and debris flows, wildland and urbaninterface fires, floods, oil spills, and spaceweather storms, impose a significant burden on society. Throughout the USA, disasters inflict many injuries and deaths, and cost the nation $20 billion each year (SDR, 2003). Disasters in other countries can affect U.S. assets and interests overseas (e.g. the eruption of Mt. Pinatubo in the Philippines, which effectively destroyed Clark Air Force Base). Also, because they have a disproportionate impact on developing countries, disasters are major barriers to sustainable development. Improving our ability to assess, predict, monitor, and respond to hazardous events is a key factor in reducing the occurrence and severity of disasters, and relies heavily on the use of information from welldesigned and integrated Earth observation systems. To fully realize the benefits gained from the

observation systems, the information derived must be disseminated through effective warning systems and networks, with products tailored to the needs of the end users and the general public.
NTIS
*Earth Observations (From Space); Losses; Observation; Remote Sensing; Systems Integration*

**20080018508** Washington Univ., Seattle, WA USA
**Bio-Gyros: Tunable Compliant Gryscopic Sensors**
Daniel, Thomas; Jan 10, 2008; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-06-1-0473
Report No.(s): AD-A476611; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476611

We examined the motion encoding characteristics of gyroscopic sensors implicated in the flight control systems of insects. These included antennae of moths and the halteres of large craneflies, two structures that encode the Coriolis forces associated with body rotations during aerial maneuvers in insects. Importantly, no prior research program has explored how the structural dynamics of such gyroscopes interact with motions to provide tunable encoding characteristics. Through both neurobiological and biomechanical approaches we showed how rotational body motions interact with the three-dimensional bending characteristics of biological gyroscopes. We used a combination of neuro-physiological and neuro-anatomical studies to show how the nervous system encodes gyroscopic information. It does so with extremely high precision in the range that is relevant for Coriolis force sensing. This one year research program culminated in a Science paper, a variety of news articles, and several publications and presentations at scientific meetings. To our knowledge this is the first successful study of the neural processing of gyroscopic forces in any living creature.
DTIC
*Detectors; Elastic Properties; Gyroscopes; Insects; Neurophysiology*

**20080018561** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Microwave Propagation Attenuation due to Earth's Atmosphere and Weather at SHF Band**
Ho, Christian; Wang, Charles; Gritton, Kelly; Angkasa, Kris; October 31, 2004; 7 pp.; In English; Military Communications Conference, MILCOM 2004, 31 Oct.-3 Nov. 2004, Monterey, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40747

In this study we have estimated radio wave propagation losses at super high frequency (SHF) band by applying available propagation models into several Air Force benchmark scenarios. The study shows that dominantly additional losses over the free space loss are atmospheric absorption, clouds, fog, and precipitation, as well as scintillation /multipath at low elevation angles. The free space loss equation has been modified to include all atmospheric attenuation and fading effects that cannot be neglected over the range of frequency of interest. Terrain profiles along all directions of interest within the coastal areas and inland areas for four benchmark cases have been analyzed in detail. We find that while the atmospheric gaseous absorption plays a significant role under a clear weather, heavy rainfalls can cause several tens of dB loss for a 100- km path through the rain. At very low elevation angles (< 5 deg), atmospheric scintillation/multipath fading becomes a very important factor. There are significant differences in the feature of anomalous mode (ducting) propagation between the east and the west coastal receiving stations.
Author
*Atmospheric Attenuation; Earth Atmosphere; Microwave Attenuation; Superhigh Frequencies; Wave Propagation; Electromagnetic Absorption; Microwave Absorption; Telemetry*

**20080018812** California Inst. of Tech., Pasadena, CA USA
**Method and apparatus for low-loss signal transmission**
Siegel, Peter, Inventor; Yeh, Cavour, Inventor; Shimabukuro, Fred, Inventor; Fraser, Scott, Inventor; January 1, 2008; 13 pp.; In English
Patent Info.: Filed December 13, 2005; US-Patent-7,315,678; US-Patent-Appl-SN-11/300,639; No Copyright; Avail.:
CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018812

The present invention relates to the field of radio-frequency (RF) waveguides. More specifically, the present invention pertains to a method and apparatus that provides ultra-low-loss RF waveguide structures targeted between approximately 300

GHz and approximately 30 THz. The RF waveguide includes a hollow core and a flexible honeycomb, periodic-bandgap structure surrounding the hollow core. The flexible honeycomb, periodic-bandgap structure is formed of a plurality of tubes formed of a dielectric material such as of low-loss quartz, polyethylene, or high-resistivity silicon. Using the RF waveguide, a user may attach a terahertz signal source to the waveguide and pass signals through the waveguide, while a terahertz signal receiver receives the signals.
Official Gazette of the U.S. Patent and Trademark Office
*Radio Frequencies; Dielectrics; Energy Gaps (Solid State); Signal Transmission; Receivers*

## 33
## 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*.

**20080018112** Air Force Research Lab., Kirkland AFB, NM USA
**Fairing Noise Control Using Tube-Shaped Resonators**
Lane, Steven A; Richard, Robert E; Kennedy, Scott J; Aug 2005; 8 pp.; In English
Report No.(s): AD-A476453; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476453

The potential for noise mitigation in composite Chamber Core fairings is investigated by using the walls of the fairing structure itself as acoustic resonators. This is the first documented application of long cylindrical tube-shaped resonators for fairing noise control. The theory and modeling of tube-shaped resonators for controlling fairing acoustic resonances is presented. The potential for noise mitigation in composite Chamber Core fairing using the walls of the fairing structure itself as acoustic resonators is investigated. Design criteria such as geometry damping, spatial coupling, and robustness are considered for a variety of tube resonators. The results showed that a small number of tube resonators reduced the amplitude of low-frequency acoustic resonances by 10-12 dB in the test system and provided nearly 6 dB of reduction over the bandwidth from 0 to 400 Hz.
DTIC
*Fairings; Launch Vehicles; Noise Reduction; Resonators; Sound Generators*

**20080018124** Naval Research Lab., Bay Saint Louis, MS USA
**Role of Minerogenic Particles in Light Scattering in Lakes and a River in Central New York**
Peng, Feng; Effler, Stevel; O'Donnell, David; Perkins, Mary Gail; Weidemann, Alan D; Sep 10, 2007; 19 pp.; In English
Report No.(s): AD-A476498; NRL/JA/7330-06-6311; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476498

The role of minerogenic particles in light scattering in several lakes and a river (total often sites) in central New York, which represent a robust range of scattering conditions, was evaluated based on an individual particle analysis technique of scanning electron microscopy interfaced with automated x-ray microanalysis and image analysis (SAX), in situ bulk measurements of particle scattering and backscattering coefficients (b sub p and b sub bp), and laboratory analyses of common indicators of scattering. SAX provided characterizations of the elemental x-ray composition, number concentration, particle size distribution (PSD), shape, and projected area concentration of minerogenic particles (PAV sub m) of sizes >0.4 m. Mie theory was applied to calculate the minerogenic components of b(sub p) (b sub m) and b(sub bp), (b sub b) with SAX data. Differences in PAV(sub m), associated primarily with clay minerals and CaCO3, were responsible for most of the measured differences in both b(sub p), and b(sub bp) across the study sites. Contributions of the specified minerogenic particle classes to b(sub bp) were found to correspond approximately to their contributions to PAV(sub m). The estimates of b(sub m) represented substantial fractions of b(sub m), whereas those of b(sub bm) were the dominant component of b(sub bp). The representativeness of the estimates of b(sub m) and b(sub bm) was supported by their consistency with the bulk measurements. Greater uncertainty prevails for the b(sub bm) estimates than those for b(sub m), associated primarily with reported deviations in particle shapes from sphericity. The PSDs were well represented by the 'B' component of the two-component model or a three parameter generalized gamma distribution.
DTIC
*Electron Microscopy; Lakes; Light Scattering; Rivers*

**20080018163** Illinois Univ., Chicago, IL USA

**Radar Array Signal Processing in the Presence of Scattering Effects**

Nehorai, Arye; Jan 15, 2008; 12 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0018

Report No.(s): AD-A476578; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476578

We developed statistical time-reversal imaging and Cramer-Rao bounds (ORB's) for point targets and scatterers; realistic clutter modeling, random scattering reflections, compound Gaussian distributions, and signal dependence; maximum likelihood estimators, CRB's, and sequential target detectors in compoun%Gaussian clutter; polarimetric radar algorithms for detectingltracking targets in clutter; microstrip antennas design with suppressed radiation in horizontal directions and reduced coupling, and 6D vector antenna; optimal synthesis of a directional beam with full polarization control; estimated building layouts and objects behind walls using exterior radar measurements and EM modeling; robust least-squares beamformers (spatial filters) for estimating unknown source signals under steering vector uncertainties; tight lower bounds on the mean-square error (MSE) of estimating multiple change points of measurement models; unification of minimal Bayesian bounds on the MSE of estimators; performance bounds on image registration useful for optimum design of registration algorithms; image reconstruction method for diffuse optical tomography; electromagnetic inverse solutions based on Poisson oint 5 atial model for estimatin unknown source e. ., brain Si nals.

DTIC

*Antenna Arrays; Detection; Electromagnetic Radiation; Radar Beams; Radar Tracking; Scattering; Signal Processing; Target Acquisition*

**20080018164** Army Research Lab., Adelphi, MD USA

**U.S. Army Research Laboratory Microelectromechanical System Electronically Scanned Antenna Testing at the Aviation and Missile Research, Development and Engineering Center**

Polcawich, Ronald G; Judy, Daniel; Pulskamp, Jeff; Weiss, Steve; Rock, Janice; Hudson, Tracy; Jan 2008; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476579; ARL-TR-4359; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476579

Microelectromechanical System (MEMS) phase shifters have been assembled in a connectorized packages for insertion in a 1x8 linear patch antenna array. The patch array provides a demonstration platform for a MEMS enabled electronically scanned antenna (ESA). The MEMS ESA along with control electronics was tested in receive mode within anechoic chambers at both ARL and Aviation and Missile Research, Development and Engineering Center (AMRDEC). Using a waveguide horn antenna for the emission source, the ESA was steered with an electronically rotating stage. In each of the test sessions, the ESA successfully demonstrated beam steering to each of the five possible beam positions using 2-bit MEMS phase shifters.

DTIC

*Laboratory Equipment; Microelectromechanical Systems; Missile Design*

**20080018168** Mission Research Corp., Santa Barbara, CA USA

**Testing of Transient Radiation Noise Subtraction Using a Commercially Available 3-Color Visible Detector**

Doughty, Kathryn L; Goldflam, Rudolf; Jan 2008; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DTRA01-03-D-0004; Proj-BD

Report No.(s): AD-A476586; MRC-R-1699; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476586

Description of testing of commercial Foveon 3-color device for total dose radiation hardness as well as the technology's suitability for use of Self-Referential Transient Suppression (SRTS) radiation mitigation techniques. The detector was shown to be hard to 100KRads total ionizing dose. The results of tests as a radiation mitigation device showed excellent agreement with predictions and indicate that modification of the structure to optimize mitigation parameters will lead to a device that can perform in high radiation flux and fluence environments.

DTIC

*Color; Color Vision; Electromagnetic Noise; Ionizing Radiation; Radiation Dosage; Radiation Hardening*

**20080018263** Loughborough Univ. of Technology, UK
**Defence Applications**
El-Fatatry, Ayman; Mar 1, 2007; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476710; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476710
No abstract available
*Military Technology; Nanotechnology*

**20080018265** Michigan Univ., Ann Arbor, MI USA
**Ablation Study in a Capillary Sustained Discharge**
Keidar, Michael; Boyd, Iain D; Williams, Anthony; Beyer, Richard; Jan 2006; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-04-1-0251
Report No.(s): AD-A476713; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476713
Electrothermal-chemical (ETC) ignition systems have been demonstrated in gun systems to provide desirable characteristics including reproducible shorter ignition delays. The optimum combination of capillary tube and fuse wire properties has not been identified yet. We present a combined theoretical and experimental study of the capillary discharge with an aim to develop a capillary plasma source with efficient energy conversion. The major emphasis in the present capillary discharge model is the ablation phenomenon. Consideration is given to different characteristic sub- regions near the ablated surface: namely, a space-charge sheath, a Knudsen layer, and a hydrodynamic layer. A kinetic approach is used to determine the parameters at the interface between the kinetic Knudsen layer and the hydrodynamic layer. Coupling the solution of the non- equilibrium Knudsen layer with the hydrodynamic layer provides a self-consistent solution for the ablation rate. According to the model predictions, the peak electron temperature is about 1.4 eV, the polyethylene surface temperature is about 700 K, and the pressure is about 10 MPa in the case of a 0.6 kJ discharge. In parallel, a parametric experimental study of the capillary ablation process is conducted. The ablation rates are measured for capillary tubes made of polyethylene and Teflon. Both experimental measurements and simulations indicate that the ablated mass increases with the peak discharge current and that a smaller diameter capillary yields a larger ablated mass. It is found that model predictions agree well with experimental measurements.
DTIC
*Ablation; Capillary Tubes; Guns (Ordnance); Ignition*

**20080018266** Army Tank-Automotive Research and Development Command, Warren, MI USA
**Integration and Test of a 2nd Generation Dual Purpose Pulse Forming Network into the P&E HWIL SIL**
Barshaw, E J; White, J; Danielson, G; Chait, M J; Frazier, G; Dixon, B; Marinos, B; Milner, D; May 2006; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476724; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476724
A 2nd Generation Dual Purpose Pulse Forming Network (DP-PFN) has been developed to power both the Electro-Thermal-Chemical (ETC)/Electro-Thermal-Ignition (ETI) lethality capability and the Electro-Magnetic Armor (EMA) survivability capability improvements envisioned for future hybrid-electric vehicles. ETI decreases the ignition variability associated with the launching of conventional munitions by roughly a factor of ten which, in conjunction with the systems ballistic computer, greatly enhances hit probability of the round. ETC provides maximum performance in all conditions, including temperature compensation, resulting in increased lethality and range with higher average muzzle velocities. EMA uses stored electric energy to disrupt a shaped-charge jet and reduce it,s depth of penetration. The second generation DP-PFN for driving both ETI/ETC and EMA emulators is scheduled to be integrated into the Power and Energy (P&E) Hardware-in-the-Loop (HWIL) System Integration laboratory (SIL) in Santa Clara, California in 2006. The DP-PFN is capable of providing either the short pulse lengths required by the EMA or the considerably longer pulse lengths required by the ETI/ ETC Gun as well as emulating various degraded functionality states such as loss of individual capacitors. Integration of this DP-PFN marks another great milestone for the SIL, ensuring that it continues to be capable of emulating all the major hybrid electric mobility functions of a ground combat vehicle as well as the major lethality and survivability electrical loads. This paper describes the DP-PFN components, the overall DP-PFN design philosophy and the planned integration and testing of the DP-PFN in the P&E HWIL SIL.
DTIC
*Electromagnetic Pulses; Magnetohydrodynamics*

**20080018337** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Small-Scale 3D Imaging Platform for Algorithm Performance Evaluation**

James, Steven A; Jun 2007; 76 pp.; In English

Report No.(s): AD-A476921; AFIT/GAE/ENY/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476921

In recent years, world events have expedited the need for the design and application of rapidly deployable airborne surveillance systems in urban environments. Fast and effective use of the surveillance images requires accurate modeling of the terrain being surveyed. The process of accurately modeling buildings, landmarks, or other items of interest on the surface of the earth, within a short lead time, has proven to be a challenging task. One approach of high importance for countering this challenge and accurately reconstructing 3D objects is through the employment of airborne 3D image acquisition platforms. While developments in this arena have significantly risen, there remains a wide gap in the verification of accuracy between the acquired data and the actual ground-truth data. In addition, the time and cost of verifying the accuracy of the acquired data on airborne imaging platforms has also increased. This thesis investigation proposes to design and test a small-scale 3D imaging platform to aid in the verification of current image acquisition, registration and processing algorithms at a lower cost in a controlled lab environment. A rich data set of images will be acquired and the use of such data will be explored.

DTIC

*Algorithms; Computer Programming; Evaluation; Image Processing; Imaging Techniques; Performance Tests; Software Engineering*

**20080018440** Chau (F.) and Associates, LLC, USA

**Apparatus and Methods for Microchannel Cooling of Semiconductor Integrated Circuit Packages**

Bezama, R. J., Inventor; Colgan, E. G., Inventor; Magerlein, J. H., Inventor; Schmidt, R. R., Inventor; 1 Jul 04; 26 pp.; In English

Patent Info.: Filed Filed 1 Jul 04; US-Patent-Appl-SN-10-883-534

Report No.(s): PB2007-109445; No Copyright; Avail.: CASI: A03, Hardcopy

Apparatus and methods are provided for microchannel cooling of electronic devices such as IC chips, which enable efficient and low operating pressure microchannel cooling of high power density electronic devices. Apparatus for microchannel cooling include integrated microchannel heat sink devices and fluid distribution manifold structures that are designed to provide uniform flow and distribution of coolant fluid and minimize pressure drops along coolant flow paths.

NTIS

*Cooling; Electronic Packaging; Integrated Circuits; Microchannels; Patent Applications; Semiconductors (Materials)*

**20080018461** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**THz Local Oscillator Technology**

Mehdi, Imran; June 21, 2004; 10 pp.; In English; SPIE Conference on Astronomical Telescopes and Instrumentation, 21-23 Jun. 2004, Glasgow, Scotland, UK; Original contains black and white illustrations; Copyright; Avail.: Other Sources ONLINE: http://hdl.handle.net/2014/40757

The last decade has seen a number of technological advancements that have now made it possible to implement fully solid state local oscillator chains up to 2 THz. These chains are composed of cascaded planar multiplier stages that are pumped with W-band high power sources. The high power W-band sources are achieved by power combining MMIC amplifiers and can provide in access of 150 mW with about 10% bandwidth. Planar diode technology has also enabled novel circuit topologies that can take advantage of the high input power and demonstrate significant efficiencies well into the THz range. Cascaded chains to 1.9 THz have now been demonstrated with enough output power to successfully pump hot-electron bolometer mixers in this frequency range. An overview of the current State-of-the-Art of the local oscillator technology will be presented along with highlighting future trends and challenges.

Author

*Oscillators; Bandwidth; Frequency Ranges; Integrated Circuits; Power Amplifiers; Bolometers*

**20080018568** Nebraska Univ., Lincoln, NE, USA

**A Low-Complexity Circuit for On-Sensor Concurrent A/D Conversion and Compression**

Leon-Salas, Walter D.; Balkir, Sina; Sayood, Khalid; Schemm, Nathan; Hoffman, Michael W.; IEEE Sensors Journal; September 2007; Volume 7, No. 9, pp. 1317-1325; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG06GH64G; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1109/JSEN.2007.902952

A low-complexity circuit for on-sensor compression is presented. The proposed circuit achieves complexity savings by combining a single-slope analog-to-digital converter with a Golomb-Rice entropy encoder and by implementing a low-complexity adaptation rule. The adaptation rule monitors the output codewords and minimizes their length by incrementing or decrementing the value of the Golomb-Rice coding parameter k. Its hardware implementation is one order of magnitude lower than existing adaptive algorithms. The compression circuit has been fabricated using a 0.35 micrometers CMOS technology and occupies an area of 0.0918 mm2. Test measurements confirm the validity of the design

Author

*Data Compression; Sensors; Integrated Circuits; Coding*

**20080018588** NASA Langley Research Center, Hampton, VA, USA

**Investigation of an Anomaly Observed in Impedance Eduction Techniques**

Watson, W. R.; Jones, M. G.; Parrott, T. L.; May 05, 2008; 29 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018588

An intensive investigation into the cause of anomalous behavior commonly observed in impedance eduction techniques is performed. The investigation consists of grid refinement studies, detailed evaluation of results at and near anti-resonance frequencies, comparisons of different model results with synthesized and measured data, assessment or optimization techniques, and evaluation or boundary condition effects. Results show that the root cause of the anomalous behavior is the sensitivity of the educed impedance to small errors in the measured termination resistance at frequencies near anti-resonance or cut-on of a higher-order mode. Evidence is presented to show that the common usage of an anechoic, plane wave termination boundary condition in ducts where the 'true' termination is reflective may act as a trigger for these anomalies. Replacing the exit impedance boundary condition by an exit pressure condition is shown to reduce the anomalous results.

Author

*Impedance; Resonant Frequencies; Boundary Conditions; Acoustic Properties; Actuators; Plane Waves*

**20080018590** NASA Langley Research Center, Hampton, VA, USA

**Uncertainty and Sensitivity Analyses of a Two-Parameter Impedance Prediction Model**

Jones, M. G.; Parrott, T. L.; Watson, W. R.; May 05, 2008; 15 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-8 May 2008, Vancouver, BC, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018590

This paper presents comparisons of predicted impedance uncertainty limits derived from Monte-Carlo-type simulations with a Two-Parameter (TP) impedance prediction model and measured impedance uncertainty limits based on multiple tests acquired in NASA Langley test rigs. These predicted and measured impedance uncertainty limits are used to evaluate the effects of simultaneous randomization of each input parameter for the impedance prediction and measurement processes. A sensitivity analysis is then used to further evaluate the TP prediction model by varying its input parameters on an individual basis. The variation imposed on the input parameters is based on measurements conducted with multiple tests in the NASA Langley normal incidence and grazing incidence impedance tubes; thus, the input parameters are assigned uncertainties commensurate with those of the measured data. These same measured data are used with the NASA Langley impedance measurement (eduction) processes to determine the corresponding measured impedance uncertainty limits, such that the predicted and measured impedance uncertainty limits (95% confidence intervals) can be compared. The measured reactance 95% confidence intervals encompass the corresponding predicted reactance confidence intervals over the frequency range of interest. The same is true for the confidence intervals of the measured and predicted resistance at near-resonance frequencies, but the predicted resistance confidence intervals are lower than the measured resistance confidence intervals (no overlap) at frequencies away from resonance. A sensitivity analysis indicates the discharge coefficient uncertainty is the major contributor to uncertainty in the predicted impedances for the perforate-over-honeycomb liner used in this study. This insight regarding

the relative importance of each input parameter will be used to guide the design of experiments with test rigs currently being brought on-line at NASA Langley.
Author
*Honeycomb Structures; Impedance Measurement; Monte Carlo Method; Experiment Design; Frequency Ranges; Grazing Incidence; Impedance; Resonant Frequencies*

**20080018637** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Effects of Hand Soldering MIL-PRF-55365 Tantalum Capacitors**
Reed, Erik K.; Spence, Penelope L.; Sheldon, Douglas; March 2008; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS7-03001; WBS 939904.01.11.10; JPL Project No. 102197; Task No. 1.22.6
Report No.(s): JPL Publication 08-12; Copyright; Avail.: CASI: A03, Hardcopy

Different values of MIL-PRF-55365 tantalum capacitors were subjected to three different types of soldering conditions. The soldering conditions were a convection reflow, a qualified hand solder condition, and an optimized hand solder condition. The electrical parameters for a large number of capacitors of each value were measured before and after thermal soldering stress. The results indicate that tantalum capacitors subjected to convection reflow conditions experience detectable changes in electrical parameters; capacitors subjected to hand solder conditions show reduced changes in electrical parameters when compared to the reflow samples. Optimized hand solder conditions are shown to have a minimal effect on electrical parameters.
Author
*Solders; Soldering; Tantalum; Capacitors; Thermal Stresses*

**20080018639** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Radiation Effects Assessment of MRAM Devices**
Elghefari, Mohamed; McClure, Steve; May 2008; 18 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS7-03001; WBS 939904.01.11.30; JPL Project No. 102197; Task No. 3.32.7
Report No.(s): JPL Publication 08-19; Copyright; Avail.: CASI: A03, Hardcopy

The Magneto-resistive Random Access Memory (MRAM) from Freescale Semiconductor, MR2A16A, was subjected to heavy ion single event testing. Test results show that this device is sensitive to Single Event Latchup (SEL). The sensitivity of the MRAM was attributed to the complementary metal oxide semiconductor (CMOS) process in which the active portion of this device is constructed. Therefore, the device must be used with caution and may require mitigation techniques if used in a space environment. There was no indication that the MRAM technology itself, the memory element construction, is subject to damage from heavy ions.
Author
*Random Access Memory; Radiation Effects; Computer Storage Devices; Semiconductors (Materials); Latch-Up; Memory (Computers)*

**20080018666** Molecular Imprints, Inc., Austin, TX, USA
**System for Varying Dimensions of a Substrate During Nanoscale Manufacturing**
Cherala, A., Inventor; Choi, B. J., Inventor; Nimmakayala, P. K., Inventor; Meissi, M. J., Inventor; Sreenivasan, S. V., Inventor; Jun. 01, 2005; 28 pp.; In English
Contract(s)/Grant(s): DARPA-N66001-01-1-8964; DARPA-N66001-02-C-8011
Patent Info.: Filed Filed 1 Jun 05; US-Patent-Appl-SN-11-142-808
Report No.(s): PB2007-109424; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention is directed toward a system to vary dimensions of a substrate, such as a template having a patterned mold. To that end, the system includes a substrate chuck adapted to position the substrate in a region; a pliant member; and an actuator sub-assembly elastically coupled to the substrate chuck through the pliant member. The actuator assembly includes a plurality of lever sub-assemblies, one of which includes a body lying in the region and spaced-apart from an opposing body associated with one of the remaining lever sub-assemblies of the plurality of lever sub-assemblies. One of the plurality of lever assemblies is adapted to vary a distance between the body and the opposing body. In this manner, compressive forces may be applied to the template to remove unwanted magnification or other distortions in the pattern on the mold. The pliant member is configured to attenuate a magnitude of resulting Forces sensed by the substrate chuck generated in response to the compressive forces.
NTIS
*Manufacturing; Semiconductor Devices; Substrates; Nanofabrication; Nanotechnology*

**20080018809** Northwestern Univ., Evanston, IL USA

**Methods and apparatus of spatially resolved electroluminescence of operating organic light-emitting diodes using conductive atomic force microscopy**

Hersam, Mark C., Inventor; Pingree, Liam S. C., Inventor; April 15, 2008; 17 pp.; In English

Contract(s)/Grant(s): NCC2-1363

Patent Info.: Filed May 26, 2005; US-Patent-7,358,490; US-Patent-Appl-SN-11/138,148; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018809

A conductive atomic force microscopy (cAFM) technique which can concurrently monitor topography, charge transport, and electroluminescence with nanometer spatial resolution. This cAFM approach is particularly well suited for probing the electroluminescent response characteristics of operating organic light-emitting diodes (OLEDs) over short length scales.

Official Gazette of the U.S. Patent and Trademark Office

*Atomic Force Microscopy; Electroluminescence; Light Emitting Diodes*

**20080018813** Lynntech, Inc., College Station, TX USA

**Transdermal delivery of therapeutic agent**

Kwiatkowski, Krzysztof C., Inventor; Hayes, Ryan T., Inventor; Magnuson, James W., Inventor; Giletto, Anthony, Inventor; January 1, 2008; 12 pp.; In English

Contract(s)/Grant(s): NAS3-03033

Patent Info.: Filed June 3, 2004; US-Patent-7,315,758; US-Patent-Appl-SN-10/860,557; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018813

A device for the transdermal delivery of a therapeutic agent to a biological subject that includes a first electrode comprising a first array of electrically conductive microprojections for providing electrical communication through a skin portion of the subject to a second electrode comprising a second array of electrically conductive microprojections. Additionally, a reservoir for holding the therapeutic agent surrounding the first electrode and a pulse generator for providing an exponential decay pulse between the first and second electrodes may be provided. A method includes the steps of piercing a stratum corneum layer of skin with two arrays of conductive microprojections, encapsulating the therapeutic agent into biocompatible charged carriers, surrounding the conductive microprojections with the therapeutic agent, generating an exponential decay pulse between the two arrays of conductive microprojections to create a non-uniform electrical field and electrokinetically driving the therapeutic agent through the stratum corneum layer of skin.

Official Gazette of the U.S. Patent and Trademark Office

*Electrical Resistivity; Pulse Generators; Encapsulating*

**20080018817** NASA, Washington, DC USA

**Subranging scheme for SQUID sensors**

Penanen, Konstantin I., Inventor; January 29, 2008; 9 pp.; In English

Patent Info.: Filed April 10, 2006; US-Patent-7,323,869; US-Patent-Appl-SN-11/279,137; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018817

A readout scheme for measuring the output from a SQUID-based sensor-array using an improved subranging architecture that includes multiple resolution channels (such as a coarse resolution channel and a fine resolution channel). The scheme employs a flux sensing circuit with a sensing coil connected in series to multiple input coils, each input coil being coupled to a corresponding SQUID detection circuit having a high-resolution SQUID device with independent linearizing feedback. A two-resolution configuration (course and fine) is illustrated with a primary SQUID detection circuit for generating a fine readout, and a secondary SQUID detection circuit for generating a course readout, both having feedback current coupled to the respective SQUID devices via feedback/modulation coils. The primary and secondary SQUID detection circuits function and derive independent feedback. Thus, the SQUID devices may be monitored independently of each other (and read simultaneously) to dramatically increase slew rates and dynamic range.

Official Gazette of the U.S. Patent and Trademark Office

*Dynamic Range; Circuits; Detection; Modulation; Feedback*

**20080018819** NASA, Washington, DC USA

**Distributed solid state programmable thermostat/power controller**

Alexander, Jane C., Inventor; Howard, David E., Inventor; Smith, Dennis A., Inventor; February 5, 2008; 13 pp.; In English
Patent Info.: Filed December 17, 2003; US-Patent-7,325,749; US-Patent-Appl-SN-10/738,352; No Copyright; Avail.:
CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018819

A self-contained power controller having a power driver switch, programmable controller, communication port, and environmental parameter measuring device coupled to a controllable device. The self-contained power controller needs only a single voltage source to power discrete devices, analog devices, and the controlled device. The programmable controller has a run mode which, when selected, upon the occurrence of a trigger event changes the state of a power driver switch and wherein the power driver switch is maintained by the programmable controller at the same state until the occurrence of a second event.

Official Gazette of the U.S. Patent and Trademark Office

*Thermostats; Electric Potential; Switches; Actuators; Communication Equipment; Controllers*

**20080018897** Alabama Univ., Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA

**General Matrix Inversion Technique for the Calibration of Electric Field Sensor Arrays on Aircraft Platforms**

Mach, D. M.; Koshak, W. J.; Journal of Atmospheric and Oceanic Technology; September 2007; Volume 24, Issue 9, pp. 1576-1587; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1175/JTECH2080.1

A matrix calibration procedure has been developed that uniquely relates the electric fields measured at the aircraft with the external vector electric field and net aircraft charge. The calibration method can be generalized to any reasonable combination of electric field measurements and aircraft. A calibration matrix is determined for each aircraft that represents the individual instrument responses to the external electric field. The aircraft geometry and configuration of field mills (FMs) uniquely define the matrix. The matrix can then be inverted to determine the external electric field and net aircraft charge from the FM outputs. A distinct advantage of the method is that if one or more FMs need to be eliminated or deemphasized [e.g., due to a malfunction), it is a simple matter to reinvert the matrix without the malfunctioning FMs. To demonstrate the calibration technique, data are presented from several aircraft programs (ER-2, DC-8, Altus, and Citation).

Author

*Electric Fields; Electrical Measurement; Matrices (Mathematics); U-2 Aircraft*

**20080018906** Air Force Research Lab., Hanscom AFB, MA USA

**Initial Plasma Tests of the IPROSEC Cathode Device**

Wheelock, A T; Cooke, D L; Geis, M W; Jun 2007; 13 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A476471; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476471

The Ion Proportional Surface Emission Cathode (IProSEC) is a low-brightness cathode technology under development for applications where large areas are available for emission and it is advantageous to avoid the space charge effects often associated with bright or intense sources. Space applications include spacecraft charge control and electrodynamic tethers. Surface Emission Cathodes emit electrons by concentrating an electric field between a p-doped insulating substrate and an adjacent metal cathode element. The substrate potential is held positive of the cathode with gate elements. In plasma, the gate is eliminated due to ambient ion flux which maintains the substrate potential near plasma ground. Prototype devices have been tested using a laboratory plasma source achieving sustained and stable operation over a wide bias voltage for a given ion flux. The principle of operation, ion flux proportionality, and prototype performance is discussed.

DTIC

*Cathodes; Emission; Plasmas (Physics)*

**20080018913** Georgia Inst. of Tech., Atlanta, GA USA

**Energy and Power Aware Computing Through Management of Computational Entropy**

Palem, Krishna V; Richards, Mark; Jan 2008; 60 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-02-2-0124; Proj-EPAC
Report No.(s): AD-A476859; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476859

With the increasing importance of computing in portable and other embedded settings, the power and energy consumed

by computation has become an important consideration driving research in computer engineering and science. Historically, the study of power and energy have roots in the field of thermodynamics. The innovations that we propose in this work aim to develop a mechanism for designing algorithms that are power (energy) aware by directly working with their thermodynamic properties, as opposed to the traditional approaches wherein algorithm design is concerned with measures such as their running time, and space consumed. Overall, our research scope was to innovate energy aware algorithms, novel semiconductor circuits, methodology and models for energy aware algorithm design by the application of thermodynamics and randomization toward algorithm and semiconductor design and analysis. As a result of this research work, we innovated probabilistic CMOS or PCMOS technology, as a promising approach to addressing the CMOS device scaling challenges and as a dramatic shift from previous work. Devices based on this technology, where noise is harnessed as a resource to implement CMOS devices exhibiting probabilistic behavior, are guaranteed to compute correctly with a probability p. Additionally, this work also characterized an explicit relationship between the probability p with which the CMOS switch computes correctly, and its associated physical attributes such as the energy consumed by each switching step across technology generations. We extended the above characterizations into PCMOS laws governing the behavior of such devices and switching. There laws were also validated across various technology generations via simulations as well as physical measurements of PCMOS inverters.
DTIC
*Entropy; Probability Theory; Semiconductor Devices; Thermodynamics*

## 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*.

**20080018098** CSA Engineering, Inc., Mountain View, CA USA
**Effectiveness and Predictability of Particle Damping**
Fowler, Bryce L; Flint, Eric M; Olson, Steven E; Jan 2000; 13 pp.; In English
Contract(s)/Grant(s): F33615-98-C-3005
Report No.(s): AD-A476422; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476422

In this paper, recent results of ongoing studies into the effectiveness and predictability of particle damping are discussed. Efforts have concentrated on characterizing and predicting the behavior of a wide range of potential particle materials, shapes, and sizes in the laboratory environment, as well as at elevated temperature. Methodologies used to generate data and extract the characteristics of the nonlinear damping phenomena are illustrated with interesting test results. Experimental results are compared to predictions from analytical simulations performed with an explicit code, based on the particle dynamics method, that has been developed in support of this work.
DTIC
*Damping; Granular Materials; Nonlinear Systems; Predictions*

**20080018128** Osaka Univ., Osaka, Japan
**Flow Instabilities in Cavitating and Non-Cavitating Pumps**
Tsujimoto, Yoshinobu; Nov 1, 2006; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476506; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476506

No abstract available
*Cavitation Flow; Pumps; Stability*

**20080018131** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium
**Optimization of Radial Impeller Geometry**
Van den Braembussche, R A; Nov 1, 2006; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476514; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476514

No abstract available
*Geometry; Impellers; Optimization; Radial Velocity*

**20080018184** Naval Surface Warfare Center, Bethesda, MD USA

**Axial Waterjet (AxWJ) Model 5662 and Mixed-Flow Waterjet (MxWJ) Model 5662-1: Comparisons of Resistance and Model-Scale Powering with Propulsion Nozzle Designs**

Cusanelli, Dominic S; Carpenter, Scott A; Powers, Anne M; Dec 2007; 133 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476622; NSWCCD-50-TR-2007/076; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476622

This report is a partial documentation of two series of model-scale experiments conducted 5/07-6/07, comparing the Axial Waterjet (AxWJ) Model 5662 and the Mixed-Flow Waterjet (MxWJ) Model 5662-1, two waterjet propelled variants of the Joint High Speed Sealift (JHSS) hull platform. This document contains calm water resistance and model-scale powering test results. Bare hull effective powers at three displacement conditions, and appended effective powers at design displacement, were determined and compared for the two waterjet variants, and then compared to the JHSS baseline shaft and strut (BSS) hull. Model-scale rotor force measurements were recorded and compared for both the AxWJ and the MxWJ under power. These tests were conducted on both models with waterjet nozzles specifically designed for propulsion. A detailed powering analysis derived from the AxWJ and MxWJ model resistance and rotor force measurements, as well as LDV velocity measurements and pressure tap measurements, will be reported in a separate document. This future document will address full-scale AxWJ and MxWJ powering predictions and comparisons to the JHSS baseline BSS.

DTIC

*Hydraulic Jets; Multiphase Flow; Nozzle Design; Propulsion*

**20080018186** Ecole Nationale Superieure d'Arts et Metiers, Lille, France

**Introduction to Design and Analysis of High Speed Pumps**

Bois, Gerard; Nov 1, 2006; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476639; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476639

No abstract available

*Design Analysis; Flow; High Speed; Pumps; Turbomachinery*

**20080018600** Savannah River Lab., Aiken, SC, USA; Westinghouse Savannah River Co., Aiken, SC, USA

**Thermal Testing of 9977 General Purpose Fissile Package Using a Pool Fire**

Gelder, L. F.; May, C. G.; Malloy, J.; Abramczyk, G. A.; Smith, A. C.; January 2006; 7 pp.; In English

Report No.(s): DE2007-899961; WSRC-STI-2007-00019; No Copyright; Avail.: Department of Energy Information Bridge

The 9977/9978 General Purpose Fissile Package (GPFP), has been designed as a cost-effective, user-friendly replacement for the DOT 6M Specification Package for transporting Plutonium and Uranium metals and oxides. To ensure the capability of the 9977 GPFP to withstand the regulatory crush test, urethane foam was chosen for the impact absorbing overpack. As part of the package development it was necessary to confirm that the urethane foam overpack would provide the required protection for the containment vessel during the thermal test portion of the Hypothetical Accident Conditions Sequential Tests. Development tests of early prototypes were performed, using a furnace. Based on the results of the development tests, detailed design enhancements were incorporated into the final design. Examples of the definitive 9977 design configuration were subjected to an all-engulfing pool fire test, as part of the HAC Sequential Tests, to support the application for certification. Testing has confirmed the package's ability to withstand the HAC thermal tests.

NTIS

*Fires; Fissionable Materials; Packaging*

**20080018815** NASA, Washington, DC USA

**System for controlling child safety seat environment**

Dabney, Richard W., Inventor; Elrod, Susan V., Inventor; January 22, 2008; 9 pp.; In English

Patent Info.: Filed January 28, 2005; US-Patent-7,320,223; US-Patent-Appl-SN-11/047,343; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018815

A system is provided to control the environment experienced by a child in a child safety seat. Each of a plurality of thermoelectric elements is individually controllable to be one of heated and cooled relative to an ambient temperature. A first

portion of the thermoelectric elements are positioned on the child safety seat such that a child sitting therein is positioned thereover. A ventilator coupled to the child safety seat moves air past a second portion of the thermoelectric elements and filters the air moved therepast. One or more jets coupled to the ventilator receive the filtered air. Each jet is coupled to the child safety seat and can be positioned to direct the heated/cooled filtered air to the vicinity of the head of the child sitting in the child safety seat.
Official Gazette of the U.S. Patent and Trademark Office
*Safety Factors; Systems Engineering; Ambient Temperature; Thermoelectricity; Safety*

**20080018903** Massachusetts Univ., USA
**Informatics and High Throughput Screening of Thermophysical Properties**
Hyers, Robert W.; Rogers, Jan R.; March 09, 2008; 1 pp.; In English; The Minerals, Metals and Materials Society, 2008 Meeting, 9-13 Mar. 2008, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

The combination of computer-aided experiments with computational modeling enables a new class of powerful tools for materials research. A non-contact method for measuring density, thermal expansion, and creep of undercooled and high-temperature materials has been developed, using electrostatic levitation and optical diagnostics, including digital video. These experiments were designed to take advantage of the large volume of data (many gigabytes/experiment, terabytes/campaign) to gain additional information about the samples. For example, using sub-pixel interpolation to measure about 1000 vectors per image of the sample's surface allows the density of an axisymmetric sample to be determined to an accuracy of about 200 ppm (0.02%). A similar analysis applied to the surface shape of a rapidly rotating sample is combined with finite element modeling to determine the stress-dependence of creep in the sample in a single test. Details of the methods for both the computer-aided experiments and computational models will be discussed.
Author
*Thermophysical Properties; Computer Techniques; Thermal Expansion; Surface Properties; Electrostatics; Diagnosis*

## 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*.

**20080018115** Naval Research Lab., Bay Saint Louis, MS USA
**Determination of Primary Bands for Global Ocean-Color Remote Sensing**
Lee, ZhongPing; Arnone, Robert; Carder, Kendall; He, MingXia; Aug 2007; 9 pp.; In English
Contract(s)/Grant(s): Proj-PE0602435N
Report No.(s): AD-A476470; NRL/PP/7330-07-7247; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476470

A few years ago, Lee and Carder' demonstrated that for the quantitative derivation of major properties in an aqua-environment (information of phytoplankton biomass, colored dissolved organic matter, and bottom status, for instance) from remote sensing of its color, a sensor with roughly 17 spectral bands in the 400 - 800 nm range can provide acceptable results compared to a sensor with 81 consecutive bands (in a 5-nm step). In that study, however, it did not show where the 17 bands should be placed. Here, from nearly 300 hyperspectral measurements of water reflectance taken in both coastal and oceanic waters that covering both optically deep and optically shallow waters, first and second derivatives were calculated after interpolating the measurements into 1-nm resolution. From these hyperspectral derivatives, the occurrence of zero value at each wavelength was accounted for, and a spectrum of the total occurrences was obtained, and further the wavelengths that captured most number of zeros were identified. Because these spectral locations indicate extremum (a local maximum or minimum) of the reflectance spectrum or inflections of the spectral curvature, placing the bands of a sensor at these wavelengths maximize the possibility of capturing (and then accurately restoring) the detailed curve of a reflectance spectrum, and thus maximize the potential of detecting the changes of water and/or bottom properties of various aqua environments with a multi-band sensor.
DTIC
*Color; Marine Environments; Remote Sensing; Remote Sensors; Water Color*

**20080018118** Naval Research Lab., Bay Saint Louis, MS USA

**Simple and Efficient Technique for Spatial/Temporal Composite Imagery**

Casey, Brandon J; Arnone, Robert A; Flynn, Peter M; Aug 2007; 10 pp.; In English

Report No.(s): AD-A476484; NRL/PP/7330-07-7251; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476484

Satellite ocean color remote sensing is plagued by loss of coverage due to cloud obscuring, glint contamination, atmospheric correction failures, and other issues. We have developed a simple and efficient technique for estimating missing remote sensing data by taking advantage of the inter-pixel spatial and temporal coherency of individual ocean color products. The technique first employs a limited iterative triangular interpolation procedure. This procedure attempts to select three neighboring pixels forming the tightest triangle enclosing the data point we are attempting to recover; and then interpolating. On failure to find three suitable neighbors, a second procedure is employed which attempts to recover missing data points by using a time dependent 'latest pixel' replacement. This procedure replaces the missing data point with the most recent data point collected at that grid point within the last seven days. This technique has been applied to MODIS (MODerate resolution Imaging Spectrometer) ocean color products of phytoplankton absorption, back-scattering coefficient, and chlorophyll concentration to produce cloud free bio-optical products on a daily basis and provide anew capability for monitoring coastal processes. We demonstrate a new method on MODIS products and show how bio-optical properties changeover a daily and monthly time scale.

DTIC

*Imagery; Imaging Spectrometers; MODIS (Radiometry); Remote Sensors*

**20080018125** Office National d'Etudes et de Recherches Aerospatiales, Palaiseau, France

**Advanced Concept for Air Data System using EBF and Lidar**

Mohamed, A K; Bonnet, J; Jun 1, 2007; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476499; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476499

No abstract available

*Air Data Systems; Electron Beams; Externally Blown Flaps; Fluorescence; Optical Radar; Remote Sensors*

**20080018162** Tanner Research, Inc., Pasadena, CA USA

**Neuromorphic Modeling of Moving Target Detection in Insects**

Shoemaker, Patrick; Dec 31, 2007; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0286; Proj-2304

Report No.(s): AD-A476576; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476576

Ionic polymers under development fir use in wide-ranging applications from bio/chem sensing to remote robotics. SMA are being considered for chevron design to reduce jet noise and increase performance, as well as attenuation in modular antennas.

DTIC

*Detection; Insects; Target Acquisition; Targets*

**20080018165** Arizona State Univ., Tempe, AZ USA

**Time-Frequency Filtering and Carrier-Phase Ambiguity Resolution for GPS-Based TSPI Systems in Jamming Environment**

Lai, Ying-Cheng; Aug 15, 2007; 33 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0115

Report No.(s): AD-A476580; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476580

In the project period, we developed a class of time-frequency filters based on the combination of the empirical-mode decomposition (EMD) method and a general blind-source separation (BSS) algorithm. We obtained evidence that the method is able to separate jamming from the GPS signal for JSR up to 45dB. A forefront research area in signal processing is particle filters. The idea is to evolve the probability distribution of a signal by using a large number of particles according to the system equations and some stochastic processes, which is similar to Monte-Carlo simulation in physics and chemistry. Motivated by the fact that particle filters have been used widely in various types of signal-processing tasks, we applied this technique to GPS

positioning of moving objects in a jamming environment. In particular, we considered a class of regularized particle filters, suitable for estimating the position of a moving object (e.g., a car) equipped with some proper GPS C/A code receiver. Theoretically, a question of interest is how the estimation error depends on uncertainties in the velocity measurement of the car and on the noise level in the UPS signal. Our analysis of the covariance matrix constructed from simulated particles led to a formula relating this matrix to the covariance matrices of the velocity and of the position error from least-squares processing of UPS pseudoranges. The formula was verified by numerical simulations.
DTIC
*Ambiguity; Decomposition; Frequencies; Global Positioning System; Jamming; Signal Processing*

**20080018289** Washington Univ., Seattle, WA USA
**Perceptually-Driven Signal Analysis for Acoustic Event Classification**
McLaughlin, Jack; Philips, Scott; Pitton, James; Sep 26, 2007; 68 pp.; In English
Contract(s)/Grant(s): N00014-01-G-0460-0023; Proj-398720
Report No.(s): AD-A476786; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476786

This research develops a framework for employing perceptual information from human listening experiments to improve automatic event classification. We focus on the identification of new signal attributes, or features, that are able to predict the human performance observed in formal listening experiments. Using this framework, our newly identified features have the ability to elevate automatic classification performance closer to the level of human listeners. We develop several new methods for learning a perceptual feature transform from human similarity measures. We also develop a new approach for learning a perceptual distance metric. Our research demonstrates these new methods in the area of active sonar signal processing and confirms anecdotal evidence that human operators are adept in the task of discriminating between active sonar target and clutter echoes. We identify perceptual features and distance metrics using our novel methods. The results show better agreement with human performance than previous approaches.
DTIC
*Classifications; Signal Analysis; Signal Transmission; Sound Waves*

**20080018304** Air War Coll., Maxwell AFB, AL USA
**Bottling Proliferation of the Uranium Genie: Identifying and Monitoring Clandestine Enrichment Programs**
Stoss, III, Ferdinand B; Apr 2007; 88 pp.; In English
Report No.(s): AD-A476809; AU/AFF/NNN/2007-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476809

America must develop robust capabilities to identify and monitor clandestine nuclear weapons programs. Accurate and timely intelligence are essential elements in combating the spread of nuclear weapons, of which the President's 2006 'National Security Strategy' succinctly describes as 'the greatest threat to our national security.' This paper first delves into why the leadership of some countries desire nuclear weapons. A brief discussion of international agreements and American policies in relation to nuclear nonproliferation follows. Then, the uranium nuclear fuel cycle is described along with several pertinent case studies. Finally, conclusions and recommendations for American nonproliferation efforts are presented. An increased emphasis on nuclear nonproliferation within the USA government is required. Nonproliferation programs are spread across many agencies and departments within the Executive Branch, lending to inefficiencies and a lack of synergistic direction. Just as a cabinet post was recently created to enhance America's intelligence assessments, similar attention is warranted for America's nonproliferation endeavors. There are shortfalls in the intelligence capabilities of the USA to detect clandestine nuclear weapons programs, as was discovered following the 2003 invasion of Iraq. To remedy this deficiency, the USA must acquire the capability to accurately detect and monitor proliferators' nuclear weapons programs. Only by understanding what proliferators are doing can approaches be developed to stop or delay their efforts. There is a compelling case that Iran's uranium enrichment effort is not exclusively for nuclear energy, as they claim. Rather, Iran's objective is likely to develop nuclear weapons. Improved technologies to detect uranium enrichment could provide the key to finding the 'smoking gun' in Iran.
DTIC
*Detection; Enrichment; Identifying; Military Operations; Nuclear Fuels; Nuclear Weapons; United States; Uranium*

**20080018317** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**The Effects of Signal and Image Compression of Sar Data on Change Detection Algorithms**

Shenoy, Kiran; Sep 2007; 110 pp.; In English

Report No.(s): AD-A476854; AFIT/GSS/ENG/07-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476854

With massive amounts of SAR imagery and data being collected, the need for effective compression techniques is growing. One of the most popular applications for remote sensing is change detection, which compares two geo-registered images for changes in the scene. While lossless compression is needed for signal compression, the same is not often required for image compression. In almost every case the compression ratios are much higher in lossy compression making them more appealing when bandwidth and storage becomes an issue. This research analyzes different types of compression techniques that are adapted for SAR imagery, and tests these techniques with three different change detection algorithms. Many algorithms exist that allow large compression ratios, however, the usefulness of the data is always the final concern. It is necessary to identify compression methods that will not degrade the performance of change detection analysis.

DTIC

*Algorithms; Change Detection; Data Compression; Image Processing; Synthetic Aperture Radar*

**20080018467** NASA Glenn Research Center, Cleveland, OH, USA

**A Globally Optimal Particle Tracking Technique for Stereo Imaging Velocimetry Experiments**

McDowell, Mark; April 2008; 24 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.16.02

Report No.(s): NASA/TM--2008-215153; E-16381; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018467

An important phase of any Stereo Imaging Velocimetry experiment is particle tracking. Particle tracking seeks to identify and characterize the motion of individual particles entrained in a fluid or air experiment. We analyze a cylindrical chamber filled with water and seeded with density-matched particles. In every four-frame sequence, we identify a particle track by assigning a unique track label for each camera image. The conventional approach to particle tracking is to use an exhaustive tree-search method utilizing greedy algorithms to reduce search times. However, these types of algorithms are not optimal due to a cascade effect of incorrect decisions upon adjacent tracks. We examine the use of a guided evolutionary neural net with simulated annealing to arrive at a globally optimal assignment of tracks. The net is guided both by the minimization of the search space through the use of prior limiting assumptions about valid tracks and by a strategy which seeks to avoid high-energy intermediate states which can trap the net in a local minimum. A stochastic search algorithm is used in place of back-propagation of error to further reduce the chance of being trapped in an energy well. Global optimization is achieved by minimizing an objective function, which includes both track smoothness and particle-image utilization parameters. In this paper we describe our model and present our experimental results. We compare our results with a nonoptimizing, predictive tracker and obtain an average increase in valid track yield of 27 percent

Author

*Imaging Techniques; Velocity Measurement; Pattern Recognition; Cylindrical Chambers; Particle Tracks; Stochastic Processes; Simulated Annealing*

**20080018708** CAE Professional Services, Ottawa, Ontario Canada

**Advanced Integrated Multi-Sensor Surveillance (AIMS): Mission, Function, Task Analysis**

Baker, Kevin; Youngson, Gord; Jun 2007; 326 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W7711-4-7904/01-TOR

Report No.(s): AD-A476937; DRDC-ATLANTIC-CR-2007-021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476937

To increase the effectiveness of searching, detecting, classifying, and identifying contacts particularly at night and in poor weather, the Advanced Integrated Multi sensor Surveillance (AIMS) system is being developed. The AIMS system is advanced through the integration of four sensors into a single gimbal. As such, the system will support a myriad of missions for both the CP 140 and Fixed Wing Search and Rescue (FWSAR) communities, including timely search and rescue (SAR) response, maritime operations, and ground surveillance in support of the Land Forces (LF). To ensure optimal performance, the AIMS system requires an appropriate interface and controls, the design of which must provide effective interaction between the operator and the technological capability of the system. This document, prepared by CAE Professional Services on behalf of Defence R&D Canada (DRDC), presents results stemming from the mission, function, and task analysis of the activities

associated with employing the AIMS system on the FWSAR and AIMP CP 140 platforms to support the conduct of SAR and ground surveillance missions respectively. This data will be used to support the design of an Operator Machine Interface (OMI) for the AIMS system.
DTIC
*Functional Analysis; Functions (Mathematics); Human Factors Engineering; Multisensor Applications; Multisensor Fusion; Patrols; Rescue Operations; Surveillance*

**20080018930** Iowa State Univ. of Science and Technology, Ames, IA USA
**Full-Field Vibration Measurement for Vibrothermography (Preprint)**
Renshaw, Jeremy; Holland, Stephen D; Nov 2007; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-C-5228; Proj-3153
Report No.(s): AD-A476864; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476864

Vibrothermography is a nondestructive technique for finding defects through vibration-induced heating imaged with an infrared camera. To model the crack heating process in vibrothermography, it is essential first to understand the vibration that causes heat generation. We describe a method for calculating internal motions from surface vibrometry measurements. A reciprocity integral and Gauss's law allow representation of internal motion by a surface integral of boundary motion times the Green's Function. We present experimental results showing internal motions calculated from measured surface motions of a vibrating sample. This will ultimately allow estimation of the detectability of a hypothetical crack at an arbitrary location in a specimen.
DTIC
*Thermography; Vibration; Vibration Measurement*

## 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*.

**20080018343** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
**Collision Broadening Using Alkali-Filled, Hollow Core Fibers**
Rodgers, Luke P; Sep 2007; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476946; AFIT/GAP/ENP/07-S01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476946

The goal of this research was to demonstrate the possibility of collision broadening in a cesium-filled, hollow-core fiber as an alternative to the proven technique of pressure broadening. Theoretically, the absorption spectrum should collisionally broaden due to the presence of fiber walls. An absorption dip located at 852.34nm was recorded in a pressure broadened comparison leg. This data was used as a baseline during analysis of the fiber leg's data. While the fiber was successfully exposed to the cesium under safe, controlled conditions, unexpected fluctuation in both the coupling efficiency and laser power levels resulted in the inability to record an absorption dip in the final data. As a result, an investigation of the fundamental assumptions and theory supporting this experiment was conducted. It was discovered that the current design does not provide an adequate opportunity for cesium to make its way into the fiber core, thus negating the possibility of achieving the desired collision broadening data. Recommendations are made as to how to improve this experiment for future study, founded on both theoretical calculations and experience gained in the lab.
DTIC
*Alkalies; Collisions; Fiber Optics; Laser Spectroscopy; Line Spectra*

**20080018344** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
**Time Resolution of Collapse Events During the Propagation of Ultraviolet Light Filaments**
Fondren, Teresa J; Mar 2008; 110 pp.; In English
Report No.(s): AD-A476947; AFIT/GAP/ENP/08-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476947

Long distance propagation, or filamentation, of short, intense laser pulses is possible through the balance of two effects:

self-focusing, when a nonlinear index of refraction of air is induced by high intensities, and de-focusing, due to the plasma created by the pulse. Applications for filamentation include areas such as remote sensing and directed energy. A split-step spectral propagation simulation is used to model the behavior of a high intensity ultraviolet laser pulse propagating through air. Convergence of femtosecond duration collapses that form on the leading edge of the pulse in the time domain is achieved with an increase in the multi-photon ionization coefficient. Through an analysis of the relative sizes of each term in the propagation equation, a lack of plasma present at the leading edge of the pulse is found to cause these collapses. Results for a more recent value of the electron-positive ion recombination rate are compared to results from a higher value used in previous work. A linear stability analysis shows inherent instability of the pulses in all cases. The inclusion of group velocity dispersion is shown to increase stability at high temporal frequencies except at zero spatial frequencies. A run similar to an experiment claiming UV filamentation is shown to be artificially limited by numerical parameters.
DTIC
*Collapse; Pulsed Lasers; Temporal Resolution; Ultraviolet Lasers; Ultraviolet Radiation*

**20080018353** Florida International Univ., Miami, FL USA
**Laser Induced Shock Waves and Vaporization in Biological System and Material Science**
Gerstman, Bernard S; Jan 30, 2008; 6 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0221
Report No.(s): AD-A476965; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476965

Theoretical and computational work was carried out to investigate the underlying physical mechanisms that cause laser induced biological damage and material stress. In order to cause damage to the absorbing material, the electromagnetic energy of the laser pulse must be converted to thermo-mechanical energy. We have developed a computational model that allows the calculation of damage resulting from a laser pulse of any duration or energy due to temperature rise, explosive bubble formation, and shock wave production. We have discovered that the system exhibits chaotic dynamics. We have shown quantitatively that the chaos inherent in the system leads to the surprising result that small changes in laser parameters, such as duration or energy, can produce large changes in the thermo-mechanical response of the system. This causes certain laser pulse durations and energies to be especially difficult to protect against, whereas other laser regimes are especially safe. We also discovered resonant effects in laser absorption and damage that allow the duration between pulses to be tuned to channel a greater or lesser fraction of the absorbed energy into shockfront and bubble production. This allows the delivery of large amounts of laser energy to produce strong thermal effects while suppressing unwanted pressure effects, or vice versa.
DTIC
*Laser Damage; Lasers; Preserving; Pulsed Lasers; Shock Waves; Tissues (Biology); Vaporizing*

**20080018654** Science Systems and Applications, Inc., Hampton, VA, USA; NASA Langley Research Center, Hampton, VA, USA
**Conductively Cooled Ho:Tm:LuLiF Laser Amplifier**
Bai, Yingxin; Yu, Jirong; Trieu, Bo; Petros, M.; Petzar, Paul; Lee, Hyung; Singh, U.; May 04, 2008; 2 pp.; In English; CLEO '08: Conference on Lasers and Electro-Optics, 4-8 May 2008, San Jose, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

A conductively-cooled Ho:Tm:LuLiF laser head can amplify 80mJ/340ns probe pulses into 400mJ when the pump pulse energy is close to amplified spontaneous emission (ASE) threshold, 5.6J. For a small signal, the double-pass amplification exceeds 25.
Author
*Amplification; Light Amplifiers; Laser Outputs; Spontaneous Emission; Polarized Light; Liquid Lasers; Energy Levels; Carbon Dioxide*

**20080018810** City Univ. of New York, NY USA
**Cr.sup.4+-doped mixed alloy laser materials and lasers and methods using the materials**
Alfano, Robert R., Inventor; Petricevic, Vladimir, Inventor; Bykov, Alexey, Inventor; April 15, 2008; 11 pp.; In English
Contract(s)/Grant(s): NCC1-03009
Patent Info.: Filed January 24, 2006; US-Patent-7,359,415; US-Patent-Appl-SN-11/338,478; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018810

A laser medium includes a single crystal of Cr.sup.4+:Mg.sub.2-xM.sub.xSi.sub.1-yA.sub.yO.sub.4, where, where M is

a bivalent ion having an ionic radius larger than Mg.sup.2+, and A is a tetravalent ion having an ionic radius larger than Si.sup.4+. In addition, either a) 0.ltoreq.x<2 and 0<y<1 or b) 0<x<2 and y is 0 or 1 with the proviso that if M is Ca.sup.2+ and x=1 then y is not 0. The laser medium can be used in a laser device, such as a tunable near infrared (NIR) laser.
Official Gazette of the U.S. Patent and Trademark Office
*Laser Materials; Single Crystals; Tunable Lasers; Alloys*

## 37
## 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*.

**20080018134** Technische Univ., Brunswick, Germany
**Unsteady Pressure and Velocity Measurements in Pumps**
Wulff, Detlev L; Nov 1, 2006; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476523; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476523
No abstract available
*Instruments; Pressure Measurement; Pumps; Unsteady Flow; Velocity Measurement*

**20080018135** Technische Univ., Brunswick, Germany
**PIV Measurements in Pumps**
Wulff, Detlev L; Nov 1, 2006; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476524; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476524
No abstract available
*Laser Doppler Velocimeters; Particle Image Velocimetry; Pumps*

**20080018140** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium
**Flow and Loss Mechanisms in Volutes of Centrifugal Pumps**
Braembussche, R A Van den; Nov 1, 2006; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476529; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476529
No abstract available
*Centrifugal Pumps; Impellers; Losses*

**20080018311** Naval Surface Warfare Center, Silver Spring, MD USA
**USS Princeton (CG 59): Microbiologically Influenced Corrosion (MIC) and Macrofouling Status of Seawater Piping Systems**
Jones, Joanne M; Little, Brenda; Jun 1, 1990; 60 pp.; In English
Report No.(s): AD-A476830; NAVSWC-TR-90-176; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476830
Preliminary results and observations on the microbiologically influenced corrosion (MIC) and other failures/corrosion problems associated with macrofouling in seawater piping systems on the USS PRINCETON (CC 59) were reported from a shipboard investigation on 23-26 January 1990 in a Naval Ship Systems Engineering Station (NAVSSES) report entitled 'Investigation of seawater piping system deterioration on USS PRINCETON (CC 59)..%1 The NAVSSES report concludes that while there was no single cause for all the reported failures, the majority were due to 'damaging flow conditions such as cavitation, turbulence and impingement'.1 This report acknowledges a pervasive problem of crevice corrosion under 'soft fouling' and under-deposit corrosion. This technical report will describe the microfouling and macrofouling within the seawater piping system of the USS PRINCETON (CC 59) and assess their contribution to the corrosion problems observed. We will further demonstrate that biocorrosion can contribute to the corrosion mechanisms cited in the NAVSSES report.
DTIC
*Corrosion; Sea Water*

**20080018441** Research and Technology Organization, Neuilly-sur-Seine, France

**Design and Analysis of High Speed Pumps**

November 2006; In English; See also 20080018442 - 20080018454

Report No.(s): RTO-EN-AVT-143; AC/323(AVT-143)TP/112; Copyright; Avail.: CASI: C01, CD-ROM

Topics covered include: Introduction to Design and Analysis of High Speed Pumps; Physics and Control of Cavitation; Numerical Modelling of Cavitation; Unsteady Pressure and Velocity Measurements in Pumps; PIV Measurements in Pumps; Impeller Volute and Diffuser Interaction; Flow Instabilities in Cavitating and Non-Cavitating Pumps; Cavitation Instabilities in Inducers; Introduction to Pump Rotordynamics; Hydrodynamic Fluid Film Bearings and their Effect on the Stability of Rotating Machinery; Annular Pressure Seals and Hydrostatic Bearings; Flow and Loss Mechanisms in Volutes of Centrifugal Pumps; and Optimization of Radial Impeller Geometry.

Derived from text

*Design Analysis; Rotor Dynamics; Pressure Measurement; Hydrostatics; Centrifugal Pumps; Cavitation Flow; High Speed; Mathematical Models; Particle Image Velocimetry*

**20080018442** Ecole Nationale Superieure des Arts et Metiers, Lille, France

**Introduction to Design and Analysis of High Speed Pumps**

Bois, Gerard; Design and Analysis of High Speed Pumps; November 2006, pp. 1-1 - 1-20; In English; See also 20080018441; Original contains color and black and white illustrations

Report No.(s): Paper 1; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The physical mechanisms which govern the flow characteristics in a turbo-machine and specifically a pump are complex, numerous and partially explained. Flow conditions are generally three dimensional, viscous and non stationary and for the case of cavitating flow, one have to take into account two or multiphase conditions. The non stationary character of the flow is obvious if one consider rotor-stator or rotor-volute interactions. In the case of non uniform inlet conditions or intrinsic heterogeneity created by off design conditions and/or two phase flow, the phenomena is more complicated to understand. Transient regimes also lead to non stationary phenomena. The correct understanding and evaluation of these physical mechanisms become more and more important because of the high level of concurrence between pump manufacturers. They have to deal with high efficiencies, extended stabilised operating zones, more compact and reliable machines with severe geometrical constrains. For example, the search for more compact and lighter pumps has led to an increased rotational speed. The consequence of this trend has inevitably increased the potential for fluid- structure interaction problems and the severity of those problems on the pump itself and its environment. Even in the absence of cavitation and its complications, these fluid structure interaction phenomena can lead to increased wear and, under the worst conditions, to structural failure. In addition, and very often simultaneously, cavitation also becomes the main issue. Cavitation first consequence in a pump concerns steady state hydraulic performance damages. Secondly, cavitation is typically a non stationary phenomena and, because of its very complicated nature, may lead to a quite important variety of other problems like global flow oscillations, local flow oscillations and fluid induced radial and rotordynamic forces.

Author

*High Speed; Cavitation Flow; Design Analysis; Two Phase Flow; Rotor Dynamics; Oscillations; Flow Characteristics*

**20080018443** Technische Univ., Brunswick, Germany

**PIV Measurements in Pumps**

Wulff, Detlev L.; Design and Analysis of High Speed Pumps; November 2006, pp. 5-1 - 5-36; In English; See also 20080018441; Original contains color illustrations

Report No.(s): Paper 5; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Digital Particle Imaging Velocimetry (DPIV) is a powerful nonintrusive measuring technique that has become popular in the last decade with the availability of commercial systems. In contrast to Particle Image Velocimetry (PIV), which utilizes analogue imaging and therefore time-consuming post processing, for DPIV digital video recording is encountered which is ideally suited for digital data processing. This offers the advantage of near real-time velocity measurements and therefore eases application. The ability to measure instantaneous planar velocity fields makes it attractive for investigations of complex flow fields encountered in pumps. While standard systems allow measurement of two velocity components, stereo DPIV will deliver all three components in the measuring plane. This paper gives an overview on the basic principles of DPIV and the main components of standard systems. Special effort is made to report on the particularities of measurements in stationary as well as rotating components of pumps. The main topics of this report are: 1) Principles of DPIV; 2) Light sources, seeding

and tracer particles, digital image recording; 3) Data processing; 4) Practical hints; 5) Optical access; 6) Refraction adaptation; 7) PIV-LIF; and 8) Examples of DPIV measurements in pumps,
Author
*Particle Image Velocimetry; Digital Systems; Velocity Distribution; Velocity Measurement; Flow Distribution; Digital Data; Data Recording; Data Processing*

**20080018444** Centre National d'Etudes Spatiales, Evry, France
**Numerical Modelling of Cavitation**
Pouffary, Benoit; Design and Analysis of High Speed Pumps; November 2006, pp. 3-1 - 3-54; In English; See also 20080018441; Original contains color and black and white illustrations
Report No.(s): Paper 3; Copyright; Avail.: CASI: A04, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The objective of the present note is to provide the basic concepts of numerical modelling of cavitation. After a brief description of the cavitation phenomena, the modelling concepts are discussed. A specific attention is given to the development of a barotropic model and its integration in a 3D unsteady CFD code. Influence of numerical and physical parameters is detailed on two two-dimensional configurations (hydrofoil and venturi). Examples of calculations on various geometries (inducers and impellers) are detailed to validate robustness of the computational methodology. Modifications of internal flows due to development of cavitation are discussed and an analysis of the mechanisms leading to the head drop is presented. Simulations of cavitation instabilities in blade cascades are presented and physical mechanisms are discussed.
Author
*Cavitation Flow; Mathematical Models; Computational Fluid Dynamics; Barotropism; Internal Flow; Hydrofoils*

**20080018445** Osaka Univ., Osaka, Japan
**Flow Instabilities in Cavitating and Non-Cavitating Pumps**
Tsujimoto, Yoshinobu; Design and Analysis of High Speed Pumps; November 2006, pp. 7-1 - 7-24; In English; See also 20080018441
Report No.(s): Paper 7; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is well known that flow instabilities called rotating stall and surge may occur in non-cavitating turbomachines at flow rates smaller than design. Rotating stall is a local instability at the turbomachinery which is basically not dependent on the hydraulic system in which the turbomachine is installed. The stalled region rotates faster than impeller. Surge is a system instability in a hydraulic system which includes a turbomachinery and a capacitance (tank) which stores the working fluid depending on the pressure at the capacitance. For pumps, if a certain quantity of air is trapped in the pipeline it serves as a capacitance and a surge may occur even if the pipeline does not include exernalt capacitance. Both rotating stall and surge occur at smaller flow rates where the performance curve has a positive slope. On the other hand, cavitation instabilities called rotating cavitation and cavitation surge may occur even at the design flow rate. Rotating cavitation is a local instability in which the cavitated region rotates, for the most cases, faster than impeller. Cavitation surge is a system instability caused by cavitation. For cavitation surge, the cavitation at the inlet of turbomachinery serves as a capacitance and it can occur in a system without any external capacitance. The present lecture is intended to explain the mechanisms of the instabilities, rotating stall, surge, rotating cavitation, and cavitation surge, as well as the characteristics of those instabilities, based on one [1] and two [13][14] dimensional stability analyses.
Author
*Cavitation Flow; Dimensional Stability; Fluid Pressure; Rotating Stalls; Surges; Turbomachinery; Impellers; Flow Velocity*

**20080018446** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium
**Optimization of Radial Impeller Geometry**
VandenBraembussche, R. A.; Design and Analysis of High Speed Pumps; November 2006, pp. 13-1 - 13-28; In English; See also 20080018441; Original contains color illustrations
Report No.(s): Paper 13; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This lecture first provides an overview of the relation between the flow mechanisms in radial impellers and the 3D geometry. Special emphasis is given to secondary flows and the pressure gradients that govern them. It is followed by the

description of a computerized optimization technique for the design of radial impellers. It is shown how the use of a Database, Artificial Neural Network and Genetic algorithm can be used to accelerate the design process and to improve performance. Author

*Genetic Algorithms; Optimization; Neural Nets; Impellers; Pressure Gradients*

**20080018447** Grenoble Univ., France

**Physics and Control of Cavitation**

Franc, Jean-Pierre; Design and Analysis of High Speed Pumps; November 2006, pp. 2-1 - 2-36; In English; See also 20080018441; Original contains color and black and white illustrations

Report No.(s): Paper 2; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The objective of the present chapter1 is to provide the basic concepts and tools required to understand the inception and development of cavitation in liquid flows. The influence of various parameters as the boundary layer and nuclei content is discussed. A special attention is given to thermal effects which may significantly influence the development of cavitation in thermosensitive fluids as cryogenic liquids. The main types of cavitation (partial attached cavities, travelling bubble cavitation, vortex cavitation and shear cavitation) are presented.

Author

*Cavitation Flow; Liquid Flow; Temperature Effects; Boundary Layers; Cryogenics*

**20080018448** Padua Univ., Italy

**Impeller Volute and Diffuser Interaction**

Pavesi, G.; Design and Analysis of High Speed Pumps; November 2006, pp. 6-1 - 6-28; In English; See also 20080018441; Original contains color illustrations

Report No.(s): Paper 6; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The flow in centrifugal pumps is exceedingly complex, involving curvature, system rotation, separation, turbulence, and secondary flows. Moreover, the geometry is often asymmetric due to the volute shape. As a result, the relative motion between impeller and volute generates an unstableness which affects not only the overall pump performance, but is also responsible for pressure fluctuations, hydraulic noises and unforeseen hydrodynamic forces. These fluctuations not only generate noise and vibration that cause unacceptable levels of stress and reduce component life due to fatigue, but also introduce unfavourable characteristics of pump performance even at or near the design point. Experimental and numerical approaches contributed to the understanding of the highly complex flow interactions that occur in a centrifugal pump. Binder et al. [1], Acosta et al. [2], and Stepanoff [3] conducted some of the earliest investigations on impeller forces in centrifugal pumps. Stepanoff proposed a simple empirical model based on impeller geometry, pump head and capacity to estimate the radial resultant forces. Agostinelli et al. [4] extended Stepanoff s model taking to account the effect of specific speed on radial forces. Biheller [5] developed an equation to predict static radial pump forces applicable for a wide range of pump types and operating conditions. Hergt and Krieger [6], Kanki et al. [7] and Chamieh et al. [8] investigated the effects of single and double volute, vaned diffuser casing pumps and the influence of the impeller blades number on the hydrodynamic forces. More recently, de Ojeda et al. [9] combined the exit momentum flux and static pressure distributions around the impeller of a double volute pump to evaluate a total resultant radial thrust.

Author

*Impellers; Rotor Blades (Turbomachinery); Pressure Distribution; Flow Characteristics; Pressure Oscillations; Centrifugal Pumps*

**20080018449** Osaka Univ., Osaka, Japan

**Cavitation Instabilities in Inducers**

Tsujimoto, Yoshinobu; Design and Analysis of High Speed Pumps; November 2006, pp. 8-1 - 8-26; In English; See also 20080018441; Original contains black and white illustrations

Report No.(s): Paper 8; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Experimental observations of various kinds of cavitation instabilities are presented. Typical cavitation instabilities occur in the range of cavitation number where the inducer head is not affected by cavitation. This type of cavitation instability is caused by the cavity volume increase due to the increase of incidence angle and is treated in section 1. Another type of

cavitation instability is caused by the positive slope of the pressure performance curve due to the blockage effect of cavitation. This type of cavitation instability is treated in section 2. Stability analyses of 1- and 2-dimensional cavitating flow predict various modes of cavitation instabilities. Usually only cavitation surge and forward rotating cavitation are observed. Other modes of cavitation instabilities such as backward rotating cavitation, higher order modes of cavitation surge and rotating cavitation are observed only under limited conditions. Those modes of cavitation instabilities are presented in section 3.
Author
*Cavitation Flow; Stability; Surges; Cavities; Rotation*

**20080018450** Texas A&M Univ., College Station, TX, USA
**Introduction to Pump Rotordynamics**
San Andres, Luis; Design and Analysis of High Speed Pumps; November 2006, pp. 9-1 - 9-26; In English; See also 20080018441; Original contains color illustrations
Report No.(s): Paper 9; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The lecture introduces the basic problems in the rotordynamics of turbomachinery, excessive vibration and instability. The acceptable performance of a turbomachine depends on the adequate design and operation of the bearing and seal elements supporting a rotor. Descriptions of the basic principles of lubrication follow with details on the operation of hydrodynamic and hydrostatic lubricated bearings and seals. The differences among these elements are highlighted with a brief account on their effects on rotordynamics. The basic equations for the modeling of linear rotor-bearing systems are given along with an example for the rotordynamics of a multiple stage compressor. Pump rotordynamics is introduced noting the major difference with other rotating systems, i.e. hydraulic side loads, static and dynamic, due to pressure changes in the volute and flow conditions in an impeller, dynamic forces from seals - neck ring and interstage and balance pistons, and impeller-rotor interaction forces. Accounting for the action of these elements is of importance to adequately predict the performance and troubleshoot the rotordynamics of high performance pumps. An example of rotordynamic analysis of a multiple-stage liquid pump stresses the differences between ‘wet’ and ‘dry’ predictions, i.e. operation with and without the pumping liquid.
Author
*Rotor Dynamics; Compressors; Hydrostatics; Lubrication; Turbomachinery; Performance Prediction; Linear Systems; Rotors*

**20080018451** Texas A&M Univ., College Station, TX, USA
**Hydrodynamic Fluid Film Bearings and their Effect on the Stability of Rotating Machinery**
San Andres, Luis; Design and Analysis of High Speed Pumps; November 2006, pp. 10-1 - 10-36; In English; See also 20080018441; Original contains color illustrations
Report No.(s): Paper 10; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The lecture introduces the basic principles of hydrodynamic lubrication and the fundamental equation of Classical Lubrication Theory. The analysis proceeds to derive the static and dynamic performance characteristics of short length cylindrical journal bearings, with application to the dynamic forced performance of a rigid rotor supported on plain bearings. In a radial bearing, the Sommerfeld number defines a relationship between the static load and the journal eccentricity within the bearing. This design parameter shows the static performance of the bearing as rotor speed increases. Rotordynamic force coefficients are introduced and their effect on the stability of a rotor-bearing system thoroughly discussed. Cross-coupled force coefficients are solely due to journal rotation, and the magnitude (and sign) of the cross-stiffness determines rotordynamic stability. The whirl frequency ratio (WFR) relates the whirl frequency of subsynchronous motion to a threshold speed of instability. The desired WFR is null; however, plain cylindrical bearings show a whirl ratio of just 0.50, limiting the operation of rotating machinery to shaft speeds below twice the system first critical speed. The analysis concludes with a review of practical (in use) journal bearing configurations with highlights on their major advantages and disadvantages, including remedies to reduce or entirely avoid subsynchronous whirl instability problems.
Author
*Fluid Films; Rotor Dynamics; Dynamic Characteristics; Lubrication; Static Characteristics; Journal Bearings; Cylindrical Bodies; Design Analysis*

**20080018452** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium

**Flow and Loss Mechanisms in Volutes of Centrifugal Pumps**

VandenBraembussche, R. A.; Design and Analysis of High Speed Pumps; November 2006, pp. 12-1 - 12-26; In English; See also 20080018441; Original contains color and black and white illustrations

Report No.(s): Paper 12; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

These lecture notes provide an overview of the different inlet and outlet volutes for radial impellers. It describes the advantages and disadvantages of the different geometries, the relation between flow and geometry, the impact on the downstream or upstream impeller, the loss mechanisms and some loss prediction models. The main purpose is to provide an insight into the flow structure that can be used later to improve the performance or remediate some problems. The use of CFD is not discussed but the flow models presented here may help to get a better understanding of the CFD output.
Author

*Computational Fluid Dynamics; Centrifugal Pumps; Flow Geometry; Losses; Fluid Flow*

**20080018453** Texas A&M Univ., College Station, TX, USA

**Annular Pressure Seals and Hydrostatic Bearings**

San Andres, Luis; Design and Analysis of High Speed Pumps; November 2006, pp. 11-1 - 11-36; In English; See also 20080018441; Original contains color illustrations

Report No.(s): Paper 11; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The lecture introduces annular seals and hydrostatic bearings in liquid pumps. The analysis details the physical principle for generation of a direct stiffness in these mechanical components. Annular seals as neck ring seals and interstage seals restrict leakage but also generate force coefficients, stiffness-damping-inertia, greatly affecting the rotordynamics of liquid turbopumps, in particular those handling large density fluids. Highlights on the bulk-flow analysis of annular seals are given with details on the performance of two water seals - long and short, featuring the advantages of an anti-swirl brake to enhance the seal rotordynamic stability. Hydrostatic bearings rely on external fluid pressurization to generate load support and large centering stiffnesses, even in the absence of journal rotation. The load capacity and direct stiffnesses of hydrostatic bearings do not depend on fluid viscosity, thus making them ideal rotor support elements in process fluid pumps. Current applications intend to replace oil lubricated bearing with hybrid bearings to improve efficiency with shorten rotor spans and less mechanical complexity. Current cryogenic liquid turbopumps implement hydrostatic bearings enabling an all fluid film bearing technology with very low number of parts and no DN limit operation. Details on the bulk-flow analysis of turbulent flow hydrostatic bearings are given along with the discussion of performance characteristics, static and dynamic, for hydrostatic bearings supporting a water pump. Angled liquid injection produces a hydrostatic bearing with unsurpassed dynamic force and stability characteristics.
Author

*Hydrostatics; Liquid Bearings; Dynamic Stability; Stiffness; Turbulent Flow; Cryogenics; Loads (Forces); Rotor Dynamics; Stability; Seals (Stoppers); Inertia*

**20080018454** Technische Univ., Brunswick, Germany

**Unsteady Pressure and Velocity Measurements in Pumps**

Wulff, Detlev L.; Design and Analysis of High Speed Pumps; November 2006, pp. 4-1 - 4-34; In English; See also 20080018441; Original contains color and black and white illustrations

Report No.(s): Paper 4; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The objective of this paper is to report the state-of-the-art of unsteady pressure measurements in pumps. Though optical techniques seem in some aspects more attracting, unsteady pressure measurements can give a detailed insight in static as well as dynamic operating behaviour of pumps. A brief description of wall mounted pressure transducers and of probes fitted with miniature pressure transducers will be given. The main topics of this report are: 1) Miniature pressure sensors; 2) Resolution in time and space (response characteristics); 3) Data acquisition; 4) Ensemble/phase averaging; 5) Measurements in stationary and rotating frame; 6) Detection of non-synchronous components; and 7) Pressure and velocity measurements by means of high response probes (2D and 3D).
Author

*Pressure Sensors; Velocity Measurement; Pressure Measurement; Pumps; Dynamic Characteristics*

**20080018606** Florida Univ., Gainesville, FL, USA

**A Micromachined Geometric Moire Interferometric Floating-Element Shear Stress Sensor**

Horowitz, S.; Chen, T.; Chandrasekaran, V.; Tedjojuwono, K.; Nishida, T.; Cattafesta, L.; Sheplak, M.; January 05, 2004; 10 pp.; In English; 42nd AIAA Aerospace Sciences Meeting, 5-8 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG1-2133; NAG10-316; 23-752-55-MA

Report No.(s): AIAA Paper 2004-1042; Copyright; Avail.: Other Sources

This paper presents the development of a floating-element shear stress sensor that permits the direct measurement of skin friction based on geometric Moir interferometry. The sensor was fabricated using an aligned wafer-bond/thin-back process producing optical gratings on the backside of a floating element and on the top surface of the support wafer. Experimental characterization indicates a static sensitivity of 0.26 microns/Pa, a resonant frequency of 1.7 kHz, and a noise floor of 6.2 mPa/(square root)Hz.

Author

*Shear Stress; Micromachining; Interferometry; Skin Friction; Resonant Frequencies; Fabrication*

**20080018607** Florida Univ., Gainesville, FL, USA

**A Wafer-Bonded, Floating Element Shear-Stress Sensor Using a Geometric Moire Optical Transduction Technique**

Horowitz, Stephen; Chen, Tai-An; Chandrasekaran, Venkataraman; Tedjojuwono, Ken; Cattafesta, Louis; Nishida, Toshikazu; Sheplak, Mark; June 06, 2004; 6 pp.; In English; Hilton Head 2004 A Solid State Sensor, Actuator and Microsystems Workshop, 6-10 Jun. 2004, Hilton Head, SC, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAG1-2133; NAG10-316; 23-762-55-MA; Copyright; Avail.: CASI: A02, Hardcopy

This paper presents a geometric Moir optical-based floating-element shear stress sensor for wind tunnel turbulence measurements. The sensor was fabricated using an aligned wafer-bond/thin-back process producing optical gratings on the backside of a floating element and on the top surface of the support wafer. Measured results indicate a static sensitivity of 0.26 microns/Pa, a resonant frequency of 1.7 kHz, and a noise floor of 6.2 mPa/(square root)Hz.

Author

*Shear Stress; Turbulent Flow; Flow Measurement; Resonant Frequencies; Fabrication; Joints (Junctions); Wafers*

**20080018673** Massachusetts Inst. of Tech., Cambridge, MA, USA; Colorado State Univ., Fort Collins, CO, USA

**Low-Engine-Friction Technology for Advanced Natural-Gas Reciprocating Engines. Final Technical Report April 1, 2002 - November 30, 2006**

Wong, V.; Tian, T.; Smedley, G.; Moughon, L.; Takata, R.; Feb. 28, 2007; 221 pp.; In English

Report No.(s): DE2007-907969; No Copyright; Avail.: National Technical Information Service (NTIS)

This program aims at improving the efficiency of advanced natural-gas reciprocating engines (ANGRE) by reducing piston and piston ring assembly friction without major adverse effects on engine performance, such as increased oil consumption and wear. An iterative process of simulation, experimentation and analysis has been followed towards achieving the goal of demonstrating a complete optimized low-friction engine system. In this program, a detailed set of piston and piston-ring dynamic and friction models have been adapted and applied that illustrate the fundamental relationships among mechanical, surface/material and lubricant design parameters and friction losses. Demonstration of low-friction ring-pack designs in the Waukesha VGF 18GL engine confirmed ring-pack friction reduction of 30-40%, which translates to total engine FEMP (friction mean effective pressure) reduction of 7-10% from the baseline configuration without significantly increasing oil consumption or blow-by flow. The study on surface textures, including roughness characteristics, cross hatch patterns, dimples and grooves have shown that even relatively small-scale changes can have a large effect on ring/liner friction, in some cases reducing FMEP by as much as 30% from a smooth surface case. The measured FMEP reductions were in good agreement with the model predictions.

NTIS

*Friction; Natural Gas; Piston Engines*

**20080018822** Isothermal Systems Research, Inc., Liberty Lake, WA USA

**Atomizer for thermal management system**

Tilton, Charles L., Inventor; Weiler, Jeff, Inventor; Palmer, Randal T., Inventor; Appel, Philip W., Inventor; Knight, Paul A., Inventor; January 1, 2008; 15 pp.; In English

Contract(s)/Grant(s): NAS8-40644

Patent Info.: Filed June 3, 2004; US-Patent-7,313,925; US-Patent-Appl-SN-10/861,333; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018822

An atomizer for thermal management system for efficiently thermally managing one or more heat producing devices. The atomizer for thermal management system includes a housing having a coolant passage and a dispensing end, an orifice within the dispensing end, and an actuator manipulating a plunger within the housing. The plunger includes a head that is sealable within a recessed portion of the orifice to open or close the orifice. The coolant passes through the coolant passage into the orifice for spraying upon a heat producing device. The actuator may reciprocate so that the coolant spray emitted through the orifice is pulsating. The pulsing frequency may be increased to increase cooling or decreased to decrease cooling of the heat producing device.

Official Gazette of the U.S. Patent and Trademark Office

*Atomizers; Management Systems; Temperature Control*

## 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*.

**20080018348** Army Construction Engineering Research Lab., Champaign, IL USA

**Fort Drum Miscellaneous Building Survey**

Smith, Adam; Stone, Sunny; Feb 2008; 152 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476957; ERDC/CERL-SR-08-2; XA-10TH-MTDIV; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476957

Through the years, the USA Congress has enacted laws to preserve the national cultural heritage. The first major Federal preservation legislation was the Antiquities Act of 1906. This Act was instrumental in securing protection for archeological resources on Federal property. The benefits derived from this Act and subsequent legislation precipitated an expanded and broader need for the preservation of historic cultural resources. With this growing awareness, the USA Congress codified the National Historic Preservation Act of 1966 (NHPA), the most sweeping cultural resources legislation to date. The Congress created the NHPA to provide guidelines and requirements aimed at preserving tangible elements of the nation's past primarily through the creation of the National Register of Historic Places (NRHP). Contained within this piece of legislation are requirements for Federal agencies to address their cultural resources, defined as any prehistoric or historic district, site, building, structure, or object. Section 110 requires Federal agencies to inventory and evaluate their cultural resources. Section 106 requires the determination of effect of Federal undertakings on properties deemed eligible or potentially eligible for the NRHP. Fort Drum, New York, consists of 107,265 acres. Its mission includes command of active component units assigned to the installation, provide administrative and logistical support to tenant units, support to tenant units, support to active and reserve units from all services in training at Fort Drum, and planning and support for the mobilization and training of almost 80,000 troops annually. The objectives of this study were as follows: (1) inventory 17 buildings and structures dating from 1941 to 1994, (2) research the history of these 17 buildings and structures, and (3) assess the eligibility of the buildings and structures according to NRHP guidelines.

DTIC

*Buildings; Cultural Resources; Preserving; Qualifications; Surveys*

**20080018586** National Inst. of Aerospace, Hampton, VA, USA

**Residual Strength Characterization of Unitized Structures Fabricated Using Different Manufacturing Technologies**

Seshadri, B. R.; Smith, S. W.; Johnston, W. M.; April 21, 2008; 21 pp.; In English; 11th Joint NASA/FAA/DoD Conference on Aging Aircraft, 21-24 Apr. 2008, Phoenix, AZ, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.07.03; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation describes residual strength analysis of integral structures fabricated using different

manufacturing procedures. The topics include: 1) Built-up and Integral Structures; 2) Development of Prediction Methodology for Integral Structures Fabricated using different Manufacturing Procedures; 3) Testing Facility; 4) Fracture Parameters Definition; 5) Crack Branching in Integral Structures; 6) Results and Discussion; and 7) Concluding Remarks.
CASI
*Manufacturing; Residual Strength; Structural Analysis; Mechanical Properties; Technology Utilization; Fracture Mechanics*

**20080018612** NASA Glenn Research Center, Cleveland, OH, USA
**Progressive Fracture of Composite Structures**
Chamis, Christos C.; Minnetyan, Levon; April 07, 2008; 11 pp.; In English; 49th SDM/AIAA Conference, 7-10 Apr. 2008, Schaumburg, IL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 659877.02.03.0573.01; WBS 561581.02.10.03.23; Copyright; Avail.: CASI: A03, Hardcopy

A new approach is described for evaluating fracture in composite structures. This approach is independent of classical fracture mechanics parameters like fracture toughness. It relies on computational simulation and is programmed in a stand-alone integrated computer code. It is multiscale, multifunctional because it includes composite mechanics for the composite behavior and finite element analysis for predicting the structural response. It contains seven modules; layered composite mechanics (micro, macro, laminate), finite element, updating scheme, local fracture, global fracture, stress based failure modes, and fracture progression. The computer code is called CODSTRAN (Composite Durability Structural ANalysis). It is used in the present paper to evaluate the global fracture of four composite shell problems and one composite built-up structure. Results show that the composite shells and the built-up composite structure global fracture are enhanced when internal pressure is combined with shear loads.
Author
*Fracture Strength; Composite Structures; Structural Analysis; Loads (Forces); Classical Mechanics; Shells (Structural Forms); Laminates*

**20080018816** NASA, Washington, DC USA
**Active multistable twisting device**
Schultz, Marc R., Inventor; January 22, 2008; 14 pp.; In English
Patent Info.: Filed March 6, 2006; US-Patent-7,321,185; US-Patent-Appl-SN-11/370,377; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018816

Two similarly shaped, such as rectangular, shells are attached to one another such that they form a resulting thin airfoil-like structure. The resulting device has at least two stable equilibrium shapes. The device can be transformed from one shape to another with a snap-through action. One or more actuators can be used to effect the snap-through; i.e., transform the device from one stable shape to another. Power to the actuators is needed only to transform the device from one shape to another.
Official Gazette of the U.S. Patent and Trademark Office
*Actuators; Shapes; Twisting; Dynamic Stability*

## 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*.

**20080018456** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**The Secret of the Svalbard Sea Ice Barrier**
Nghiem, Son V.; Van Woert, Michael L.; Neumann, Gregory; September 20, 2004; 1 pp.; In English; IEEE International Topical Meeting on Geoscience and Remote Sensing Symposium, 20-24 Sep. 2004, Anchorage, AK, USA; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40752

An elongated sea ice feature called the Svalbard sea ice barrier rapidly formed over an area in the Barents Sea to the east

of Svalbard posing navigation hazards. The secret of its formation lies in the bottom bathymetry that governs the distribution of cold Arctic waters masses, which impacts sea ice growth on the water surface.
Author
*Sea Ice; Bathymeters; Air Sea Ice Interactions; Arctic Regions; Remote Sensing; Meteorology*

## 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*.

**20080018316** Air War Coll., Maxwell AFB, AL USA
**Department of Defense Energy Strategy: Teaching an Old Dog New Tricks**
Lengyel, Gregory J; Apr 2007; 75 pp.; In English
Report No.(s): AD-A476848; AU/AFF/NNN/2007-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476848

The USA has a National Security problem, energy security, in which the Department of Defense (DoD) has a unique interest. The USA imports 26% of its total energy supply and 56% of the oil it consumes. The DoD is the largest single consumer of energy in the USA, and energy is the key enabler of U.S. military combat power. High energy consumption, increased competition for limited energy supplies, ever-increasing energy costs, and the lack of a comprehensive Energy Strategy and oversight of energy issues in the DoD have created vulnerabilities. These include potential fuel and electricity supply disruptions as well as foreign policy and economic vulnerability. The DoD needs a comprehensive Energy Strategy and organizational structure to improve National Security by decreasing U.S. dependence on foreign oil, ensuring access to critical energy requirements, maintaining or improving combat capability, promoting research for future energy security, being fiscally responsible to the American tax payer, and protecting the environment. This strategy can be implemented through leadership and culture change, innovation and process efficiencies, reduced demand, and increased and diversified energy sources.
DTIC
*Defense Program; Dogs; Education; Energy Consumption; Petroleum Products; Security*

**20080018319** Pacific Air Forces, Hickam AFB, HI USA
**The Ash Warriors**
Anderegg, C R; Jan 2000; 161 pp.; In English
Report No.(s): AD-A476866; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476866

In November 1991 the American flag was lowered for the last time at Clark Air Base in the Philippines. This act brought to an end American military presence in the Philippines that extended back over 90 years. It also represented the final act in a drama that began with the initial rumblings in April of that year of the Mount Pinatubo volcano, located about 9 miles to the east of Clark. The following pages tell the remarkable story of the men and women of the Clark community and their ordeal in planning for and carrying out their evacuation from Clark in the face of impending volcanic activity. It documents the actions of those who remained on the base during a series of eruptions, and the packing out of the base during subsequent months. This is the story of the 'Ash Warriors,' those Air Force men and women who carried out their mission in the face of an incredible series of natural disasters, including volcanic eruption, flood, typhoons, and earthquakes, all of which plagued Clark and the surrounding areas during June and July 1991. The author of 'The Ash Warriors' knew the situation first hand. Colonel Dick Anderegg was the vice commander of the 3rd Tactical Fighter Wing when the volcano erupted, and he was at Clark throughout the evacuation and standing down of the base. He brought his own personal experience to bear in writing this story. He also conducted extensive research in the archives of the Pacific Air Forces and Thirteenth Air Force, utilized scores of interviews of those who witnessed and participated in the events, and visited Clark in 1998 to see in person how the installation had changed in the 8 years since the Americans left. This story is one of courage, resourcefulness, and dedication to duty on the part of Air Force men and women called upon to respond to one of the great natural disasters of the 20th Century. As the following pages reveal, the Ash Warriors were up to the challenge in every respect.
DTIC
*Airports; Ashes; Closures; Disasters; Military Air Facilities; Philippines; Volcanoes*

**20080018560** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Ocean Surface Topography Data Products and Tools**

Case, Kelley E.; Bingham, Andrew W.; Berwin, Robert W.; Rigor, Eric M.; Raskin, Robert G.; September 20, 2004; 3 pp.; In English; IEEE International Topical Meeting on Geoscience and Remote Sensing Symposium, IGARSS '04, 20-24 Sep. 2004, Anchorage, AK, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS7-03001; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40746

The Physical Oceanography Distributed Active Archiving Center (PO.DAAC), NASA's primary data center for archiving and distributing oceanographic data, is supporting the Jason and TOPEX/Poseidon satellite tandem missions by providing a variety of data products, tools, and distribution methods to the wider scientific and general community. PO.DAAC has developed several new data products for sea level residual measurements, providing a longterm climate data record from 1992 to the present These products provide compatible measurements of sea level residuals for the entire time series including the tandem TOPEX/Poseidon and Jason mission. Several data distribution tool. are available from NASA PO.DAAC. The Near-Real-Time Image Distribution Server (NEREIDS) provides quicklook browse images and binary data files The PO.DAAC Ocean ESIP Tool (POET) provides interactive, on-tine data subsetting and visualization for several altimetry data products.

Author

*Oceanographic Parameters; Data Bases; Data Management; Data Storage; Data Systems; Ocean Data Acquisitions Systems; Satellite Altimetry; Topography*

**20080018566** NASA Dryden Flight Research Center, Edwards, CA, USA

**Global Test Range: Toward Airborne Sensor Webs**

Mace, Thomas H.; Freudinger, Larry; DelFrate John H.; April 17, 2008; 12 pp.; In English; W-HALES 2008: NASA-NICT Joint Workshop on HALE UAV and Wireless Systems, 17-18 Apr. 2008, Honolulu, HI, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018566

This viewgraph presentation reviews the planned global sensor network that will monitor the Earth's climate, and resources using airborne sensor systems. The vision is an intelligent, affordable Earth Observation System. Global Test Range is a lab developing trustworthy services for airborne instruments - a specialized Internet Service Provider. There is discussion of several current and planned missions.

CASI

*Airborne Equipment; Earth Observations (From Space); Internets; Remote Sensing; Remote Sensors*

## 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*.

**20080018361** Texas Univ., Austin, TX USA

**Design, Construction, and Testing of an Inductive Pulsed-Power Supply for a Small Railgun**

Sitzman, A; Surls, D; Mallick, J; Jan 2006; 9 pp.; In English

Contract(s)/Grant(s): DAAD17-01-D-0001

Report No.(s): AD-A476977; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476977

Advances in high-power-density batteries have rekindled interest in using inductive store as a pulse compression system. Although these batteries are considered very power dense, they lack over an order of magnitude of power density to drive a deployable electric gun However, one can add an inductive circuit to a battery bank to make a hybrid system that has a much higher power density than batteries alone A battery-inductor hybrid pulsed-power supply boasts several advantages over pulsed alternators, as inductors are static and relatively easy to cool Inductors are potentially more energy dense than capacitors, making a battery-inductor hybrid pulsed-power supply an attractive alternative to capacitor-based pulsed-power supplies The opening switch has been a major obstacle in previous inductive store projects, but in simulation, a new circuit topology the Slow TRansfer of Energy Through Capacitive Hybrid (STRETCH) meat grinder greatly attenuates the problem

This paper discusses the design, construction and testing of a small-scale STRETCH meat grinder system designed which was successfully used to power a miniature railgun.
DTIC
*Construction; Railgun Accelerators; Supplying*

**20080018460** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
**Conceptual MEMS Devices for a Redeployable Antenna**
Miller, Virginia; Sep 2007; 83 pp.; In English
Report No.(s): AD-A476914; AFIT/GE/ENG/07-30; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476914

Micro-Electro-Mechanical Systems (MEMS) are becoming an integral part of our lives through a wide range of applications, including MEMS accelerators for air bag deployment in vehicles, micromirrors in projection devices, and various sensors for chemical/biological applications. MEMS are a key aspect of ever-increasing significance in a myriad of commercial and military applications. Because of this importance, this thesis utilizes MEMS devices that can deploy and retract an antenna suitably sized for placement on an insect or microrobot for communication purposes. A target monopole antenna with a length of 1 mm was used as a test metric. From this requirement, several MEMS designs using scratch drives and thermal actuators as the basis for powering the motor were developed. Some of the fabricated and tested designs included a gear with side flaps that flip up perpendicular to the substrate; gears that push an antenna beam off the edge of the substrate; and an antenna beam that is moved upwards such that it stands perpendicular to the substrate. These designs had the highest likelihood of success. Other designs included an array of micro gears and guiding beams, a large wheel powered by scratch drives, and a gear with the pawl requiring assembly. For these designs to be successful, several basic modifications would be necessary. The antenna beam that moves into a position perpendicular to the substrate was successfully self-assembled.
DTIC
*Microelectromechanical Systems; Air Bag Restraint Devices; Antenna Radiation Patterns; Antenna Design*

**20080018503** Army Construction Engineering Research Lab., Champaign, IL USA
**Condition Assessment Aspects of an Asset Management Program**
Foltz, Stuart D; McKay, David T; Jan 2008; 146 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476675; ERDC/CERL-SR-08-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476675

Central to a comprehensive asset management program is the ability to evaluate and know the condition and performance characteristics of all inventoried assets in the real property inventory (Federal Real Property Council [FRPC] Guidance, Section 4 Operations of Real Property Assets ). In the case of the U.S. Army Corps of Engineers (USACE) Civil Works business area, this inventory includes an enormous array of multipurpose dams, locks, levees, and hydropower generation facilities (as well as buildings, roads, and bridges). This report is a digest of condition assessment methodologies for Civil Works infrastructure. Included in the digest are insights and observations collected by the research team over the duration of the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Program that are pertinent to any organization interested in developing an asset management program. This digest is intended to be used in creating a USACE asset management program that also follows FRPC guidance.
DTIC
*Hydroelectricity; Dams; Maintenance*

**20080018672** Energy Conversion Devices, Inc., Troy, MI, USA
**Implementation of a Comprehensive On-Line Closed-Loop Diagnostic System for Roll-to-Roll Amorphous Silicon Solar Cell Production. Final Subcontract Report April 23, 2003-September 30, 2006**
Ellison, T.; May 01, 2007; 63 pp.; In English
Report No.(s): DE2007-908019; NREL/SR-520-41560; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes Energy Conversion Devices' diagnostic systems that were developed in this program, as well as ECD's other major accomplishments. This report concentrates on work carried out in the final (third) phase of this program, beginning in the fall of 2004 and ending in the fall of 2006. ECD has developed a comprehensive in-situ diagnostic system that: (1) Reduces the time between deposition in the a-Si machine and device characterization from about 200 hours to about 1 hour. (2) The Photovoltaic Capacitive Diagnostic systems measure the open-circuit voltage and charging rate (a measure of

the short-circuit current) and intra-cell series resistance for each cell in the triple-junction device prior to deposition of the top conductive-oxide coating in a subsequent deposition machine. These systems operate with an rms precision of about 0.03% and have operated for almost 4 years with no need for servicing of the electronics or for calibration. (3) Spectrometers are used to measure the ZnO thickness of the backreflector, a Si thickness, and top conductive-oxide, ITO, coatings.
NTIS
*Amorphous Silicon; Feedback Control; Solar Cells; Manufacturing; Photoelectric Materials; Evaluation; Quality*

**20080018911** Universal Energy Systems, Inc., Dayton, OH USA; Air Force Research Lab., Wright-Patterson AFB, OH, USA
**Power and Thermal Technologies for Air and Space. Delivery Order 0003: Development of High-Performance Solid Oxide Fuel Cell (SOFC) Technology for Remote Base Applications**
Xiao, Haiming; Reitz, Thomas; Aug 2007; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-D-2404-0003; Proj-3145
Report No.(s): AD-A476856; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476856

The longevity performance of a tape cast SOFC using a LSM-based cathode was studied for 500 hours at various power densities. Polarization experiments indicated an enhancement in performance during the long-term polarization. Electrochemical Impedance Spectroscopy (EIS) experiments were used to deconvolute the component impedances in the cell. The EIS data indicated that the vast majority of cell activation was associated with a single semi-circular feature which occurred in the low frequency region. Additional experiments were performed to attempt to assign specific electrode processes to corresponding semicircular features in the EIS spectra. These data suggest that steady polarization of the cell results in a gradual increase in cell performance which can be attributed to a ripening of the LSM-based cathode.
DTIC
*Solid Oxide Fuel Cells; Polarization; Low Frequencies; Electrodes*

## 45
## ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

**20080018302** Congressional Budget Office, Washington, DC USA
**Policy Options for Reducing CO2 Emissions**
Bogusz, Christine; Howlett, Christian; Feb 2008; 41 pp.; In English
Report No.(s): AD-A476802; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476802

There is a growing scientific consensus that rising concentrations of carbon dioxide (CO2) and other greenhouse gases, which result from the burning of fossil fuels, are gradually warming the Earth's climate. The amount of damage associated with that warming remains uncertain, but there is some risk that it could be large and perhaps even catastrophic. Reducing that risk would require restraining the growth of CO2 emissions and ultimately limiting those emissions to a level that would stabilize atmospheric concentrations which would involve costs that are also uncertain but could be substantial. The most efficient approaches to reducing emissions of CO2 involve giving businesses and households an economic incentive for such reductions. Such an incentive could be provided in various ways, including a tax on emissions, a cap on the total annual level of emissions combined with a system of tradable emission allowances, or a modified cap-and-trade program that includes features to constrain the cost of emission reductions that would be undertaken in an effort to meet the cap. This Congressional Budget Office (CBO) study prepared at the request of the Chairman of the Senate Committee on Energy and Natural Resources compares those policy options on the basis of three key criteria: their potential to reduce emissions efficiently, to be implemented with relatively low administrative costs, and to create incentives for emission reductions that are consistent with incentives in other countries. In keeping with CBO's mandate to provide objective, impartial analysis, the report contains no recommendations.
DTIC
*Carbon Dioxide; Costs; Policies*

**20080018491** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

**Technical Support Document for the Proposed Small Spark Ignition (SI) and Marine SI Emissions Standards: Ozone Air Quality Modeling**

Apr. 01, 2007; 18 pp.; In English

Report No.(s): PB2007-111685; EPA/454/R-07/006; No Copyright; Avail.: National Technical Information Service (NTIS)

This document was prepared to describe the ozone air quality modeling performed by EPA in support of the proposed rule. Two basic types of modeling were completed. First, source apportionment modeling was conducted with the Comprehensive Air Quality Model with Extensions (CAMx) to gauge the potential impacts of emissions from the entire sector subject to the proposed rule on future levels of ozone. Second, CAMx was used to simulate the effects of the proposed emissions reductions on ozone air quality in the future. The methodology and results of both modeling approaches will be summarized.

NTIS

*Air Quality; Environment Models; Gas Turbine Engines; Marine Propulsion; Ozone; Spark Ignition*

**20080018492** California Univ., Davis, CA, USA

**Micro Air Borne Particulate Analyzer (MicroAPA)**

Niemeier, D. A.; Chua, B.; Nov. 01, 2006; 86 pp.; In English

Contract(s)/Grant(s): CARB-03-346

Report No.(s): PB2007-109587; No Copyright; Avail.: CASI: A05, Hardcopy

This report describes the design, development, fabrication and testing for primary functionality of an integrated prototype of a small footprint particle size sampler, the MicroAPA. The new instrument consists of a custom designed and fabricated MEMS based ionizer and mini-DMA (separator electrodes), custom designed electrometer and Faraday's cup, as well as off-the-shelf components. The MEMS based corona ionizer and mini-DMA were constructed using microfabrication techniques. This allows a corona pin diameter of 20um to be easily achieved at a very low cost. It also permits the corona pin to be accurately positioned between two miniature copper grids 4mm apart. By using a high voltage but low current power source, a steady corona discharge is achieved at very low power consumption (less than 20mW). In-lab experiments show that the MEMS based corona ionizer .and mini- DMA are able to adequately sort particles ranging from 30nm to 300nm (with the size distribution limited by the TSI constant output atomizer capabilities, which is 30nm to 300nm).

NTIS

*Air Pollution; Ionizers; Nanoparticles; Particulate Sampling; Pollution Monitoring; Samplers; Microelectromechanical Systems*

**20080018493** California Univ., Riverside, CA, USA

**Evaluation of On-Road Results From a Test Fleet of Heavy-Duty Trucks**

Miller, J. W.; Apr. 01, 2007; 46 pp.; In English

Contract(s)/Grant(s): CARB-01-340

Report No.(s): PB2007-109586; No Copyright; Avail.: CASI: A03, Hardcopy

New and upcoming regulations for heavy-duty diesel (HDD) on-road vehicles are expected to provide significant reductions in the emissions from newly purchased HDD vehicles. California also has a Heavy Duty Vehicle Inspectiori and Periodic Smoke Inspection Program (HDVIP and PSIP) in place for in-use HDD vehicles, but this only monitors smoke opacity. CARB has conducted several pilot studies to understand the incidence of mal-maintenance and tampering in heavy-duty diesel vehicles (HDDVs) and to develop a program to control emissions from in-use trucks. In the earlier Measure 17 or M-17 program, 109 vehicles were tested at the CARB Heavy-Duty Inspection and Maintenance Laboratory (HDIML) facility in Stockton CA over a power lug curve and a steady-state cycle. The objective of the current program was to collect in- use, on-road emissions measurements on a subfleet of 5 vehicles in the Stockton, CA area. Emissions measurements were made with the University of California at Riverside's (UCR's) Mobile Emissions Laboratory (MEL), which is mobile measurement platform with a full dilution tunnel. The results of this study provide information about emissions from in-use HDDVs under typical driving conditions and can be used to better understand emissions inventories and in the development of regulations for in-use vehicles.

NTIS

*Air Pollution; Exhaust Emission; Roads; Trucks*

**20080018594** EnviRes, LLC, Lexington, KY, USA

**Reducing Ultra-Clean Transportation Fuel Costs with HyMelt (TRADE NAME) Hydrogen. Quarterly Report July 1-September 30, 2006**

Malone, D. P.; Renner, W. R.; Oct. 2006; 7 pp.; In English

Contract(s)/Grant(s): DE-FC26-02NT41102

Report No.(s): DE2007-899957; No Copyright; Avail.: Department of Energy Information Bridge

This report describes activities for the sixteenth quarter of work performed under this agreement. MEFOS, the gasification testing subcontractor, reported to EnviRes that the vendor for the pressure vessel for above atmospheric testing now plans to deliver it by November 20, 2006 instead of October 20, 2006 as previously reported. MEFOS performed a hazardous operation review of pressurized testing. The current schedule anticipates above atmospheric pressure testing to begin during the week of April 16, 2007. Phase I of the work to be done under this agreement consisted of conducting atmospheric gasification of coal using the HyMelt technology to produce separate hydrogen rich and carbon monoxide rich product streams. In addition smaller quantities of petroleum coke and a low value refinery stream were gasified. Phase II of the work to be done under this agreement, consists of gasification of the above-mentioned feeds at a gasifier pressure of approximately 3 bar. The results of this work will be used to evaluate the technical and economic aspects of producing ultra-clean transportation fuels using the HyMelt technology in existing and proposed refinery configurations.

NTIS

*Clean Fuels; Costs; Hydrogen; Transportation*

**20080018601** Savannah River Lab., Aiken, SC, USA; Westinghouse Savannah River Co., Aiken, SC, USA

**Investigation of Mis Item 011589A and 3013 Containers Having Similar Characteristics**

Friday, G. P.; Peppers, L. G.; Aug. 2006; 14 pp.; In English

Contract(s)/Grant(s): DE-AC09-96R18500

Report No.(s): DE2007-892716; WRSC-TR-2000-00236; No Copyright; Avail.: Department of Energy Information Bridge

The Materials Identification and Surveillance (MIS) program was established to confirm the suitability-bearing materials for stabilization, packaging, and long-term storage under DOE-STD-3013. As part of this program, representative samples of the materials that were packaged to meet the standard are undergoing tests to monitor gas generation and corrosion to verify that the storage package will not be challenged during storage. These tests are performed at the standard maximum limit for moisture content (0.5wt%). Recently, one test item, MIS Item 011589A, exhibited an increase in partial pressure for both hydrogen and oxygen that was inconsistent with other MIS items. The presence of oxygen and hydrogen within a 3013 container is important because it has the potential to produce flammable gas mixtures.

NTIS

*Plutonium Oxides; Radioactive Wastes; Waste Management; Environment Protection; Radiogenic Materials; Toxicity and Safety Hazard*

**20080018704** Army Chemical Materials Agency, Aberdeen Proving Ground, MA USA

**Vapor Screening Level (VSL)**

Dec. 20, 2007; 3 pp.; In English

Report No.(s): AD-A476397; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476397

The U.S. Centers for Disease Control and Prevention (CDC), the U.S. Environmental Protection Agency, and the National Research Council give health protection guidance to the U.S. Army Chemical Materials Agency (CMA) as it executes its mission of safely storing and destroying the nation's aging chemical weapons. By using advanced monitoring systems placed in and around storage and disposal areas, CMA ensures the air is safe for workers and the public. The airborne exposure limit (AEL) is a guideline developed by the CDC to determine how long people can be exposed to potential pollutants in the air without resulting effects to their health. AELs are based on a short-term exposure limit (STEL) for acute worker exposure, a worker population limit (WPL) for long-term worker exposure, and the general population limit (GPL) for the public. The GPL is the concentration that the unprotected general population can be exposed to 24 hours a day, 7 days a week, for a long period of time without experiencing any adverse health effects. The WPL is the concentration a worker can be exposed to for an average 8-hour work day. The STEL defines the concentration of contamination in the air that an unprotected worker may be safely exposed to for up to four 15-minute periods spaced at least an hour apart in an 8-hour workday. The STEL level concentration also is useful in monitoring secondary waste generated by destroying chemical weapons. These wastes include items such as personal protective equipment, insulation, cleaning materials, and other solid waste materials. CMA adapted the STEL level vapor concentration to screen for agent-exposed waste material. The adapted STEL is called the Vapor Screening

Level (VSL). It is the same vapor concentration as the STEL, but unlike a STEL, a VSL is determined from air sampled typically about 5 minutes. VSLs are used to supplement the STEL to protect workers' health during plant operations as waste is generated and moved to storage areas.
DTIC
*Chemical Warfare; Destruction; Safety; Solid Wastes; Toxicity; Vapors*

**20080018931** Defence Science and Technology Organisation, Victoria, Australia
**Sampling for Airborne Radioactivity**
Harty, Peter D; Oct 2007; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476870; DSTO-TN-0782; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476870

This report examines how to sample airborne radioactivity with minimal complexity and time expenditure, using conventional high-volume samplers in combination with alpha-particle spectrometry. The use of alpha spectrometry provides compensation for radon/thoron decay products collected on the filter paper of the sampler, leading to a seven-fold improvement in measurement sensitivity of artificial airborne alpha sources compared to simply treating radon/thoron products as a background contribution. It is estimated that high sensitivity measurements of airborne radioactivity can be made in under 30 minutes, using the procedures recommended in this report.
DTIC
*Radioactivity; Sampling*

**20080018937** Eastern Research Group, Inc., Arlington, MA, USA
**Urban Air Toxics Monitoring Program (UATMP) 2005 - Hexavalent Chromium**
Feb. 2007; 286 pp.; In English
Report No.(s): PB2007-111699; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes and interprets the 2005 UATMP and NATTS hexavalent chromium monitoring effort, and serves as a companion to the 2005 UATMP annual report (U.S. EPA, 2007). This report includes up to 12 months of 1-in-6 and 1-in-12 day measurements of ambient air quality at 22 monitoring sites in or near 19 urban/rural locations, including 14 metropolitan statistical areas (MSAs). The analysis and data interpretation in this report focuses on hexavalent chromium data trends. In addition to the planned schedule for 2005 sampling, additional measurements were collected in the wake of Hurricane Katrinas devastation to the Gulf Coast in late August 2005. The results from post-Katrina hexavalent chromium sampling are included in this report at the request of the State of Mississippi.
NTIS
*Air Quality; Chromium; Environmental Monitoring*

**20080018938** ARCADIS Geraghty and Miller, Inc., Durham, NC, USA
**Field Test Measurements at Five Municipal Solid Waste Landfills with Landfill Gas Control Technology**
Apr. 2007; 65 pp.; In English
Report No.(s): PB2007-111698; No Copyright; Avail.: CASI: A04, Hardcopy

The purpose of this field test program is to generate data that may be used to update EPAs factors for quantifying landfill gas emissions from municipal solid waste (MSW) landfills. Because of health and environmental concerns, EPA issued in 1996 New Source Performance Standards (NSPS) and Emission Guidelines (EGs) for new and existing MSW landfills. These regulations are contained in 40 CFR Parts 51, 52, and 60, Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources: Municipal Solid Waste Landfills (U.S. EPA, 1996, 1991a, 1991b, 1991c). These regulations require that large landfills collect and control landfill gas emissions.
NTIS
*Field Tests; Landfills; Solid Wastes; Exhaust Emission; Exhaust Gases*

**20080018940** Texas Southern Univ., Houston, TX, USA; Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
**Analytical Tool for Measuring Emission Impact of Acceleration and Deceleration Lanes**
Teng, H.; Yu, L.; Qi, Y.; Sep. 2001; 87 pp.; In English
Report No.(s): PB2007-111688; No Copyright; Avail.: CASI: A05, Hardcopy

In this study, nonlinear regression models were developed to take into account factors of acceleration or deceleration. To fully capture the dynamics of specific accelerations or decelerations, not only is the acceleration or deceleration of the current

time period included in the models as independent variables, but those of previous time periods are also included. In addition, the durations that acceleration or deceleration has been exercised are also included as independent variables. The factor of road grade is considered in the models by adjusting the values of acceleration or deceleration according to the grade. Besides these independent variables, variables representing tractive power are also introduced into the models because they directly determine the amount of emissions that are produced by a vehicle. With this modeling approach, the validation results show that the emission model developed in this study can produce a close match to raw emissions data on both microscopic and macroscopic levels.
NTIS
*Air Quality; Measurement; Regression Analysis*

## 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*.

**20080018147** Naval Research Lab., Bay Saint Louis, MS USA
**Wind Stress Drag Coefficient over the Global Ocean**
Kara, Ahmet B; Wallcraft, Alan J; Metzger, E J; Hurlburt, Harley E; Fairall, Chris; Dec 1, 2007; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476538; NRL/JA/7320-06-7059; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476538

Interannual and climatological variations of wind stress drag coefficient are examined over the global ocean from 1998 to 2004. Here CD is calculated using high temporal resolution (3- and 6-hourly) surface atmospheric variables from two datasets: 1 )the 40-yr European Centre for Medium-Range Weather Forecasts (ECMWF) Re-Analysis (ERA-40) and 2) the Navy Operational Global Atmospheric Prediction System. The stability-dependent CD algorithm applied to both datasets gives almost identical values over most of the global ocean, confirming the validity of results. Overall, major findings of this paper are as follows: 1) the CD value can change significantly (e.g, greater than 50%) on 12-hourly time scales around the Kuroshio and Gulf Stream current systems: 2) there is strong seasonal variability in CD, but there is not much interannual change in the spatial variability for a given month; 3) a global mean Cd ~ 1.25 x 10-3 is found in all months, while CD is less than or equal to 1.5 x 10-3 is prevalent over the North Pacific and North Atlantic Oceans and in southern high-latitude regions as well. and CD is less than or equal to 1.0 x 10-3 is typical in the eastern equatorial Pacific cold tongue; and 4) including the effects of air-sea stability on CD generally causes an increase of less than 20% in comparison to the one calculated based on neutral conditions in the tropical regions. Finally, spatially and temporally varying CD fields are therefore needed for a variety of climate and air-sea interaction studies.
DTIC
*Aerodynamic Coefficients; Aerodynamic Drag; Ocean Surface; Shear Stress; Wind Shear*

**20080018351** Bath Univ., Bath, UK
**An Investigation into the Relationship between Ionospheric Scintillation and Loss of Lock in GNSS Receivers**
Meggs, Robert W; Mitchell, Cathryn N; Smith, Andrew M; Jun 1, 2006; 52 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476963; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476963

No abstract available
*Global Positioning System; Losses; Navigation Satellites; Receivers; Scintillation*

**20080018359** Bath Univ., Bath, UK
**Polar Ionospheric Imaging at Storm Time**
Yin, Ping; Mitchell, Cathryn; Bust, Gary; Jun 1, 2006; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476974; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476974

No abstract available
*Global Positioning System; Imaging Techniques; Ionospheric Disturbances; Ionospheric Storms; Polar Regions; Storms*

**20080018360** SRI International Corp., Menlo Park, CA USA
**Studies of Ionospheric Processes in the Atmosphere and the Laboratory**
Slanger, T G; Jun 1, 2006; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476976; SRI-MP-IST-056; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476976
No abstract available
*Airglow; Collisions; Ionospheres; Oxygen Atoms*

**20080018363** Northeast Radio Observatory Corp., Westford, MA USA
**Observations of the Tongue of Ionization with GPS TEC and SuperDARN**
Coster, Anthea; Colerico, M; Foster, J C; Ruohoniemi, J M; Jun 2006; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NSF-0455831
Report No.(s): AD-A477021; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA477021
No abstract available
*Global Positioning System; Ionization; Ionospheres; Polar Caps; Tongue*

**20080018364** Saskatchewan Univ., Saskatoon, Saskatchewan Canada
**VLF Phase Perturbations Produced by the Variability in Large (V/m) Mesospheric Electric Fields in the 60-70 km Altitude Range**
Manson, A H; Meek, C E; Martynenko, S I; Rozumenko, V T; Tyrnov, O F; Jun 2006; 60 pp.; In English; Original contains color illustrations
Report No.(s): AD-A477022; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA477022
No abstract available
*Electric Fields; Mesosphere; Perturbation; Variability; Very Low Frequencies*

**20080018365** Naval Research Lab., Washington, DC USA
**Quasi-Analytic Models for Density Bubbles and Plasma Clouds in the Equatorial Ionosphere**
Bernhardt, Paul A; Jun 1, 2006; 47 pp.; In English; Original contains color illustrations
Report No.(s): AD-A477023; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA477023
No abstract available
*Bubbles; Ionospheres; Mathematical Models; Plasma Clouds*

**20080018366** National Observatory of Athens, Greece
**The European Server for Ionospheric Specification and Forecasting: Final Results from DIAS Project**
Belehaki, A; Cander, L; Zolesi, B; Bremer, J; Juren, C; Stanislawska, I; Dialetis, D; Hatzopoulos, M; Jun 2006; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A477025; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA477025
No abstract available
*Data Management; Ionospheres*

**20080018367** Bath Univ., Bath, UK
**Real-Time Imaging of the Ionosphere over the UK - Preliminary Results**
Meggs, Robert W; Mitchell, Cathryn N; Watson, Robert J; Dear, Richard M; Jun 2006; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A477026; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA477026
No abstract available
*Imaging Techniques; Ionospheres; Mapping; Real Time Operation; United Kingdom*

**20080018368** Magnetic Observatory, Hermanus, South Africa

**Characterization of the Ionosphere over the South Atlantic Ocean by Means of Ionospheric Tomography using Dual Frequency GPS Signals Received On Board a Research Ship**

Cilliers, Pierre J; Mitchell, Cathryn N; Opperman, Ben D; Jun 2006; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477027; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA477027

No abstract available

*Atlantic Ocean; Computer Aided Tomography; Frequencies; Global Positioning System; Ionospheres; Ocean Surface; Ships; Southern Hemisphere; Tomography*

**20080018369** Naval Research Lab., Washington, DC USA

**Modeling of Sporadic-E Structures from Wind-Driven Kelvin-Helmholtz Turbulence**

Bernhardt, Paul A; Werne, Joseph; Larsen, Miguel F; Jun 1, 2006; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA477029

No abstract available

*Kelvin-Helmholtz Instability; Sporadic E Layer; Turbulence; Wind Shear*

**20080018371** Bonn Univ., Germany

**Ionospheric F-Region Storms: Unsolved Problems**

Proelss, Gerd W; Jun 1, 2006; 21 pp.; In English

Report No.(s): AD-A477033; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA477033

No abstract available

*F Region; Ionospheric Disturbances; Ionospheric Storms; Latitude*

**20080018464** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Vegetation Effects on Soil Moisture Estimation**

Kim, Yunjin; van Zyl, Jakob; September 20, 2004; 6 pp.; In English; IEEE International Topical Meeting on Geoscience and Remote Sensing Symposium, IGARSS '04, 20-24 Sep. 2004, Anchorage, AK, USA; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40760

Several successful algorithms have been developed to estimate soil moisture of bare surfaces. We previously reported a new algorithm using the tilted Bragg approximation. However, these algorithms are only applicable to bare surfaces. When vegetation is present, soil moisture is typically underestimated by bare surface algorithms. In order to derive soil moisture under vegetation, we have to understand the complex scattering process due to vegetation. Our main interest is to retrieve the global soil moisture information using Hydros L-band polarimetric radar data. The Hydros mission will provide the first global view of land soil moisture using L-band radar and radiometer. The unique characteristics of the Hydros data are the availability of the low resolution soil moisture information from radiometer data and the continuous time series radar data collected at the same incidence angle. In this paper, we will examine a potential inversion algorithm to retrieve soil moisture under vegetation canopies using Hydros L-band polarimetric radar data.

Author

*Soil Moisture; Canopies (Vegetation); Polarimetry; Vegetation; Time Series Analysis; Algorithms*

**20080018910** Army Research Lab., White Sands Missile Range, NM USA

**Campbell Systems Sampling Mean Conditions in an Urban Environment at White Sands Missile Range (WSMR), NM**

Bustillos, Manuel D; Vaucher, Gail T; D'Arcy, Sean; Cionco,, Ronald M; Dumais, Robert; Brice, Robert; Sep 2006; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476852; ARL-TR-3926; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476852

This report provides documentation on Campbell systems, which are used to sample mean atmospheric conditions in an urban environment. This report includes mean condition measurements used in an U.S. Army Research Laboratory (ARL) Urban Study conducted at White Sands Missile Range, NM, in 2005. Secondly, the report summarizes the Army relevance for the WSMR 2003/2005 Urban Field Study. It describes an overview of the actual WSMR 2004/2005 Urban Study; the elements

of the Campbell's contributions, sensor details, and sensor descriptions; measurement rates; lessons learned from the WSMR 2005 Urban Study; and a conclusion. The report also describes a valuable piece of data acquisition for modeling that still leaves much room for improvement. NOTE: The Campbell instrumentation setup is mostly an off-the-shelf unit that collects data using two groups of instruments.
DTIC
*Air Flow; Atmospheres; Atmospheric Models; Buildings; Cities; Missile Ranges; Samplers; Sampling*

## 47
## METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

**20080018145** Naval Research Lab., Bay Saint Louis, MS USA
**Properties of Coastal Waters Around the US: Preliminary Results Using MERIS Data**
Lee, ZhongPing; Hu, Chuanmin; Gray, Deric; Casey, Brandon; Arnone, Robert; Weidemann, Alan; Ray, Richard; Goode, Wesley; Apr 2007; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476536; NRL/PP/7330-07-7169; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476536

MERIS imageries over coastal waters around the USA were ordered from ESA. These data either reveal enormous phytoplankton blooms (chlorophyll concentrations in the range of 100 - 1000 mg/m) or turbid river plume waters or optically shallow environments. We used in situ measurements to validate remote-sensing reflectance derived from MERIS. Further, we applied algorithms designed for optically deep or optically shallow waters, respectively, to derive water and/or bottom properties of the study area. The derived results were found consistent with in situ measurements or known values. Discussions were also provided regarding remaining issues related to MERIS data. These exercises and results demonstrate the great potentials and capabilities of using MERIS data to monitor water environments in coastal regions.
DTIC
*Coastal Water; Coasts; Meteorological Instruments*

**20080018150** Naval Research Lab., Bay Saint Louis, MS USA
**Observed Oceanic Response over the Upper Continental Slope and Outer Shelf during Hurricane Ivan**
Teague, William J; Jarosz, Ewa; Wang, David W; Mitchell, Douglas A; Sep 2007; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476542; NRL/JA/7330-05-5172; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476542

Hurricane Ivan passed directly over an array of 14 acoustic Doppler current profilers deployed along the outer continental shelf and upper slope in the northeastern Gulf of Mexico. Currents in excess of 2OO cm s-l were generated during this hurricane. Shelf currents followed Ekman dynamics with overlapping surface and bottom layers during Ivan's approach and transitioned to a dominant surface boundary layer as the wind Stress peaked. Slope currents at the onset of Ivan were wind driven near the surface, hut deeper in the water column they were dominated during and after the passage of Ivan by subinertial waves with a period of 2-5 days that had several characteristics of topographic Rossby waves. Currents on the slope at 50 m and greater depths commonly exceeded 50 cm s-l. Surprisingly, the strangest currents were present to the left of the storm track on the shelf while more energetic currents were to the right of the hurricane path on the slope during the forced stage. Near-inertial motion lasting for a time period of about 10 days was excited by the storm on the shelf and slope. Record wave heights were measured near the eye wall of Hurricane Ivan and were shown not to be rogue waves. The large surface waves and strong near-bottom currents caused significant bottom scour on the outer shelf at water depths as deep as 90 m.
DTIC
*Continental Shelves; Hurricanes; Ocean Currents*

**20080018157** Naval Research Lab., Bay Saint Louis, MS USA
**Global Ocean Prediction Using HYCOM**
Wallcraft, Alan J; Chassignet, Eric P; Cummings, James A; Hurlburt, Harley E; Metzger, E J; Smedstad, Ole M; Jul 2007; 6 pp.; In English
Report No.(s): AD-A476567; NRL/PP/7320-07-7197; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476567

In the third year of this project, fully-global eddy-resolving simulations have been performed using the HYCOM at

1/12-deg resolution. HYCOM is isopycnal in the open, stratified ocean, but makes a dynamically smooth transition to a terrain-following coordinate in shallow water and to pressure coordinates in the mixed layer and/or unstratified regions via the layered continuity equation. This approach incorporates the disadvantages of these three distinct vertical coordinate types into one ocean model that includes the deep ocean as well as coastal regions. In addition, it is designated for high vertical resolution in the surface mixed layer. The majority of the first and second year simulations were atmospherically forced only (no data assimilation). In the second year and third year we added cases with ocean data assimilation. Since December 2006 we have run a nowcast every day, and since February 2007 we perform a nowcast and a 3-day forecast every day in real time. Results from HYCOM's data-assimilative hindcast of 2004 are compared to observations and to the existing operational nowcast/forecast system at the Naval Oceanographic Office.
DTIC
*Ocean Models; Oceans*

**20080018291** Naval War Coll., Newport, RI USA
**Global Climate Change: Threat Multiplier for AFRICOM?**
Yackle, Terri A; Nov 6, 2007; 23 pp.; In English
Report No.(s): AD-A476789; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476789

The recent increased pace in which extreme weather patterns are occurring has received national attention. Whatever the catalyst for this abrupt climate change, stability for Africa hinges upon mitigating the effects of global climate change to prevent future conflicts such as Darfur, and the instability that fosters terrorism. The National Security Act of 2010 will formally address climate change and the planning requirement for the threat environment. While this strategic process is developing, it would be wise for the new African Combatant Commander (AFRICOM) to start planning for his Area of Responsibility (AOR). He will need to integrate multinational and multiagency cooperation to address climate change forecasts. The author recommends the formation of an interim planning cell, a new Joint Interagency Coordination Group for Climate Change (JIACG-CC), that would guarantee unity of effort in the case of a climate disaster. The author presents the case of Darfur, Sudan, as the first climate change crisis to challenge the new combatant commander for AFRICOM. Located in southern Sudan, the Darfur region has experienced a 40% decrease in rainfall since the early 1980s and is steadily losing agricultural production due to the Sahara's southward expansion. This desertification turns arable lands into desert by depleting the soil of nutrients. The associated loss of rainwater coupled with desertification changed the dynamics of the local population. The shortage of resources created distrust and desperation. In 2003 competition for food and water devolved into regional conflict. This conflict is continuing to escalate into genocide; more than 200,000 people have been killed and 2.5 million refugees have been displaced.
DTIC
*Africa; Climate Change; Climatology; Disasters; Greenhouse Effect; Military Operations; Multipliers; Planning*

**20080018295** Naval War Coll., Newport, RI USA
**The Domestic Coalition: The Command and Control Relationship Between Active Component and National Guard Forces in Defense Support of Civil Authorities Operations**
Teague, Michael J; Nov 6, 2007; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476794; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476794

The aftermath of Hurricane Katrina saw the largest military response ever undertaken by the USA. While the press highlighted the political clashes at the strategic level, there was also confusion at the operational level that led to a lack of efficiency. The command and control structure among the military forces was a constant irritant that degraded relief operations. This paper addresses the specific issue of the relationship between active component and National Guard forces during the Hurricane Katrina response operations. When confronted with any situation, the American military turns to doctrine to identify solutions and best practices. In this case, Joint Doctrine does provide a framework for effective C2 and coordination for domestic disaster response operations but it was not well utilized. This study uses the doctrinal framework to develop command authorities, relationships, and operational areas that allow the rapid response to crisis situations by all portions of our military. With unity of effort, not unity of command, as the goal, the Parallel Command Model is a good fit for DSCA operations. Treating the active component and National Guard forces as a coalition is appropriate. Using the support relationship clearly delineates the responsibilities of all involved. As the final piece to our analysis of the doctrinal framework for DSCA operations, future plans must account for FEMA and State adherence to state boundaries. Smaller JTFs with an

objective of supporting a single state, and a JOA drawn accordingly, prevent adding any extraneous confusion during already complex DSCA operations.
DTIC
*Armed Forces (United States); Civil Defense; Command and Control; Hurricanes; Military Operations*

**20080018457** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Rainfall and Snowfall Observations by the Airborne Dual-frequency Precipitation Radar during the Wakasa Bay Experiment**
Tanelli, Simone; Im, Eastwood; Durden, Stephen L.; Meagher, Jonathan P.; September 20, 2004; 4 pp.; In English; IEEE International Topical Meeting on Geoscience and Remote Sensing Symposium, IGARSS '04, 20-24 Sep. 2004, Anchorage, AK, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40735

Radar data obtained through the NASA/JPL Airborne Precipitation Radar APR-2 during the Wakasa Bay Experiment in January/February 2003 were processed to obtain calibrated reflectivity measurements, rainfall/snowfall velocity measurements, classification of the surface type and detection of the boundaries of the melting layer of precipitation. In this paper the processing approach is described together with an overview of the resulting data quality and known issues.
Author
*Precipitation (Meteorology); Rain; Snow; Airborne Radar; Meteorological Radar; Classifications; Calibrating; Multispectral Radar*

**20080018463** Washington Univ., Seattle, WA, USA
**Millimeter-Wave Measurement of Frozen Hydrometeors during the 2003 Wakasa Bay Field Experiment**
Kim, Min-Jeong; Chang, Dong-Eon; Weinman, James A.; Wang, J. R.; Tanelli, Simone; Roman, J.; Sekelsky, S.; September 20, 2004; In English; IEEE International Topical Meeting on Geoscience and Remote Sensing Symposium, IGARSS '04, 20-24 Sep. 2004, Anchorage, AK, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NCC5-584; S-69019-G; NAG5-9668; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40759

This study analyzes the millimeter-wave radiometric measurements of frozen hydrometeors during the field experiment that was held in Wakasa bay of Japan in January 29, 2003. The MM5 cloud simulation is employed to provide temperature and humidity profiles for the radiative transfer calculations.
Author
*Hydrometeors; Millimeter Waves; Atmospheric Temperature; Humidity; Radiative Transfer*

**20080018542** Meteorological Satellite Center, Tokyo, Japan
**Monthly Report for the Meteorological Satellite Center: January 2008**
January 2008; In English; Copyright; Avail.: Other Sources

The CD-ROM concerning the January 2008 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Derived from text
*Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan*

**20080018554** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**AIRS - the Atmospheric Infrared Sounder**
Lambrigsten, Bjorn H.; Fetzer, Eric; Fishbein, Evan; Lee, Sung-Yung; Paganao, Thomas; September 20, 2004; 4 pp.; In English; IEEE International Topical Meeting on Geoscience and Remote Sensing Symposium, IGARSS '04, 20-24 Sep. 2004, Anchorage, AK; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40748

The Atmospheric Infrared Sounder (AIRS) was launched in 2002, along with two companion microwave sounders. This

AIRS sounding suite is the most advanced atmospheric sounding system to date, with measurement accuracies far surpassing those of current weather satellites. From its sun synchronous polar orbit, the AIRS system provides more than 90% of the globe every 24 hours. Much of the post-launch period has been devoted to optimizing the 'retrieval' system used to derive atmospheric and other parameters from the observations and to validate those parameters. The geophysical parameters have been produced since the beginning of 2003 - the first data were released to the public in mid-2003, and future improved versions will be released periodically. The ongoing calibration/validation effort has confirmed that the system is very accurate and stable. There are a number of applications for the AIRS products, ranging from numerical weather prediction - where positive impact on forecast accuracy has already been demonstrated, to atmospheric research - where the AIRS water vapor products near the surface and in the mid and upper troposphere as well as in the stratosphere promise to make it possible to characterize and model phenomena that are key for short-term atmospheric processes, from weather patterns to long-term processes, such as interannual variability and climate change.
Author
*Atmospheric Sounding; Infrared Instruments; Numerical Weather Forecasting; Water Vapor; Climate Change; Microwave Sounding; Geophysics*

**20080018920** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Lightning Charge Retrievals: Dimensional Reduction, LDAR Constraints, and a First Comparison with LIS Satellite Data**
Koshak, W. J.; Krider, E. P.; Murray, N.; Boccippio, D. J.; Journal of Atmospheric and Oceanic Technology; November 2007; Volume 24, Issue 11, pp. 1817-1838; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG10-302; 621-1598; NRA-97-MTPE-03; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1175/jtech2089.1

A 'dimensional reduction' ('DR') method is introduced for analyzing lightning field changes ((Delta)Es) whereby the number of unknowns in a discrete two-charge model is reduced from the standard eight (x, y, z, Q, x', y', z', Q') to just four (x, y, z, Q). The four unknowns (x, y, z, Q) are found by performing a numerical minimization of a chi-square function. At each step of the minimization, an overdetermined fixed matrix (OFM) method is used to immediately retrieve the best 'residual source' (x', y', z', Q'), given the values of (x, y, z, Q). In this way, all eight parameters Ix. y, z, Q, x', y', z', Q') are found, yet a numerical search of only four parameters (x, y, z, Q) is required. The DR method has been used to analyze lightning-caused (Delta)Es derived from multiple ground-based electric field measurements at the NASA Kennedy Space Center (KSC) and U.S. Air Force Eastern Range (ER). The accuracy of the DR method has been assessed by comparing retrievals with data provided by the lightning detection and ranging (LDAR) system at the KSC-ER. and from least squares error estimation theory, and the method is shown to be a useful 'stand alone' charge retrieval tool. Since more than one charge distribution describes a finite set of (Delta)Es (i.e., solutions are nonunique), and since there can be appreciable differences in the physical characteristics of these solutions, not all DR solutions are physically acceptable. Hence. an alternative and more accurate method of analysis is introduced that uses LDAR data to constrain the geometry of the charge solutions. thereby removing physically unacceptable retrievals. The charge solutions derived from this method are shown to compare well with independent satellite- and ground-based observations of lightning m several Florida storms.
Author
*Satellite Observation; Lightning; Electrical Measurement; Charge Distribution; Storms; Rangefinding; Matrix Methods; Error Analysis; Detection*

## 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*.

**20080018086** Rockefeller Univ., New York, NY USA
**Broad T Cell Immunity to the LcrV Virulence Protein is Induced by Targeted Delivery to DEC-205/CD205-Positive Mouse Dendritic Cells**
Do, Yoonkyung; Park, Chae Gyu; Kang, Young-Sun; Park, Sung Ho; Lynch, Rebecca M; Lee, Haekyung; Powell, Bradford S; Steinman, Ralph M; Aug 13, 2007; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476395; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476395

There is a need for a more efficient vaccine against the bacterium Yersinia pestis, the agent of pneumonic plague. The

F1-LcrV (F1-V) subunit vaccine in alhydrogel is known to induce humoral immunity. In this study, we utilized DC to investigate cellular immunity. We genetically engineered the LcrV virulence protein into the anti-DEC-205 CD205 mAb and thereby targeted the conjugated protein directly to mouse DEC205+ DC in situ. We observed antigen-specific CD4+ T cell immunity measured by intracellular staining for IFN-gamma in three different mouse strains (C57BL/6, BALB/c, and C3F/HeJ), while we could not observe such T cell respinses with F1-V vaccine in alhydrogel. Using a peptide library for LcrV protein, we identified two or more distinct CD4+ T cell mimetopes in each MHC haplotyupe, consistent with the induction of broad immunity. When compared to nontargeted standard protein vaccine, DC targeting greatly the efficiency for inducing IFN-gamma-producing T cells. The targeted LcrV protein induced antibody responses to a similar extent as the F1-V subunit vaccine, but Th1-dependent IgG2a and IgG2c isotypes were observed only after anti-DEC-205:LcrV mAb immunization. This study sets the stage for the analysis of functional roles of IFN-gamma-producing T cells in Y. pestis infection.
DTIC
*Antibodies; Cells (Biology); Immunity; Lymphocytes; Mice; Proteins; Vaccines; Virulence*

**20080018090** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
**Interleukin-15 Increases Vaccine Efficacy through a Mechanism Linked to Dendritic Cell Maturation and Enhanced Antibody Titers**
Saikh, Kamal U; Kissner, Teri L; Nystrom, Steven; Ruthel, Gordon; Ulrich, Robert G; Nov 26, 2007; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476405; USAMRIID-TR-07-056; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476405

Interleukin-15 (IL-15) is generally considered to be a growth factor for natural killer cells and for sustaining T-cell memory. Previous data from our laboratory demonstrated that IL-15 is also an important factor for developing human dendritic cells. In this study, we investigated the effect of IL-15 on antibody responses to a recombinant staphylococcal enterotoxin B (SEB) vaccine (STEBVax), in a pre-clinical model of toxic-shock syndrome induced by SEB. We observed that mouse spleen cells treated with IL-15 in ex vivo culture gained a dendritic cell-like phenotype. Administration of IL-15 to mice also resulted in an increased number of mature CD11c+ dendritic cells in mouse spleens. A significant, IL-15 dose-dependent increase in antigen-specific antibody was observed after co-administration with vaccine and an aluminum-based adjuvant (alhydrogel). Furthermore, the co-administration of IL-15 with STEBVax and alhydrogel also protected mice from lethal toxic shock above the levels that obtained without IL-15. Thus, the vaccine response enhanced by IL-15 appears to be mediated by mature dendritic cells, and results in prevalent sero-conversion to Th2-dependent antibodies. This suggests a potential use of IL-15 as an adjuvant for antibody-dependent responses to vaccines.
DTIC
*Antibodies; Growth; Immune Systems; Immunology; Interleukins; Staphylococcus; Vaccines*

**20080018091** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
**Use of a Recombinant Fluorescent Substrate with Cleavage Sites for All Botulinum Neurotoxins in High-Throughput Screening of Natural Product Extracts for Inhibitors of Serotypes A, B, and E7**
Hines, Harry B; Kim, Alexander D; Stafford, Robert G; Badie, Shirin S; Brueggemann, Ernst E; Newman, David J; Schmidt, James J; Dec 14, 2007; 8 pp.; In English
Report No.(s): AD-A476408; TR-07-061; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476408

The seven serotypes of botulinum neurotoxin (BoNTs) are zinc metalloproteases that cleave and inactivate proteins critical for neurotransmission. Synaptosomal protein of 25 kDA (SNAP-25) is cleaved by BoNTs A, C, and E, while vesicle-associated membrane protein (VAMP) is the substrate for BoNTs B, D. F. and G. BoNTs are not only medically useful drugs, but are also potential bioterrorist and biowarfare threat agents. Because BoNT protease activity is required for toxicity, inhibitors of that activity might be effective for anti-botulinum therapy. To expedite inhibitor discovery, we constructed a hybrid gene encoding (from N-terminus to C-terminus, with respect to the expressed product) green fluorescent protein, then a SNAP-25 fragment encompassing residues met-127 to gly-206, followed by VAMP residues met-1 to lys-94. Cysteine was added as the C-terminus. The expressed product, which contained the protease cleavage sites for all seven botulinum serotypes, was purified and coupled covalently through the C-terminal sulfhydryl group to maleimide-activated 96-well plates. The substrate was readily cleaved by BoNTs A, B, D, E, and F. Using this assay and an automated 96-well pipettor, we screened 528 natural product extractsfor inhibitors of BoNTs A, B, and E protease activities. Serotype-specific inhibition was found in 30 extracts, while five others inhibited two serotype.
DTIC
*Bacteria; Cleavage; Clostridium Botulinum; Fluorescence; Inhibitors; Substrates; Toxins and Antitoxins*

**20080018093** Library of Congress, Washington, DC USA

**Veteran's Health Care Issues**

Panangala, Sidath V; Nov 30, 2007; 60 pp.; In English

Report No.(s): AD-A476414; CRS-RL33993; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476414

The Department of Veterans Affairs (VA) provides services and benefits to veterans who meet certain eligibility criteria. VA carries out its programs nationwide through three administrations and the Board of Veterans Appeals (BVA). The Veterans Health Administration (VHA) is responsible for veterans health care programs. The Veterans Benefits Administration (VBA) is responsible for providing compensation, pensions, and education assistance, among other things. The National Cemetery Administration s (NCA) responsibilities include maintaining national veterans cemeteries. VHA operates the nation's largest integrated health care system. Unlike most other federal health programs, VHA is a direct service provider rather than a health insurer or payer for health care. VA health care services are generally available to all honorably discharged veterans of the U.S. Armed Forces who are enrolled in VA's health care system. VA has a priority enrollment system that places veterans in priority groups based on various criteria. Under the priority system, VA decides each year whether its appropriations are adequate to serve all enrolled veterans. If not, VA could stop enrolling those in the lowest-priority groups. Since the terrorist attacks of September 11, 2001, U.S. Armed Forces have been deployed in two major theaters of operation. Operation Enduring Freedom (OEF) in Afghanistan and Operation Iraqi Freedom (OIF) constitute the largest sustained ground combat mission undertaken by the USA since the Vietnam War. Veterans from these conflicts and from previous wars are exerting tremendous stress on the VA health care system. With increased patient workload and rising health care costs, the 110th Congress is focused on such issues as how to contain costs and at the same time maintain high-quality health care services to veterans who need them. DTIC

*Health; Medical Services*

**20080018111** Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA

**Differential Dengue Tropism & Neutralization: Potential Mechanisms of Pathogenesis**

Martin, Nicole C; Jan 4, 2006; 195 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476452; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476452

The mechanisms underlying the pathogenesis of dengue hemorrhagic fever (DHF) remain poorly understood. Intriguing evidence suggest a role for viral strain differences. Consistent genetic differences exist in the envelope glycoproteins of dengue 2 strains associated with DHF epidemics (Asian genotype) and dengue 2 strains only associated with DF (American genotype). It has also been established that dengue virus infection can be mediated by C-type lectins DC-SIGN and L-SIGN. We developed an assay that uses cells expressing these relevant lectin receptors and low-passage viral isolates. Using this assay, we examined whether Asian and American genotype dengue 2 viruses exhibit differences in utilization of these two receptors. Our results showed that American strains infect DC-SIGN bearing cells to a greater extent than L-SIGN bearing cells while Asian strains preferentially infect L-SIGN bearing cells. A single mutation in the envelope glycoprotein of an American strain at E390 from aspartic acid (American) to asparagine converted the C-type lectin binding phenotype from an American strain to an Asian strain by the observation that the E390 amino acid (aa) in the Asian strain is also asparagine. Asian and American strains differed in their sensitivity to antibody neutralization. The neutralizing capacity of mAbs 3H5 and 4G2 for Asian virus was significantly decreased when infection was measured in L-SIGN bearing cells compared to DC-SIGN bearing cells. Serum from Venezuelan DF patients had much greater neutralizing capacity for Asian virus in L-SIGN cells than serum from patients who progressed to DHF. Magnitude of neutralization of L-SIGN-mediated Asian virus infection was inversely associated with disease severity. Our studies suggest that differences in receptor utilization and neutralization sensitivity may contribute to our understanding of the role that viral strain differences play in dengue pathogenesis.
DTIC

*Infectious Diseases; Pathogenesis; Proteins; Tropism; Viruses*

**20080018149** Naval Research Lab., Bay Saint Louis, MS USA

**A Test of Empirical and Semi-Analytical Algorithms for Euphotic Zone Depth with SeaWiFs Data Off Southeastern China**

Chen, Jingjing; Shang, Shaoling; Tang, Junwu; Lee, Zhongping; Hong, Huasheng; Dai, Minhan; Zhai, Weidong; Feb 4, 2008; 11 pp.; In English

Report No.(s): AD-A476540; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476540

This study employs SeaWiFS data over the waters off the southern China to evaluate semi-analytical algorithm for

euphotic zone depth(Z). This algorithms is based on water's inherent optical properties (IOPs), which can he near-analytically calculated from spectral remote-sensing reflectance, where remote-sensing reflectance can be derived from the normalized water-leaving radiance provided by SeaWiFS. In the Taiwan Strait, compared with in situ Z (+/-3 hour within SeaWiFS collection), average error() is l5.0 % and root mean square error (RMSE)is 0074, with Z, in a range of 14-34 m from field measurements. In the South China Sea, compared within situ Z, (+48 hour within SeaWiFS collection), is 5.1% in summer and 22.6 in winter, while RMSE is 0.032 in summer and 0.129 in winter, with Z in a range of 10-82 m from field measurements. For comparison, we also evaluate the performance of the empirical Z algorithm that is based on chromophyll concentration. It is found that the IOP-centered approach has higher accuracy compared to the chlorophyll-a centered approach (e.g. in the South China Sea in winter, is 55.3 % and RMSE is 0.219). The new algorithm is thus found not only worked well with waters of the Gulf of Mexico, Monterey Bay and the Arabian Sea, hut also worked well with waters of the China Sea. DTIC

*Algorithms; China; Chlorophylls; Depth; Marine Environments; Photosynthesis; Regions; Seas; Sea-Viewing Wide Field-of-View Sensor*

**20080018169** Florida International Univ., Miami, FL USA

**Transgenic Silk Moths to Produce Spider Silk**

Herrera, Rene J; Jan 24, 2008; 4 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0034

Report No.(s): AD-A476587; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476587

The unusual combination of strength and extensibility of the Nephila clavipes spider dragline silk greatly suipasses all currently known high-performance synthetic materials. Together with the fact that silk is biocompatible and biodegradable, this natural polymer constitutes a very promising fiber for novel applications including use in bullet-and explosion-proof clothing and highly resistant surgical thread. Yet, massive production of this fiber from natural sources is not feasible so far. Other alternatives like production of the protein that yields same or similar mechanical properties of dragline silk in microorganisms or mammalian cells, in spinning fibers from concentrated protein solutions, have failed or are inefficient. Currently, silk is produced from the cocoon of the silk moth Bombyx mori; however, this silk has about one-tenth the strength and flexibility of Nephila clavipes silk. The goal of this proposal is to develop a transgenic silk moth able to produce Nephila clavipes dragline-like silk. In order to do this, a chimeric gene called Spidrofibroin (SpF) have been constructed. SpF combined the repetitive domains of spider dragline silk with the N- and C- terminal domains of the Bombyx mori silk gene, Fibroin-H (Fib-H). Various SpF genes have been cloned under the promoter of the Fib-H gene in pBac vectors and used to generate silk moth embryos. The silk fibers spun in the transgenic silk moth cocoons are being analyzed with respect to expression of SpF and mechanical properties of the resulting fiber. Since the SpF variants will have all the necessary elements for expression, transport and assembly into the silk fiber of Bombyx mori as Fib-H does, we believe that SpF will compete with Fib-H for its assembly into the silk fiber.
DTIC

*Mammals; Moths; Proteins; Silk; Spiders*

**20080018175** Cornell Univ., Ithaca, NY USA

**Engineering Biological Interfaces to Enhance Prosthetic Integration**

Bonnassar, Lawrence; Jan 17, 2008; 6 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0536

Report No.(s): AD-A476602; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476602

The decline in battlefield mortality driven by advances in body armor technology has resulted in a concomitant increase in injuries to extremities requiring the use of prosthetics. A main limitation in deployment of prosthetic technology is the integration of the prosthetic device into the body. Using current procedures, effective prosthetic integration often requires 18 months and multiple surgeries. The proposed solution to this problem involves merging tissue engineering and medical imaging technology to directly implant a prosthetic interface that will rapidly and securely integrate with surrounding bone and soft tissue. Through controlled placement of appropriate cells, signaling factors, and scaffold materials, this process will enable the generation of multi-component implants that include a prosthetic interface. The grand vision for such technology is the widespread deployment of tissue implants that use CT or MRI scans and robot-assisted surgery to guide the direct in vivo generation of composite implants that provide a secure interface for any prosthetic device desired. This will provide a

more functional prosthetic interface in a shorter time and enable the more rapid development and deployment of advanced prosthetic devices.
DTIC
*Bioengineering; Prosthetic Devices*

**20080018180** New Mexico Univ., Albuquerque, NM USA
**Biocompatible and Biomimetic Self Assembly of Functional Nanostructures**
Brinker, Jeffrey; Jan 17, 2008; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0087
Report No.(s): AD-A476610; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476610

Immobilization of individual cells and collections of cells in well defined reproducible nano-to-microscale structures that allow structural and functional manipulation and interrogation is important for developing new classes of biotic/abiotic materials for establishing the relationship between genotype and phenotype and for elucidating responses to disease injury/stress or therapy - primary goals of biomedical research Although there has been considerable recent progress in investigating the response of cells to chemical or topological patterns defined lithographically on two-dimensional (2D) surfaces it is time to advance from 2D adhesion on dishes/fluidic devices to 3D architectures that better represent the natural nanoporous and 3D extracellular matrix (EGM) 3D immobilization in nanostructured hosts enables cells to be surrounded by other cells maintains fluidic connectivity/accessibility and allows development of 3D molecular or chemical gradients that provide an instructive background to guide cellular behavior Although 3D cell immobilization in polymers hydrogels and inorganic gels has been practiced for decades these approaches do not provide for bio/nano interfaces with 3D spatial control of topology and composition important to both the maintenance of natural cellular behavior patterns and the development of new non-native behaviors and functions. In particular for ALL previously reported approaches there was no apparent effect of the cell on the surrounding host nor any apparent means to purposefully use the nanostructured host to develop new cellular behaviors. Here we show that cell directed assembly (GDA) to be a unique distinguishing approach to prepare new bio/nano interfaces and to develop new cellular behaviors.
DTIC
*Biomedical Data; Biomimetics; Medical Science; Nanostructures (Devices); Self Assembly*

**20080018187** Stanford Univ., Stanford, CA USA
**The Temporal Program of Peripheral Blood Gene Expression in the Response of Nonhuman Primates to Ebola Hemorrhagic Fever**
Rubins, Kathleen H; Hensley, Lisa E; Wahl-Jensen, Victoria; Daddario DiCaprio, Kathleen M; Young, Howard A; Reed, Douglas S; Jahrling, Peter B; Brown, Patrick O; Relman, David A; Geisbert, Thomas W; Aug 28, 2007; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N65236-99-1-5428
Report No.(s): AD-A476641; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476641

BACKGROUND: Infection with Ebola virus (EBOV) causes a fulminant and often fatal hemorrhagic fever. In order to improve our understanding of EBOV pathogenesis and EBOV-host interactions, we examined the molecular features of EBOV infection in vivo. RESULTS: Using high-density cDNA microarrays, we analyzed genome-wide host expression patterns in sequential blood samples from nonhuman primates infected with EBOV. The temporal program of gene expression was strikingly similar between animals. Of particular interest were features of the data that reflect the interferon response, cytokine signaling, and apoptosis. Transcript levels for tumor necrosis factor-alpha converting enzyme (TACE)/alpha-disintegrin and metalloproteinase (ADAM)-17 increased during days 4 to 6 after infection. In addition, the serum concentration of cleaved Ebola glycoprotein (GP2 delta) was elevated in late-stage EBOV infected animals. Of note, we were able to detect changes in gene expression of more than 300 genes before symptoms appeared. CONCLUSION: These results provide the first genome-wide ex vivo analysis of the host response to systemic filovirus infection and disease. These data may elucidate mechanisms of viral pathogenesis and host defense, and may suggest targets for diagnostic and therapeutic development.
DTIC
*Blood; Complementary DNA; Fever; Gene Expression; Genes; Hemorrhages; Pathogenesis; Primates; Viruses*

**20080018189** State Univ. of New York, Stony Brook, NY USA

**Clinically Practical Magnetic Resonance Protocol for Improved Specificity in Breast Cancer Diagnosis**

Tudorica, Luminita A; Jun 2007; 36 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0513

Report No.(s): AD-A476663; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476663

The purpose of this postdoctoral training award is for the PI to be trained in every aspect of conducting a research breast cancer study in a clinical setting. This study aims to improve specificity of breast cancer detection by using a combined MRI/MRS protocol. In the past year, the third year of this award, the PI has performed the following tasks independently: renewing IRB, recruiting and consenting patients, MRI/MRS data acquisition, and data analysis. A total of 35 patients were recruited for the study in the past year. The results from these 35 subjects and previously recruited subjects show 100% sensitivity and 100% specificity of the combined MRI/MRS protocol.

DTIC

*Breast; Cancer; Clinical Medicine; Diagnosis; Imaging Techniques; Magnetic Resonance; Mammary Glands; Protocol (Computers)*

**20080018197** Army Inst. of Surgical Research, Fort Sam Houston, TX USA

**Evaluation of Cytokine Synthesis in Human Whole Blood by Enzyme Linked Immunoassay (ELISA), Reverse Transcriptase Polymerase Chain Reaction (RT-PCR), and Flow Cytometry**

Gilligan, G R; Delgado, A V; Burleson, D; Cassidy, R; Dubick, M A; Bowman, P D; May 8, 2007; 30 pp.; In English

Report No.(s): AD-A476684; 2007-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476684

Whole blood stimulated for 2 hours with small amounts of lipopolysaccharide (LPS, l0-l000 pg/ml) was used for evaluating methods for detecting cytokine expression in leukocytes. The anticoagulants heparin, citrate, and EDTAwere examined for their influence on synthesis oftumornecrosis factor 0 (%%F-a), interleukin-l% and -l%%(IL-la and IL-l%), and interleukin-8 (IL-%). Cytokine secretion into blood was followed by enzyme liiiked immunoassay (ELISA) and rnRNA synthesis was determined by reverse transcriptase-polymerase chain reaction (RT-PCR). Leukocytes responsible for synthesis of cytokines were identified by imniunolabeling of cell surface markers and intracellular cytokines followed by detection by flow cytometry. Translation of mRNA and secretion of cytokines into the plasma were affected by the method of anticoagulation. Use of heparin resulted in higher levels of cytokines than citrate or EDTA, Heparin interfered with RT-PCR detection of mRNA if it was not removed.

DTIC

*Biometrics; Blood; Cytometry; Enzymes; Immunoassay; Leukocytes*

**20080018271** California Univ., Los Angeles, CA USA

**Quality of Breast Cancer Care: The Role of Hispanic Ethnicity, Language, and Socioeconomic Position**

Tisnado, Diana M; Kahn, Katherine L; Jun 2007; 53 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0328

Report No.(s): AD-A476741; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476741

Using data from a population-based sample of breast cancer patients in Los Angeles County. Their physicians, and neighborhood data, our goal is to examine the relative importance of ethnicity, language, and socio-economic position, and how they relate to structure, process, and outcomes of breast cancer care. In neighborhood-level analyses, Hispanic neighborhood was statistically significantly associated with numerous measures of socio-economic resources and acculturation. In patient-level analyses, we found evidence of socio-economic disparities in breast cancer decision-making and treatment: 1) Low-income was a barrier to breast reconstruction discussion and receipt; 2) Physician-patient discussion of treatment outcomes was correlated with patient satisfaction; 3) Older and lower income women were at higher risk of not participating in decision-making. Ethnic differences appeared to be explained by socio-economic status in these analyses. In provider-level analyses: 1) Physicians reported high career satisfaction levels but were least satisfied with time spent with patients; 2) Explicit financial incentives tied to performance on quality measures were reported at modest rates, primarily associated with HMO settings; 3) Most frequent reports of financial incentives to perform more services were among medical oncologists performing office-based chemotherapy and growth factor injections; 4) Treating more limited English-proficient

patients was associated with decreased physician satisfaction with time spent with patients; 5) Greater intensity of interpreter service use ameliorated some of this dissatisfaction.
DTIC
*Breast; Cancer; Economics; Ethnic Factors; Mammary Glands; Sociology*

**20080018272** Fox Chase Cancer Center, Philadelphia, PA USA
**Tailored Communication to Enhance Adaptation Across the Breast Cancer Spectrum**
Miller, Suzanne M; Oct 2007; 103 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0238
Report No.(s): AD-A476746; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476746

The Behavioral Center of Excellence (BCE) in Breast Cancer was established to provide a comprehensive, multidisciplinary approach for studying the process of, and methods for facilitating, successful adaptation in the context of breast cancer risk, treatment, and recovery. The four ongoing studies are derived from and integrated by a unifying theoretical framework, and ere supported by four care facilities ( i . e . , Administrative, Communication, Genetic Testing and Bioinformatics Core). The four projects are: 1) development of an intervention to promote utilization of breast cancer risk assessment programs and adherence to screening recommendations and underserved African-American women; 21 use of a ‘teachable moments and tailored communication materials to g r a t e utilization of risk assessment and adherence to screening amen0 daughters of diagnosed breast cancer patients 3) the g r m t i o n of psychological and physical adaptation among breast cancer patients at the completion of active treatments., during the re-entry phase); 4) promotion of psychological adaptation among metastatic breast cancer patients. The overarching goal is to develop theoretically guided, tailored, and transportable breast cancer communications to enhance screening adherence, decision-making, and quality of life across the spectrum of disease ( i . e . , from risk through treatment to survivorship).
DTIC
*Breast; Cancer; Mammary Glands; Spectra; Telecommunication*

**20080018273** California Univ., Davis, CA USA
**Castration Induced Neuroendocrine Mediated Progression of Prostate Cancer**
Evans, Christopher P; Sep 2007; 61 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0818
Report No.(s): AD-A476747; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476747

We have made headway into understanding the paracrine relationship between neuropeptide expressing, androgen-insensitive CaP cells and their ability to support the proliferation and migration of androgen sensitive CaP cells. Critically, we have identified src kinase as a molecule central to the process. We have been awarded a NIH CTEP phase II trial to study a novel, oral src kinase inhibitor AZD0530 in androgen-insensitive prostate cancer patients based upon our work.
DTIC
*Cancer; Endocrine Systems; Neurophysiology; Peptides; Prostate Gland*

**20080018274** California Univ., Irvine, CA USA
**Combined Biology and Bioinformatics Approaches to Breast Cancer**
Lu, Zhongxian; Oct 2007; 66 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0483
Report No.(s): AD-A476748; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476748

LMO4 is highly expressed in breast epithelial cells and is related to cell proliferation and/or invasion in vivo. Because these cellular features are associated with breast carcinogenesis and since LMO4 is overexpressed in more than 50% of breast cancer cases, we hypothesize that LMO4 may play roles in oncogenesis of breast epithelial cells by regulating proliferation, invasion and/or other cellular features. Using LMO4 over-expression or shRNA expression system in vitro, I found that LMO4 play crucial roles in the regulation of cell proliferation and apoptosis of normal mammary gland epithelial cells or breast cancer cells. Furthermore, I have also observed that deletion of LMO4 impaired the function and development of mammary gland in LMO4 conditional knockout mice, indicating that LMO4 protein is necessary for maintaining the normal development of mice mammary gland. In addition, I demonstrated that the LMO4 can modulate TGF signaling and regulated

the proliferative response of epithelial cells to TGF signaling, and thereby linked LMO4 to a conserved signaling pathway that plays important roles in epithelial homeostasis. Under the support of grant, I received excellent training in bioinformatics. By combining previously described functional methods with bioinformatics approaches, we used DNA microarrays to discover LMO4-responsive genes, and identified BMP7 as a key down-stream gene of LMO4. In addition, we also found a significant correlation between LMO4 and BMP7 transcript levels in a large dataset of human breast cancers, providing additional support that BMP7 is a bona fide target gene of LMO4. Finally, we demonstrated that LMO4 binds to HDAC2 and that they are recruited together to the BMP7 promoter. We also suggested a novel mechanism for LMOs; LMO4, Clim2 and HDAC2 are part of a transcriptional complex, and alterations in LMO4 levels can disrupt the complex, leading to decreased HDAC2 recruitment and increased promoter activity.
DTIC
*Breast; Cancer; Mammary Glands*

**20080018275** Baylor Coll. of Medicine, Houston, TX USA
**Fibroblast Growth Factor Receptor-4 and Prostate Cancer Progression**
Ittmann, Michael M; Oct 2007; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0843
Report No.(s): AD-A476749; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476749

We have found that the FGFR-4 Arg388 allele is strongly associated with the occurrence of prostate cancer and with metastasis and PSA recurrence in men undergoing radical prostatectomy. Our published data indicates that FGFR-4 plays an important role in prostate cancer initiation and progression. We have now proven that FGFR-4 plays an important role in prostate cancer progression in vivo. We have established that Ehm2 plays an important role in this process. Furthermore, HIP1 plays an important role in modulating FGFR-4 Gly388 activity and is associated with more aggressive prostate cancer.
DTIC
*Cancer; Fibroblasts; Prostate Gland*

**20080018276** University of Southern California, Los Angeles, CA USA
**Androgen Receptor-Mediated Escape Mechanisms From Androgen Ablation Therapy**
Coetzee, Gerhard A; Rice, Judd; Jia, Li; Oct 2007; 10 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0823
Report No.(s): AD-A476751; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476751

Too many prostate-cancer treatments, especially those relying on the suppression of androgen, eventually fail to slow the advance of the disease. One explanation for this situation is the absence of any systematic knowledge on the role and function of the androgen receptor (AR) in the course of prostate cancer development. Recent findings indicate that the AR is the key master regulator (transcription factor) that determines disease progression to androgen independence, which ultimately contributes to death from prostate cancer. During the third year of this grant funding, we concentrated our efforts on the understanding of how transcriptional control of the AR at target loci is achieved as the PCa cells escape from androgen ablation therapy to become treatment resistant. We found that histone H3 lysine 4 methylation patterns are unique in ablation resistant PCa cells. Furthermore, globally the AR and certain histone modifications co-locate in discreet areas in the nucleus. In the final no-cost extension year of the grant we will complete our work on other AR traget genes. Thus, armed with a deeper knowledge of the hormonal and receptor requirements as well as mechanisms associated with prostate cancer growth and expansion, we may be able to develop therapies that prolong lives. Understanding the behavior of the AR, as documented above, is a first step in that quest.
DTIC
*Ablation; Cancer; Hormones; Males; Prostate Gland; Therapy*

**20080018277** University of Southern Illinois, Springfield, IL USA
**Dysregulation of RNA Interference in Breast Cancer**
Mo, Yi-Yuan; Jul 2007; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0471
Report No.(s): AD-A476753; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476753

The newly discovered RNA interference is a novel type of gene regulation mechanism, which is required for normal

expression of genes. This study tests the hypothesis that breast tumor carries dysregulated RNA interference pathways, and thus, some tumor suppressor genes will be down-regulated while other genes (e.g., oncogenes) will be up-regulated, leading to tumor cell proliferation and survival. Using real time RT-PCR, we demonstrate that microRNA-21 is overexpressed in breast tumors compared to the matched normal breast tissue. Furthermore, we show that antisense oligonucleotide against microRNA-21 can suppress the endogenous microRNA-21 and causes tumor cell growth inhibition. Experiments with a xenograft carcinoma mouse model reveal that the antisense microRNA-21 oligonucleotide also inhibits tumor growth. Therefore, microRNA-21 is a potential therapeutic target for breast cancer therapy.
DTIC
*Breast; Cancer; Mammary Glands; Ribonucleic Acids*

**20080018278** California Univ., San Francisco, CA USA
**Design and Testing of a PSA-Activated Pro-Apoptotic Peptide**
Quinn, Timothy; Nov 2007; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0122
Report No.(s): AD-A476757; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476757

The goal of this project is to design and test novel synthetic peptides that can be cleaved by the extracellular enzyme Prostate Specific Antigen (PSA) to yield a peptide fragment that can enter cells and directly induce apoptosis. The objective is to explore a new approach for developing molecularly targeted systemic agents for metastatic prostate cancer. The synthetic peptides were designed with domains that could be (i) cleaved by PSA, (ii) permeate the plasma membrane, and (iii) disrupt mitochondrial membranes to induce apoptosis. Cell lines on which the synthetic peptides will be tested (human prostate cancer cells, normal primary human prostate epithelial cells, and human endothelial cells) were obtained and optimal culture conditions were determined. Optimal assays for cytotoxicity or apoptosis for each cell line were determined. Testing of the peptides will be performed in the final six months of the project.
DTIC
*Apoptosis; Cancer; Peptides; Prostate Gland*

**20080018279** Medicine and Dentistry Univ. of New Jersey, Newark, NJ USA
**The Importance of Autophagy in Breast Cancer Development and Treatment**
Hait, William; Yang, Jin-Ming; Jun 2007; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0557
Report No.(s): AD-A476761; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476761

Autophagy is an evolutionally conserved process employed by cells to degrade proteins and organelles in response to metabolic stress. Cells can recycle amino acids, fatty acids and nucleotides for macromolecular biosynthesis and ATP generation, and by sequestering damaged organelles can prevent the release or accumulation of toxic substances. We described elongation factor-2 kinase (eEF-2 kinase) as a structurally and functionally unique enzyme that is activated by starvation and phosphorylates and inactivates eEF-2, thereby terminating peptide chain elongation. Since protein synthesis is a major energy-consuming process, decreasing protein elongation by activating eEF-2 kinase could be an energy-saving survival strategy. We now test the hypothesis that eEF-2 kinase plays a critical role in the ability of cancer cells to survive oxygen and nutrient deprivation. MCF-7 human breast cancer cells were transfected with a GFP-tagged LC3 expression vector to track the formation of autophagosomes. Autophagy was induced by nutrient/growth factor deprivation as manifested by autophagosome formation in GFP-LC3-transfected MCF-7 cells. Treatment with a potent and specific inhibitor of eEF-2 kinase, NH125 inhibited autophagy as indicated by a reduction in autophagosome formation. In either transient or stable MCF-7 transfectants, NH125 was 10-times more potent and more effective than 3-methyladenine, a known autophagy inhibitor. To determine the effects of blocking autophagy via inhibition of eEF-2 kinase on cellular energetics, we studied the rate and amount of ATP depletion in NH125- and vehicle-treated MCF-7 transfectants. Following nutrient deprivation, inhibition of eEF-2 kinase by NH125 resulted in a greater and more rapid reduction of cellular ATP as compared to vehicle treatment.
DTIC
*Breast; Cancer; Elongation; Enzymes; Mammary Glands; Phosphorus*

**20080018283** Roswell Park Memorial Inst., Buffalo, NY USA

**High Throughput Screen to Identify Novel Drugs that Inhibit Prostate Cancer Metastasis**

Gelman, Irwin H; Oct 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0893

Report No.(s): AD-A476774; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476774

We have proposed to developed indicator cell lines that would allow for the high throughput screening (HTS) for compounds that potentially inhibit prostate cancer (CaP) metastasis. The cell lines are based on stably expressing a construct containing the promoter of SSeCKS/ gravin/AKAP12- a metastasis-suppressor gene downregulated in CaP progression- linked to a green fluorescence protein (GFP), plus a control reporter, in metastatic CaP cells, and then screening for compounds that induce GFP. We also proposed to characterize the pathways controlling SSeCKS expression in CaP progression. UPDATE: Our data indicate that SSeCKS re-expression can be induced in CaP cell lines using inhibitors of histone deacetylation (TSA) but not by inhibitors of methylation (5-aza-C). We have now produced stable indicator C4-2 cells with GFP expression inducible by TSA and by retinoids. We have also characterized the cis- and trans-acting factors of the human SSeCKS promoter required for transcriptional suppression in CaP cells.

DTIC

*Cancer; Drugs; Metastasis; Prostate Gland*

**20080018285** Missouri Univ., Saint Louis, MO USA

**Delineating the Effects of Tumor Therapies on Prostate Cancer Using Small Animal Imaging Technologies**

Lewis, Jason S; Nov 2007; 100 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0906

Report No.(s): AD-A476780; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476780

This final report presents the data generated under the grant awarded to Jason S. Lewis, PhD (W81XWH-04-1-0906). This proposal was aimed at delineating the relationship between androgen ablation and hypoxia as well as monitoring changes in blood flow, metabolism, oxygenation, vascular permeability and cellular proliferation in animal models of prostate cancer using small animal PET. In this final report we detail the advances made in relation to the original Statement of Work. During this funding period we have shown that, (1) it is not possible to delineate changes in prostate tumor glucose utilization with 2-[18F]Fluoro-2-deoxyglucose (FDG) and microPET following androgen ablation treatment; (2) it is not possible to monitor alterations in cellular proliferation with 18F-3 -deoxy-3 -fluorothymidine (18F-FLT) and microPET following treatment; (3) 64Cu-ATSM uptake is affected by the presence of fatty acid synthase (FAS) and, therefore, may not be suitable for the imaging of hypoxia in prostate tumors as the redox balance is changed, and (4) that 1-11C-acetate is a marker for FAS. This work has led to the presentation of six abstracts at international meetings and two peer-reviewed manuscripts. These findings are promising as they suggest a possible biomarker for more effective treatments in prostate cancer patients, and possibly others, since FAS expression has shown links to poor prognosis in other cancers as well. Moreover, since FAS inhibitors are being developed as anti-tumor agents, this technology also provides a unique opportunity to monitor the effectiveness and the validation of new FAS inhibitors for translation into a clinical setting.

DTIC

*Animals; Cancer; Imaging Techniques; Prostate Gland; Therapy; Tumors*

**20080018286** Karolinska Inst., Stockholm, Sweden

**A Population-Based Study of Dietary Acrylamide and Prostate Cancer Risk**

Adami, Hans-Olov; Jun 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0288

Report No.(s): AD-A476781; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476781

The aim of this study is to determine whether intake of foods found to have high levels of acrylamide increase the risk of prostate cancer among men. Methods: A population-based case-control study on prostate cancer. The exposure to acrylamide was estimated by using a food frequency questionnaire (FFQ) and by hemoglobin adducts in blood. Results: The intake of acrylamide and adduct levels are in line with previous studies, but there was only a weak correlation between the two estimates. The relative risk of prostate cancer was 0.97 (95% CI 0.75-1.27) for the highest quintile of exposure compare

to the lowest quintile. Conclusions: "‘There was no evidence of an overall association between exposure to dietary acrylamide and prostate cancer risk in the present study.
DTIC
*Acrylic Resins; Amides; Cancer; Diets; Populations; Prostate Gland; Risk*

**20080018287** San Francisco Univ., CA USA
**Inhibitors for Androgen Receptor Activation Surfaces**
Fletterick, Robert J; Sep 2007; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0545
Report No.(s): AD-A476782; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476782

Studies from this grant led to discovery of a new interaction site on the androgen receptor for binding proteins that regulate the function of the receptor. The protein binders have not been identified, but we showed that the site has the characteristics of functioning in repression. We used X-ray crystallography to discover the binding mode of four compounds that bind to this site. Their binding is accompanied by weakening the interaction of the androgen receptor with coactivators as shown by disorder or representative peptides that were well ordered before adding the compounds. Thus, atomic level imaging of these interactions fit with the notion that the site functions in repression, as suggested by analysis of mutations of amino acid residues found in humans in cell and biochemical assays. This work suggests that compounds may be designed to target this site and weaken activity of the androgen receptor. Such compounds could form a new class of chemical therapeutics for treatment of prostate cancer.
DTIC
*Hormones; Inhibitors; Males*

**20080018288** Texas Univ., Dallas, TX USA
**PSMA-Targeted Nano-Conjugates as Dual-Modality (MRI/PET) Imaging Probes for the Non-Invasive Detection of Prostate Cancer**
Sun, Xiankai; Oct 2007; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-O5-1-0592
Report No.(s): AD-A476783; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476783

The goal of this project is to develop dual modality imaging probes for the detection of prostate cancer by doping radioisotopes to iron oxide nanopartides so that the sensitivity and specificity of prostate cancer diagnosis could be significantly improved. In the second year a rigorous synthetic protocol has been developed to prepare dextran TI 0-coated iron oxide nanoparticles with uniform size distribution and better controllable reproducibility compared to the method developed in the first year. Protocol of conjugating nanoparticles with prostate cancer targeting molecules has been successfully established. Two nanoparticles with mean sizes of 11=8 and 30.6 nm (radii) were evaluated in vitro and in vivo. The relaxivity values (r2) of the prepared nanoparticles were observed up to 43.3 mM-Is-I with the r21rI ratio being 88.4 exhibiting potential application of contrast enhancement on T2- and T2*-weighted MR images. Both nanoparticles showed excellent in vitro stability in rat serum. The biodistribution studies in normal animal showed that the smaller nanoparticle (NP-I radius 11.8 nm) has a better tissue distribution profile than the larger one (NP-2 radius 30.6 nm). Impressively NP-I showed remarkable tumor uptake in a PC-3 xenograft model with a tumor to muscle ratio of 12.11 i 3.87 at 24 h post injection.
DTIC
*Cancer; Conjugates; Detection; Images; Imaging Techniques; Prostate Gland*

**20080018294** Texas Univ., Dallas, TX USA
**Prostate Cancer Evaluation: Design, Synthesis, and Evaluation of Novel Enzyme-Activated Proton MRI Contrast Agents**
Yu, Jian-Xin; Oct 2007; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0593
Report No.(s): AD-A476792; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476792

The lacZ gene encoding E. coli beta-gal has already been recognized as the most commonly used reporter system in cancer gene therapy. Moreover, prostrate-specific membrane antigen (PSMA) has been identified as an ideal antigenic target

in prostate cancer. We propose to develop a novel class of Gd(III)-based MRI contrast agents for in vivo detection of beta-gal or PSMA activity. This new concept of the GD(III)-based MRI contrast agents is composed of three moieties: (A) a signal enhancement group, such as Gd-DOTA or Gd-PCTA; (B) an Fe(III) chelating group; (C) beta-D-galactose or glutamate. Following cleavage by lacZ transgene or PSMA in prostate cancer cells, the released, activated aglycone Fe(III)-ligand will spontaneously trap endogenous Fe(III) at the site of enzyme activity forming a highly stable complex, to restrict motion of the GD(III) chelates enhancing relaxivity and providing local contrast accumulation. We plan to synthesize 8 novel MRI contrast agents for imaging beta-gal or PSMA activity in prostate cancer cell culture, explore the feasibility of applying the most promising analogies to cells grown in vivo in mice and rats.
DTIC
*Cancer; Enzymes; Imaging Techniques; In Vivo Methods and Tests; Magnetic Resonance; Prostate Gland; Protons*

**20080018301** Naval War Coll., Newport, RI USA
**Combat Trauma -- Placing Surgeons to Save the Most Lives**
Zinder, Daniel J; Nov 6, 2007; 32 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476801; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476801

Small mobile surgical teams attached to maneuver units save lives in the initial stages of major combat operations. But in the later phases of an operation, consolidating surgical capability will save more lives with fewer resources. This is because surgical care can be initiated sooner, the variety of specialists can be increased, and fewer complications are likely. The problem is that tactical commanders resist moving surgeons away from their areas of responsibility, even when it will provide timelier, more comprehensive care to their wounded. This problem of 'resistance' and its complexity are well known. The objectives of this paper are to discuss the reasons for this resistance and to provide recommendations for overcoming it. The author contends that when conditions permit in late Phase 3 or beyond, small surgical sites should be consolidated into a theater trauma system that provides rapid evacuation, increased surgical capability, and surge capacity for mass casualty events. Although the benefits of this restructuring can be shown empirically, the resistance to moving surgeons off the battlefield is high. This resistance exists because of the emotional attachment of leaders to their wounded, and because keeping surgeons on the battlefield is a common belief passed down through generations of military personnel. The author analyzes the intense emotional attachment of leaders to their men through excerpts of conversations with tactical commanders during Operation Iraqi Freedom (OIF). He then discusses three misunderstood concepts driving line officer opinions on surgical placement: the Golden Hour, the Capability-Proximity Paradox, and the Surgeon's Mentality. Data from civilian trauma literature and from OIF surgeons' experience are provided as supporting evidence. The author concludes with recommendations for maintaining premier surgical care on a dynamic battlefield.
DTIC
*Combat; Consolidation; Injuries; Surgeons; Surgery*

**20080018307** Johns Hopkins Univ., Baltimore, MD USA
**Prostate Cancer Progression and Serum SIBLING (Small Integrin Binding N-Linked Glycoprotein)Levels**
Fedarko, Neal S; Oct 2007; 11 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0844
Report No.(s): AD-A476824; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476824

We have been studying a gene family termed SIBLINGs (for small integrin binding ligand N-linked glycoproteins) whose members include bone sialoprotein (BSP), osteopontin (OPN), dentin matrix protein-1 (DMP1), dentin sialophosphoprotein (DSPP) and matrix extracellular phosphoglycoprotein (MEPE). Our Specific Aims are to describe the distribution of serum-based measurements of SIBLINGs among (a) normal individuals, (b) individuals with benign prostatic disease, (c) individuals with clinically defined prostate cancer, and (d) longitudinal samples from individuals with prostate cancer before and after treatment; and to establish serum-based measurements which maximize sensitivity and specificity of SIBLINGs as markers for prostate cancer detection as well as for prostate cancer progression and response to treatment. Although the laboratory is still blinded to staging and progression data at this point in time, some significant observations can be made. The distribution of serum levels of BSP and DSPP suggest they have utility for prostate cancer detection. Whether used separately or as an adjunct to PSA screening, the preliminary data indicates that measurement of SIBLINGs will have a significant effect on current prostate cancer management.
DTIC
*Blood; Cancer; Prostate Gland; Proteins; Sensitivity; Serums*

**20080018309** Long Island Jewish Medical Center, Lake Success, NY USA

**Breast Cancer Prevention by Fatty Acid Binding Protein MRG-Induced Pregnancy Like Mammary Gland Differentiation**

Wang, Mingsheng; Aug 2005; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0353

Report No.(s): AD-A476828; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476828

A mammary derived growth inhibitor related gene (MRG) was previously identified and characterized. MRG induces differentiation of mammary epithelial cells in vitro and its expression is associated with mammary differentiation. Overexpression of MRG in human breast cancer cells induced differentiation with changes in cellular morphology and a significant increase in the production of lipid droplets. Treatment of mouse mammary gland in organ culture with MRG protein resulted in a differentiated morphology and stimulation of beta-casein expression. To further define the role of MRG on mammary differentiation, a MRG transgenic mice model under the control of MMTV promoter was established and investigated. While there was no lobulo-alveolar structure in control virgin mice, expression of MRG transgene in the mammary gland resulted in the formation of alveolar-like structure. Consistent with the morphological change, expression of MRG also increased milk protein beta-casein expression in the gland. Our results suggest that MRG is a candidate mediator of the differentiating effect of pregnancy on breast epithelial cells.

DTIC

*Breast; Cancer; Fatty Acids; Health; Inhibitors; Mammary Glands; Pregnancy; Prevention; Proteins*

**20080018313** Scripps Research Inst., La Jolla, CA USA

**Creation of Polyvalent Decoys of Protein Cytotoxins as Therapeutics and Vaccines**

Reddy, Vijay S; Jan 2008; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-2-0027

Report No.(s): AD-A476841; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476841

Polyvalent protein shells (capsids) are useful platforms for the display of molecules of interest (MOI) on their surface. The resulting polyvalent reagents can be used as efficacious prophylactic vaccines and therapeutics. The coat protein subunits of Tomato Bushy Stunt Virus (TBSV) and structurally similar Norwalk viruses, when expressed in insect cells, spontaneously self assemble to form protein shells. The self assembly of the coat protein mutants of TBSV resulted in two types of nanoparticles: small (60 subunit) and the regular size (180 subunit) capsids. Norwalk virus particles predominantly result in formation of 180 subunit shells. These protein shells(capsids) can be used for the display of 60-180 copies of peptides/proteins of the pathogens of concern. Previously, it has been shown that antibodies raised against various cytotoxins (e.g., ricin and Shiga toxin) render protection against the potential toxin attack. The proposed polyvalent reagents, which display various peptide/protein fragments of ricin would act as efficacious prophylactic vaccines of the ricin toxin by priming the immune system. We have successfully produced two polyvalent reagents displaying multiple copies of 1) 16 a.a. RTA antigenic peptide (mouse epitope) and 2) a large 188 a.a. stable RTA domain.

DTIC

*Decoys; Proteins; Therapy; Vaccines*

**20080018345** Library of Congress, Washington, DC USA

**P.L. 110-173: Provisions in the Medicare, Medicaid, and SCHIP Extension Act of 2007**

Chaikind, Hinda; Hahn, Jim; Hearne, Jean; Herz, Elicia J; Jacobson, Gretchen A; Morgan, Paulette C; Peterson, Chris L; Stockdale, Holly; O'Sullivan, Jennifer; Stone, Julie; Feb 7, 2008; 22 pp.; In English

Report No.(s): AD-A476949; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476949

On December 29, 2007, the President signed 5. 2499, the Medicare, Medicaid, and SCHIP Extension Act of 2007 (P.L. 110-173). This Act was passed by the House on December 19, 2007, and by a voice vote in the Senate on December 18, 2007. The Act makes changes to the nation's three major health programs, Medicare, Medicaid, and the State Children's Health Insurance Program (SCHIP), as well as other federally funded programs. The most prominent provisions in the Act were to (1) suspend the Medicare physician payment cut scheduled to take effect and (2) provide SCHIP funding through March 2009. P.L. 110-173 mandates a 0.5% increase in the Medicare physician fee schedule for the six-month period from January 1, 2008, through June 30, 2008, and provides FY2008 and FY2009 SCHIP funding allotments through March 31, 2009. The Act also extends a number of expiring provisions and programs. These extensions affect Medicare plans and providers and Medicaid

payments and programs. The Act also includes funding for some miscellaneous activities. The Act's Medicare extensions include incentive payments for certain physicians, and extensions of current law provisions for Medicare Special Needs Plans and cost-based plans. A variety of extensions also affect how long-term care, rural, and acute care hospitals are paid or classified. Other extensions affect Medicare payments for certain services and providers, outpatient physical therapy services, speech language pathology services, certain pathology laboratories, brachytherapy services, and therapeutic radiopharmaceuticals. The Act also includes Medicaid provisions designed to extend certain payments and programs, such as Medicaid disproportionate hospital share (DSH) allotments for Tennessee and Hawaii, the Transitional Medical Assistance (TMA) program, and the Qualifying Individual (QI) program, among other provisions.
DTIC
*Insurance (Contracts); Law (Jurisprudence); Medical Services*

**20080018346** Georgetown Univ. Hospital, Washington, DC USA
**The Key Involvement of Poly(ADP-Ribosyl)ation in Defense Against Toxic Agents: Molecular Biology Studies**
Smulson, Mark E; May 2007; 6 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0395
Report No.(s): AD-A476950; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476950

Our study during the period 2005-2007 focused in lung cell as critical in the regulation of airway inflammation in response to environmental pollutants.
DTIC
*Genes; JP-8 Jet Fuel; Lungs; Molecular Biology; Toxicity*

**20080018350** Library of Congress, Washington, DC USA
**Veterans Affairs: Health Care and Benefits for Veterans Exposed to Agent Orange**
Panangala, Sidath V; Feb 11, 2008; 11 pp.; In English
Report No.(s): AD-A476962; CRS-RL34370; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476962

Since the 1970s, Vietnam-era veterans have attributed certain medical illnesses, disabilities, and birth defects to exposure to Agent Orange and other herbicides sprayed by the U.S. Air Force to destroy enemy crops and remove forest cover. During the last 30 years, Agent Orange legislation has established and updated the health and disability benefits of Vietnam veterans exposed to herbicides. The Veterans Health Care, Training and Small Business Loan Act (P.L. 97-72) elevated Vietnam veterans priority status for health care at Department of Veterans Affairs facilities by recognizing a veteran's own report of exposure as sufficient proof to receive medical care unless there was evidence to the contrary. The Veterans Health Care Eligibility Reform Act of 1996 (P.L. 104-262) completely restructured VA medical care eligibility requirements for all veterans. Under P.L. 104-262, a veteran does not have to demonstrate a link between a certain health condition and exposure to Agent Orange; instead, medical care is provided unless the VA has determined that the condition did not result from exposure to Agent Orange or the condition has been identified by the Institute of Medicine (IOM) as having limited/suggestive evidence of no association between the occurrence of the disease and exposure to a herbicide.
DTIC
*Health; Herbicides; Medical Services*

**20080018480** Army Research Inst. of Environmental Medicine, Natick, MA USA
**Heat Stroke and Cytokines**
Leon, Lisa R; Jan 2007; 45 pp.; In English
Report No.(s): AD-A476868; MISC-06-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476868

Heat stroke is a life-threatening illness that affects all segments of society. The etiology of the long-term consequences of this syndrome remains poorly understood such that preventive/treatment strategies are needed to mitigate its debilitating effects. Cytokines are important modulators of the acute phase response to stress, infection and inflammation. Despite several studies implicating cytokines in heat stroke pathophysiology, few studies have examined the protective effect(s) of cytokine antagonism on the morbidity and mortality of heat stroke. Heat shock proteins (HSPs) are highly conserved proteins that function as molecular chaperones for denatured proteins and reciprocally modulate cytokine production in response to stressful stimuli. A complex pathway of interactions between cytokines, HSPs and endotoxin is thought to be occurring in vivo in the

orchestration of the APR to heat injury. This chapter provides an overview of current knowledge regarding cytokine, HSP and endotoxin interactions in heat stroke. Insight is provided into the potential therapeutic benefits of cytokine neutralization for mitigation of heat stroke morbidity and mortality based on our current understanding of their role in this syndrome.
DTIC
*Heat Stroke; Thermal Shock; Signs and Symptoms; Infectious Diseases*

**20080018509** National Marrow Donor Program, Minneapolis, MN USA
**Quarterly Performance/Technical Report of the National Marrow Donor Program**
Setterholm, Michelle; Feb 5, 2008; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-06-1-0704
Report No.(s): AD-A476629; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476629

1. CONTINGENCY PREPAREDNESS: Collect information from transplant centers, build awareness of the Transplant Center Contingency Planning Committee and educate the transplant community about the critical importance of establishing a nationwide contingency response plan. 2. RAPID IDENTIFICATION of MATCHED DONORS: Increase operational efficiencies that accelerate the search process and increase patient access. These are key to preparedness in a contingency event. 3. IMMUNOGENETIC STUDIES: Increase understanding of the immunologic factors important in HSC transplantation. 4. CLINICAL RESEARCH IN TRANSPLANTATION: Create a platform that facilitates multicenter collaboration and data management.
DTIC
*Bone Marrow; Clinical Medicine; Data Management; Patients; Transplantation*

**20080018536** Nebraska Univ., Omaha, NE USA
**Neurotoxin Mitigation**
Hinrichs, Steven H; Nov 2007; 102 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0102
Report No.(s): AD-A476755; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476755

Organophosphorus esters (OP) are highly toxic poisons used as chemical nerve agents and as pesticides. It is generally agreed that the toxicity from high dose OP exposure involves inhibition of acetyl cholinesterase. The role of other proteins in the toxicity of OP is unknown. Our hypothesis is that several proteins become modified after exposure to OP and that the biological actions of OP are not explained by inhibition of acetylcholinesterase alone. We are using mass spectrometry to identify proteins modified by exposure to OP. A new motif for OP binding is beginning to emerge from our work. We are seeing a pattern of covalent OP binding to tyrosine where the tyrosine is adjacent to an arginine or lysine. We have identified tyrosine 411 on the surface of human albumin and tyrosine 238 of human transferrin as OP-binding sites. Our results are relevant to diagnosis of OP exposure. The mass spectrometry methods we have developed are rapid and simple, but expensive. The new information from our mass spectrometry results can be used to develop antibody based dipstick assays to diagnose OP exposure.
DTIC
*Toxicity; Esters; Organic Phosphorus Compounds; Poisons*

**20080018818** Colgate-Palmolive Co., New York, NY USA
**Computer-implemented system and method for automated and highly accurate plaque analysis, reporting, and visualization**
Kemp, James Herbert, Inventor; Talukder, Ashit, Inventor; Lambert, James, Inventor; Lam, Raymond, Inventor; January 29, 2008; 19 pp.; In English
Patent Info.: Filed April 30, 2004; US-Patent-7,324,661; US-Patent-Appl-SN-10/836,567; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018818

A computer-implemented system and method of intra-oral analysis for measuring plaque removal is disclosed. The system includes hardware for real-time image acquisition and software to store the acquired images on a patient-by-patient basis. The system implements algorithms to segment teeth of interest from surrounding gum, and uses a real-time image-based morphing procedure to automatically overlay a grid onto each segmented tooth. Pattern recognition methods are used to classify plaque

from surrounding gum and enamel, while ignoring glare effects due to the reflection of camera light and ambient light from enamel regions. The system integrates these components into a single software suite with an easy-to-use graphical user interface (GUI) that allows users to do an end-to-end run of a patient record, including tooth segmentation of all teeth, grid morphing of each segmented tooth, and plaque classification of each tooth image.
Official Gazette of the U.S. Patent and Trademark Office
*Enamels; Gums (Substances); Image Analysis; Teeth; Tooth Diseases; Dental Calculi*

**20080018882** CTA Solutions, Honolulu, HI, USA
**Mass Medication Clinic (MMC) Patient Medical Assistant (PMA) System Training Initiative**
Clyde, R D; Garshnek, Victoria; Burgess, Lawrence; Jun 2007; 151 pp.; In English
Contract(s)/Grant(s): W81XWH-06-2-0045
Report No.(s): AD-A476406; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476406

In a disease outbreak medication needs to be rapidly yet safely distributed to a population to minimize infection outbreak. We investigated if there are significant differences in efficiency (time) and error rates in drug dissemination to large groups of people using algorithm driven paper vs. PDA methodology. Subjects were sent through points of dispensing with volunteer clerks processing them during two sessions (alternating modes for session two). Time to process subjects through each arm was recorded, along with the errors in medication prescription. Data analysis indicated no significant difference in time or number of errors made with PDA vs. paper methods. However, the mode and order of testing affected time. Clerks doing the paper method second were slower than those who did paper first (P = 0.001). The PDA method was consistent in time whether clerks used it first or second. This may indicate the presence of a fatigue factor from using the paper method. Both methods require questions to be asked, but the PDA requires less thinking as one only plugs in answers to questions, whereas the clerks using paper must also interpret the answer and follow the paper-based algorithm. This may have resulted in slower times as fatigue played a role in the second session. The findings may indicate that during a disease outbreak, when clerks are tired yet still must continue processing citizens, an algorithm-driven PDA may be beneficial to improve efficiency.
DTIC
*Clinical Medicine; Education; Medical Services; Patients*

**20080018883** James Madison Univ., Harrisonburg, VA, USA
**Yersinia pestis YopD 150-287 Fragment is Partially Unfolded in the Native State**
Raab, Ronald; Swietnicki, Wieslaw; Nov 17, 2007; 10 pp.; In English
Report No.(s): AD-A476407; TR-07-067; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476407

Yersinia pestis is a human and animal pathogen uses the type III secretion system (TTSS) for delivering virulence factors and effectors into the host cells. The system is conserved in animal pathogens and is hypothesized to deliver the virulence factors directly from bacterial to mammalian cells through a pore composed of YopB and YopD translocation proteins. The YopB and YopD effector proteins must be delivered first to form a functional pore in the mammalian cell. The criteria by which Yersinia selects the two proteins for initial delivery are not known and we hypothesized that the extensive binding by the chaperone and partial unfolding of the unbound region may be the criteria for selection. The YopB and YopD proteins, unlike other effectors, have a common chaperone SycD, which binds through multiple regions. Due to the small size of the pore, we hypothesized that many of the transported virulence factors, YopB and YopD included, are delivered in a partially unfolded state stabilized by binding to specific chaperones. The YopD protein binds the chaperone through amino acid (a.a.) 53-149 and a.a. 278-292 regions but biophysical characterization of YopD has not been possible due to the lack of an expression system for soluble, large fragments of the protein. In our present work, we demonstrated that the YopD 150-287 peptide fragment, almost the full soluble C-terminal part, including the non-interacting peptide fragment YopD150-277, was partially unfolded in its native state by a combination of biophysical methods: circular dichroism, quasi-elastic light scattering, chemical unfolding and 8-anilino-1-naphtalene sulfonate (ANS) binding. The secondary structure of the peptide converted easily between alpha-helical and random coil states at neutral pH, and the alpha-helical state was almost fully recovered by lowering the temperature to 262 K. The current re
DTIC
*Bacteria; Fragments; Microorganisms; Pathogens; pH Factor*

**20080018884** Air Force Research Lab., Brooks AFB, TX USA

**Sleep Loss and Complex Team Performance**

Whitmore, Jeff; Chaiken, Scott; Fischer, Joseph; Harrison, Richard; Harrison, Donald; Feb 2008; 19 pp.; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A476418; AFRL-RH-BR-TR-2008-0005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476418

There are few objective assessments of the impact of sleep loss on team performance. The present study was designed to quantify the effects of fatigue on teams performing a complex task and to compare team data with individual data on a similar task. Participants were trained on a complex air battle management task (both in individual and team mode) for one week and then experienced a 36-hr period of sustained wakefulness. Forty-minute scenarios (individual and team) were iteratively completed throughout each experimental period alongside traditional cognitive performance tasks (e.g., simple math processing). Individual data showed the well-established performance reduction resulting from sleep loss and circadian variation at both the simple and complex task levels. Significant decrements were seen for both process measures (e.g., information gathering) and outcome measures (e.g., number of targets attacked) after sleep-loss on the complex task. In contrast, team scores on similar measures after sleep loss, did not degrade, and in some cases showed improvements relative to baseline (indicating a continuing team building process). Individual performance (both simple and complex) was significantly degraded during the early morning hours. Team data did not show the expected performance decrements.

DTIC

*Cognition; Human Performance; Losses; Sleep; Sleep Deprivation; Teams*

**20080018899** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Thermococcus thioreducens sp. nov., a Novel Hyperthermophilic, Obligately Sulfur-Reducing Archaeon from a Deep-Sea Hydrothermal Vent**

Pikuta, Elena V.; Marsic, Damien; Itoh, Takashi; Bej, Asim K.; Tang, Jane; Whitman, William B.; Ng, Joseph D.; Garriott, Owen K.; Hoover, Richard B.; International Journal of Systematic and Evolutionary Microbiology; February 2007; Volume 57, pp. 1612-1618; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1099/ijs.0.65057-0

A hyperthermophilic, sulfur-reducing, organo-heterotrophic archaeon, strain OGL-20P(sup T), was isolated from 'black smoker' chimney material from the Rainbow hydrothermal vent site on the Mid-Atlantic Ridge (36.2degN, 33.9degW). The cells of strain OGL-20P(T) have an irregular coccoid shape and are motile with a single flagellum. Growth was observed within a pH range of 5.0-8.5 (optimum pH 7.0), an NaCl concentration range of 1-5%(w/v) (optimum 3%)and a temperature range of 55-94 C (optimum 83-85 C). The novel isolate is strictly anaerobic and obligately dependent upon elemental sulfur as an electron acceptor, but it does not reduce sulfate, sulfite, thiosulfate, Fe(III) or nitrate. Proteolysis products (peptone, bacto-tryptone, Casamino acids and yeast extract) are utilized as substrates during sulfur reduction. Strain OGL-20P(sup T) is resistant to ampicillin, chloram phenicol, kanamycin and gentamicin, but sensitive to tetracycline and rifampicin. The G + C content of the DNA is 52.9 mol% The 16S rRNA gene sequence analysis revealed that strain OGL-20P(sup T) is closely related to Thermococcus coalescens and related species, but no significant homology by DNA-DNA hybridization was observed between those species and the new isolate. On the basis of physiological and molecular properties of the new isolate, we conclude that strain OGL-20P(sup T) represents a new separate species within the genus Thermococcus, for which we propose the name Thermococcus thioreducens sp. nov. The type strain is OGL-20P(sup T) (=JCM 12859(exp T) = DSM 14981(exp T)=ATCC BAA-394(exp T)).

Author

*Deoxyribonucleic Acid; Tetracyclines; Acceptor Materials; Penicillin; Submarine Hydrothermal Vents; Homology; Nitrates*

**20080018925** Defence Science and Technology Organisation, Victoria, Australia

**Assessment of a DNA Vaccine Encoding Burkholderia pseudomallei Bacterioferritin**

McAllister, Jane; Gauci, Penny; Lazzaroni, Sharon; Barnes, Jodie; Ketheesan, Natkunam; Proll, David; Aug 2007; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476862; DSTO-TR-2051; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476862

Burkholderia pseudomallei is the causative agent of melioidosis, a disease endemic in Southeast Asia and Northern Australia. The bacteria cause infection via subcutaneous or inhaled routes, resulting in either acute lethal sepsis or chronic and eventually fatal disease. Currently no licensed vaccine is available to provide protection against this pathogen. Intracellular

enzymatic proteins of other bacterial species, such as the iron storage protein bacterioferritin, have been shown to be potent inducers of the immune response. In this study, a DNA vaccine encoding the B. pseudomallei bacterioferritin protein was constructed. The DNA vaccine was then used to immunise mice and analyse subsequent immune responses and protective capability following live challenge with B. pseudomallei. There was a substantial increase in anti-bacterioferritin IgG titers following immunisation, however the cellular response and survival following challenge was limited, suggesting that the vaccine may need to be used in conjunction with adjuvant such as CpG or in a multicomponent vaccine in order to increase protective capabilities.
DTIC
*Bacteria; Coding; Deoxyribonucleic Acid; Immunity; Infectious Diseases; Vaccines*

## 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*.

**20080018336** Army Construction Engineering Research Lab., Champaign, IL USA
**Sleep Impacts of Nighttime Training Noise From Large Weapons on Residents Living Near a Military Installation**
Nykaza, Edward T; Pater, Larry L; Melton, Robert H; Aug 2006; 74 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-A896
Report No.(s): AD-A476918; ERDC/CERL-TR-06-21; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476918

Training during the hours of darkness is a necessity for the Army and other branches of the Department of Defense (DoD). Nighttime training is needed to ensure military forces are ready for combat, but installations also endeavor to minimize community noise disturbance and resulting negative public reaction. As a result, most installations restrict nighttime training or enforce training curfews to reduce the negative impact of the nighttime training noise on local residents. There is, however, little research-based guidance on the types of restrictions and curfews needed to effectively reduce the negative impact. Consequently, current training restrictions may sacrifice more training capability than necessary. During the fall of 2004 a field study was conducted adjacent to a military installation to determine if there are preferred times to conduct nighttime training. The results of this research project clearly and strongly indicate that community disturbance is more effectively reduced by conducting training between 0000 and 0200 hours, and avoiding noisy training during the evening hours before midnight. These findings suggest that night-time training should be postponed until after midnight in order to effectively reduce the negative impact of nighttime training on local residents and to preserve nighttime training capabilities throughout DoD.
DTIC
*Combat; Education; Installing; Night; Sleep*

**20080018871** Civil Aerospace Medical Inst., Oklahoma City, OK, USA
**Use of Alternative Primers for Gender Discrimination in Human Forensic Genotyping**
Kupfer, Doris M.; Jenkins, Marita; Burian, Dennis; Canfield, Dennis V.; April 2008; 10 pp.; In English; Original contains color illustrations
Report No.(s): DOT/FAA/AM-08/8; No Copyright; Avail.: CASI: A02, Hardcopy

An assay using the Federal Bureau of Investigation's human Combined DNA Identity System (CODIS) primers has been developed for polymerase chain reaction (PCR)-based human identity testing. Recent forensic literature has identified several human populations that carry a deletion mutation in the Y-chromosome copy of the amelogenin locus. This is the standard locus used for gender determination in CODIS. Additionally, the amelogenin male PCR products are very close in size requiring manual annotation of PCR electrophoresis results for this locus. This study was designed to test several gender-specific primers which are to loci outside the amelogenin region, have well-separated PCR products, and could serve as additions or replacements to amelogenin in our human identity testing assay.
Author
*Chromosomes; Deoxyribonucleic Acid; Sex Factor; Gene Expression; Genetic Code; Polymerase Chain Reaction; Biochemistry*

## 53
## BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**20080018551** Wyle Labs., Inc., Houston, TX, USA
**International Space Station Human Behavior and Performance Competency Model: Volume II**
Schmidt, Lacey; March 2008; 80 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A05, Hardcopy

This document further defines the behavioral markers identified in the document 'Human Behavior and Performance Competency Model' Vol. I. The Human Behavior and Performance (HBP) competencies were recommended as requirements to participate in international long duration missions, and form the basis for determining the HBP training curriculum for long duration crewmembers. This document provides details, examples, knowledge areas, and affective skills to support the use of the HBP competencies in training and evaluation. This document lists examples and details specific to HBP competencies required of astronauts/cosmonauts who participate in ISS expedition and other international long-duration missions. Please note that this model does not encompass all competencies required. While technical competencies are critical for crewmembers, they are beyond the scope of this document. Additionally, the competencies in this model (and subsequent objectives) are not intended to limit the internal activities or training programs of any international partner.
Derived from text
*International Space Station; Human Behavior; Human Performance; Astronauts; Crews*

**20080018552** Wyle Labs., Inc., Houston, TX, USA
**International Space Station Human Behavior and Performance Competency Model: Volume I**
Schmidt, Lacey; March 2008; 24 pp.; In English; No Copyright; Avail.: CASI: A03, Hardcopy

This document defines Human Behavior and Performance (HBP) competencies that are recommended to be included as requirements to participate in international long duration missions. They were developed in response to the Multilateral Crew Operations Panel (MMOP) request to develop HBP training requirements for the International Space Station (ISS). The competency model presented here was developed by the ITCB HBPT WG and forms the basis for determining the HBP training curriculum for long duration crewmembers. This document lists specific HBP competencies and behaviors required of astronauts/cosmonauts who participate in ISS expedition and other international longduration missions. Please note that this model does not encompass all competencies required. For example, outside the scope of this document are cognitive skills and abilities, including but not limited to concentration, memorization, perception, imagination, and thinking. It is assumed that these skills, which are crucial in terms of human behavior and performance, are considered during selection phase since such professionally significant qualities of the operator should be taken into consideration in order to ensure sufficient baseline levels that can be further improved during general astronaut training. Also, technical competencies, even though critical for crewmembers, are beyond the scope of this document. It should also be noted that the competencies in this model (and subsequent objectives) are not intended to limit the internal activities or training programs of any international partner.
Derived from text
*International Space Station; Human Behavior; Mental Performance; Astronaut Training; Astronauts; Crews; Abilities*

## 54
## 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*.

**20080018688** NASA Langley Research Center, Hampton, VA, USA
**NASA ATP Force Measurement Technology Capability Strategic Plan**
Rhew, Ray D.; May 05, 2008; 7 pp.; In English; 6th International Symposium on Strain Gauge Balances, 5-8 May 2008, Zwolle, Netherlands
Contract(s)/Grant(s): WBS 122711.03.06.07.02; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018688

The Aeronautics Test Program (ATP) within the National Aeronautics and Space Administration (NASA) Aeronautics Research Mission Directorate (ARMD) initiated a strategic planning effort to re-vitalize the force measurement capability within NASA. The team responsible for developing the plan included members from three NASA Centers (Langley, Ames and

Glenn) as well as members from the Air Force s Arnold Engineering and Development Center (AEDC). After visiting and discussing force measurement needs and current capabilities at each participating facility as well as selected force measurement companies, a strategic plan was developed to guide future NASA investments. This paper will provide the details of the strategic plan and include asset management, organization and technology research and development investment priorities as well as efforts to date.
Author
*Management Planning; NASA Programs; Management Systems; Space Missions*

**20080018766** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands
**Restriction of Movement of Impact Protective Clothing for the Anti-Riot Squad of the Dutch Military Police**
Tan, T. K.; Kistemaker, J. A.; December 2007; 3 pp.; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): TNO Proj. 013.14416
Report No.(s): TD2007-0252; TNO-DV 2007 A599; TNO-DV 2007 A559; Copyright; Avail.: Other Sources

Impact protective clothing was ergonomically tested by experts from the Dutch Military Police and the Police and by naive subjects. Movements above the head and across the chest and bending give restriction. The new impact protective clothing gives more restriction than the present used impact protective clothing.
Author
*Human Factors Engineering; Protective Clothing; Protection; Constrictions*

**20080018881** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Clearing the Air: New Approaches to Life Support in Outer Space**
Knox, J.; Howard, D.; May 16, 2008; 12 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018881

This article reports on research into atmospheric revitalization systems for long-term space travel and the use ofCOMSOL Multiphysics to understand how structured sorbents can be used to improve the performance of adsorption processes via thermal management. We are developing the next generation of atmosphere revitalization systems, which will reach for new levels of resource conservation via a high percentage of loop closure. For example, a high percentage of carbon dioxide, exhaled by crew, can be converted via reaction to drinking water, closing the loop from human metabolic waste to supply. Adsorption processes play a lead role in these new/closed loop systems.
Derived from text
*Adsorption; Life Support Systems; Metabolic Wastes; Sorbents*

## 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*.

**20080018455**
**VIRTEX-4 VQ static SEU Characterization Summary**
Allen, Gregory; Swift, Gary; Carmichael, Carl; April 2008; 22 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40768

This report is the result of the combined efforts of members within the Xilinx Radiation Test Consortium (XRTC), sometimes known as the Xilinx SEE Test Consortium. The XRTC is a voluntary association of aerospace entities, including leading aerospace companies, universities and national laboratories, combining resources to characterize reconfigurable FPGAs for aerospace applications. Previous publications of Virtex-4 radiation results are for commercial (non-epitaxial) devices; see, for example, Refs. 1-4. A notable exception is Ref. 5, which presents XRTC upset measurements of storage elements in the PowerPC405s in the XQR4VFX60. This report of upset susceptibility to heavy ions and protons of the static

memory elements in the Virtex-4QV family is a direct parallel to the XRTC report on the thin epitaxial devices in the Virtex-2 family released four years ago.
Author
*Field-Programmable Gate Arrays; Aerospace Engineering; Computer Storage Devices; Memory (Computers); Heavy Ions; Characterization*

**20080018490** Office of Management and Budget, Washington, DC USA
**Office of Management and Budget Report to Congress on Implementation of the Federal Information Security Management Act of 2002, FY 2006**
Jan. 01, 2006; 144 pp.; In English
Report No.(s): PB2007-111768; No Copyright; Avail.: CASI: A07, Hardcopy

This report informs Congress and the public of the Federal government's security performance, and fulfills OMB's requirement under FISMA to submit an annual report to the Congress. It provides OMB's assessment of government-wide IT security strengths and weaknesses and a plan of action to improve performance. It also examines agency status against key security and privacy performance measures from fiscal year 2002 through fiscal year 2006. Data used within this report is based on fiscal year 2006 agency, IG, and privacy reports to OMB. Appendix A contains statistical summaries of security performance at 25 large agencies. Appendix B provides a summary of small and independent agency compliance with FISMA. Appendix C of the report summarizes the roles and responsibilities within the Federal government's IT security program.
NTIS
*Information Management; Management Planning; United States; Computer Information Security*

**20080018563** California Univ., Los Angeles, CA, USA
**Milcom 04 Paper ID# 1158: A New Class of Turbo-like Codes with Efficient and Practical High-speed Decoders**
Abbasfar, Aliazam; Divsalar, Dariush; Yao, Kung; October 31, 2004; 10 pp.; In English; Military Communications Conference, MILCOM 2004, 31 Oct.-3 Nov. 2004, Monterey, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40731

Turbo codes not only achieve near Shannon-capacity performance, but also have decoders with modest complexity, which is crucial for implementation. So far efficient architectures for decoding of turbo codes have been proposed that is suitable for serial processing. In this paper a novel architecture for very high-speed turbo decoder is presented. The performance of this decoder is illustrated and the tradeoff between speed and efficiency is discussed. It is shown that some decoders can run faster by some order of magnitude while maintaining almost the same processing load.
Author
*Decoders; High Speed; Decoding; Loads (Forces)*

**20080018732** NATO Research and Technology Organization, Neuilly-sur-Seine, France
**Visualising Network Information**
December 2006; In English; RTO Information Systems Technology Panel (IST) Workshop, 17-20 Oct. 2006, Copenhagen, Denmark; See also 20080018733 - 20080018755; Original contains color illustrations
Report No.(s): RTO-MP-IST-063; AC/323(IST-063)TP/41; Copyright; Avail.: CASI: C01, CD-ROM

Topics covered include: A Dynamic Network Approach to the Assessment of Terrorist Groups and the Impact of Alternative Courses of Action; A Need for Better Network Visualization; Automating the Presentation of Computer Networks; KDD - Overcoming Massive Data Streams for Intelligence Tasks; A Framework for Network Visualisation: Progress Report; Characterisation and Showcasing of Network Visualisation Approaches for Command and Control; Scalable HAIPE Discovery; Custom Ontologies for Expanded Network Analysis; Real-Time Extraction of Course Track Networks in Confined Waters as Decision Support for Vessel Navigation in 3-D Nautical Chart; A Three Pronged Approach for Improved Data Understanding: 3-D Visualization, Use of Gaming Techniques, and Intelligent Advisory Agents; Reduction of Complexity: An Aspect of Network Visualization; Cognitive Engineering Research Methodology: A Proposed Study of Visualization Analysis Techniques; Epidemiologic Considerations in Network Modeling of Theoretical Disease Events; Applications of Network Visualisation in Infectious Disease Management; Modeling Influenza Pandemic Response Effectiveness in Canada; Investigative Data Mining Toolkit: A Software Prototype for Visualizing, Analyzing and Destabilizing Terrorist Networks; Information Fusion and Visualisation in Anti Asymmetric Warfare; Runtime Simulation for Post-Disaster Data Fusion Visualization; Framework-Survey Integration Group Report; Report of Break-Out Group 1: Network Vulnerability and Risk

Assessment; Report of Break-Out Group 2: Reliability and Uncertainty in Situation Awareness of Network Visualization; Report of Break-Out Group 3: Reliability and Uncertainty in Situational Awareness; and Report of Break-Out Group 4: Situation Awareness.
Derived from text
*Command and Control; Computer Networks; Data Flow Analysis; Situational Awareness; Warfare; Scientific Visualization; Risk Assessment; Network Analysis; Multisensor Fusion; Epidemiology; Data Mining*

**20080018733** Alward, [Randy G.], Ontario, Canada
**A Need for Better Network Visualization**
Visualising Network Information; December 2006, pp. KN2-1 - KN2-10; In English; See also 20080018732; Original contains color illustrations
Report No.(s): Keynote 2; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

I hold strong views on the need for Network Visualization. This paper is not scientific, but rather prescriptive of a way forward for the NATO R&D community. There is an urgent need to improve Network Visualization and I present my view of how to proceed herein.
Derived from text
*Network Analysis; World Wide Web; Information Transfer; Web Services; Telecommunication*

**20080018734** Defence Research and Development Canada, Ottawa, Ontario, Canada
**Automating the Presentation of Computer Networks**
Vandenberghe, G.; Treurniet, J.; Visualising Network Information; December 2006, pp. 1-1 - 1-18; In English; See also 20080018732; Original contains color illustrations
Report No.(s): Paper 1; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are several graph layout algorithms available to automatically display a computer network. This study applies seven existing layout algorithms to a computer network and compares their readability, complexity, and speed. These algorithms generate network diagrams that are difficult to quickly interpret. To address this issue two improved layout algorithms called the XY Control algorithm and Voting algorithm were developed. The XY algorithm is a new type of force-directed model with an improved gridlike appearance relative to other force-directed algorithms. The Voting algorithm is a directed hierarchal layout technique that provides better space utilization while minimizing edge crossings. Both new algorithms are comparable in speed to the existing algorithms.
Author
*Management Systems; Algorithms; Computer Networks; Automation; Local Area Networks*

**20080018735** Mitre Corp., Bedford, MA, USA
**Scalable HAIPE Discovery**
Nakamoto, Glen; Visualising Network Information; December 2006, pp. 5-1 - 5-14; In English; See also 20080018732; Original contains color illustrations
Report No.(s): Paper 5; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents a scalable concept for the dynamic discovery of High Assurance Internet Protocol Encryption (HAIPE) devices situated across multiple ‘striped’ network segments. The term ‘striped’ in this context refers to traversing from a red (or classified) network to a black (or unclassified) network to a red network in a multiple concatenated manner (i.e., red-black-red-black-red ...). There are many reasons why network ‘segmentation’ using IP encryption may occur: use of a commercial satellite link, traversing from one secure facility to another on an existing base network, operating over a radio frequency network, and so on. Each of these network segments or enclaves need to be secured (in this case, via IP encryption) which causes the segments to exist. The boundary between red and black sides is assumed to be protected via a HAIPE device (or an equivalent of an IPSEC virtual private network gateway). Our design also addresses mobile enclaves (where whole networks may come and go every 15 minutes) and multi-homed enclaves (where multiple entry/exit points exist). Finding how one traverses this striped environment and operate on a global scale (millions of network) are key challenges and the subject of this pape
Author
*Internets; Protocol (Computers); Cryptography; Radio Frequencies*

**20080018736** Wavelet Technologies, Inc., USA

**Custom Ontologies for Expanded Network Analysis**

Vanderbilt, Amy K. S. C.; Strauss, George; Visualising Network Information; December 2006, pp. 6-1 - 6-10; In English; See also 20080018732; Original contains color illustrations

Report No.(s): Paper 6; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper discusses a new approach to answering Requests for Information (RFIs) from military commanders, intelligence analysts, individual soldiers and others received by reach-back information and intelligence collection repositories. This new approach avoids the previous ideals of either searching out a set of a thousand documents or building one large all-encompassing ontology and instead embraces the concept of custom ontologies based on each users query and returns to that user a concise and organized knowledge set along with visualizations that invite exploration and facilitate assimilation.

Author

*Information Retrieval; Intelligence; Network Analysis; Assimilation; Dichotomies*

**20080018737** Pennsylvania State Univ., University Park, PA, USA

**Cognitive Engineering Research Methodology: A Proposed Study of Visualization Analysis Techniques**

Hall, Cristin M.; McMullen, Sonya A. H.; Hall, David L.; Visualising Network Information; December 2006, pp. 10-1 - 10-10; In English; See also 20080018732; Original contains color illustrations

Report No.(s): Paper 10; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The rapid development of new sensors and wide-band communications provides the capability to collect enormous amounts of data. An increasing challenge involves how to understand and interpret the data to yield knowledge about evolving situations or threats (e.g., of military situations, state of complex systems, etc.). New visualization tools and techniques are becoming available to support advanced visualization including three-dimensional, full immersion display environments and tools to support novel visualizations. Examples include network system display tools and evolving multi-sensory situation environments. Despite the emergence of such tools, there has been limited systematic test and evaluations to determine the efficacy of such tools for knowledge understanding and decision making. This paper provides an overview of this problem and argues for the need to conduct controlled experiments. A sample experiment is suggested.

Author

*Decision Making; Three Dimensional Models; Display Devices; Examination; Multisensor Applications; Imaging Techniques; Image Processing*

**20080018738** Taylor (Martin) Consulting, Toronto, Ontario, Canada

**A Framework for Network Visualisation: Progress Report**

Visualising Network Information; December 2006, pp. 3-1 - 3-22; In English; See also 20080018732; Original contains color illustrations; Copyright; Avail.: CASI: A04, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hundreds of different representations of networks have been produced for different purposes. Many are very well suited to their purpose, but it is seldom clear how to generalize their insights to other situations. Networks can be described in many different ways, each representing an attribute of the network that might be useful if displayed for some user task, of which there are an indefinite number. The objective of a Framework is to provide some structure in this universe of possibility, in order to assist a user with a particular task to find a good way of displaying useful network attributes, or to help a designer produce a display that will help a range of users with a variety of related tasks. The IST-059/RTG-025 Working group on Framework for Network Visualisation has developed a conceptual structure for a Framework, based around two previously developed reference models for visualisation, a set of possible local and global dimensions of description of networks, the concept of ‘embedding fields’ both for networks and for displays, a typology or taxonomy of data and display types, and a categorization of user task types. The resulting structure will be developed, along with the complementary IST-059/RTG-025 Survey of applications for network visualisation, into a structured guide for users, researchers, and developers.

Author

*Thermoelectric Generators; Taxonomy; Surveys; Radioisotope Batteries; Display Devices*

**20080018739** Alward, [Randy G.], Ontario, Canada

**Report of Break-Out Group 1: Network Vulnerability and Risk Assessment**

Carley, Kathleen M.; Madsen, Frederik; Taylor, Vincent K.; Vandenberghe, Grant; Visualising Network Information; December 2006, pp. BR-1-1 - BR-1- 6; In English; See also 20080018732; Copyright; Avail.: CASI: A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

To help understand a network and its ability to continue operating when under attack, the break out group discussed issues that need to be considered when presenting network vulnerability information to an analyst, manager or commander in effective support of that person's 'observe, orient, decide, action' (OODA) loop. The break out group discussed vulnerability presentation needs common across various application domains, particularly in support of network discovery and network analysis tasks in those domains. Finally, the break out group wished to determine whether there is a means of characterizing a vulnerability. This would take into account the potential for the vulnerability to be exploited as well as the potential impact on the operations supported by the network, and on the network structure itself, of a successful exploit of that vulnerability. Author

*Network Analysis; Risk Assessment; Vulnerability; Domains; Information Systems*

**20080018740** Malardalen Univ., Eskilstuna, Sweden

**Real-Time Extraction of Course Track Networks in Confined Waters as Decision Support for Vessel Navigation in 3-D Nautical Chart**

Porathe, Thomas; Visualising Network Information; December 2006, pp. 7-1 - 7-6; In English; See also 20080018732; Original contains color and black and white illustrations

Report No.(s): Paper 7; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In an information design project at Malardalen University in Sweden a computer based 3-D nautical chart system is designed based on human factors principles of more intuitive navigation in high speeds. In this project dynamic NoGo area polygons is generated based on the draught of the individual ship and the current water level and by doing so space is divided into free and forbidden areas. Based on this an automatic wayfinding method is presented in this paper that will allow vessels to enter a goal position and have the system display a path through free water to the goal based on different parameters such as shortest route, most weather sheltered route or route most sheltered from radar detection.

Author

*Radar Detection; Human Factors Engineering; Confinement; Navigation; Real Time Operation; Nautical Charts; Extraction*

**20080018741** EADS Deutschland G.m.b.H, Ulm, Germany

**Information Fusion and Visualisation in Anti Asymmetric Warfare**

Opitz, Felix; Trapp, Thilo; Daestner, Kaeye; Kausch, Thomas; Visualising Network Information; December 2006, pp. 15-1 - 15-16; In English; See also 20080018732; Original contains color and black and white illustrations

Report No.(s): Paper15; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Information fusion is a key factor for insuring information superiority in various military and civil surveillance systems. These may be found in combat management, ground based air defence or in coastal surveillance systems addressing more civil areas. A new aspect in all these applications is the issue of new types of threats, e. g. anti asymmetric warfare and low intensity conflicts. Consideration of these new types of asymmetric threats leads to new requirements and very new concepts for design, implementation and integration of the information fusion and visualisation process. Also the usage of network information on different abstraction levels and its visualisation becomes an essential issue in anti asymmetric warfare. This paper presents some of the aspects and concepts related to information fusion and its visualisation within the mentioned systems realizing anti asymmetric warfare aspects.

Author

*Information Systems; Warfare; Asymmetry; Management Systems; Surveillance; Air Defense*

**20080018742** Taylor (Martin) Consulting, Toronto, Ontario, Canada

**Framework-Survey Integration Group Report**

Taylor, M. Martin; Vanderbilt, Amy K. C. S.; Nixon, Mark R.; Zeltzer, David; Bouchard, Alain; Visualising Network Information; December 2006, pp. BR-FG-1 - BR-FG-4; In English; See also 20080018732; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The framework and survey have been independently generated within the RTG. To bring them together is an ongoing

project. The objective of the working group was to converge them so that the framework could be used to determine the effectiveness of the applications in the survey for various user purposes. The group worked mainly on the framework to further develop it in terms useful towards integration with the survey.
Author
*Display Devices; Thermoelectric Generators; Radioisotope Batteries*

**20080018743** Pennsylvania State Univ., USA
**Report of Break-Out Group 3: Reliability and Uncertainty in Situational Awareness**
Hall, David; Kamp, Vera; Hussain, Akbar; Kesavadas, T.; Johansen, Tom; Visualising Network Information; December 2006, pp. BR-3-1 - BR-3-6; In English; See also 20080018732; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The motivation behind our discussion and analysis focused on understanding the realities of current political, strategic, operational and tactical environments. Current operations involve an increasingly rapid tempo, involving short decision cycles and high stress. There is an increased link between the units in which political considerations affect strategy, operations and tactics on a short term basis. While there are fewer tactical units, these units have increased fire power. Hence the activities of an individual tactical unit can have a greater impact at tactical, strategic and political arenas (in a negative and positive way). This is made possible due to increased communications capacity (both bandwidth and connectivity). Thus, network centricity is a double-edged sword.
Author
*Situational Awareness; Motivation; Bandwidth; Tactics; Fires*

**20080018744** Defence Research and Development Canada, Val-Belair, Quebec, Canada
**Characterisation and Showcasing of Network Visualisation Approaches for Command and Control**
Bouchard, Alain; Vernik, Rudi; Visualising Network Information; December 2006, pp. 4-1 - 4-16; In English; See also 20080018732; Original contains color illustrations
Report No.(s): Paper 4; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Network Visualisation technologies are becoming more relevant in Command and Control environments to help cope with the increased complexity of defence operations. A significant number of Network Visualisation technologies are currently available so the choice of a particular approach to support specific C2 tasks can be difficult. This paper describes an approach for characterising Network Visualisation tools in terms of domains of use, what they describe and how they present information using a reference model for visualisation. The paper also introduces a novel distributed system, named Imago, which supports the characterisation, discovery, showcasing, and evaluation of Information Visualisation approaches. We argue that the methods proposed in this paper could aid the process of selecting and deploying Network Visualisation tools for Command and Control activities.
Author
*Command and Control; Characterization; Deployment*

**20080018745** Norwegian Defence Research Establishment, Horten, Norway
**Reduction of Complexity: An Aspect of Network Visualization**
Bjorke, Jan Terje; Visualising Network Information; December 2006, pp. 9-1 - 9-10; In English; See also 20080018732; Original contains color illustrations
Report No.(s): Paper 9; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Networks are topological structures composed of nodes and arcs. Often, networks are visualized by point symbols and lines illustrating the nodes and the arcs, respectively. As the number of the nodes and links increases, the visual representation of the network needs generalization in order to keep the visual clarity of the image. To solve the problem considered, a methodology to aggregate nodes and links into hypernodes and hyper-links is developed. The algorithm, which is based on an information theoretic approach to reorder the adjacency matrix of the network, can generate hierarchies of hyper-networks. This kind of generalization algorithm can be used to construct images which visualize the main structures of the network. Some case studies demonstrate the algorithm.
Author
*Information Theory; Algorithms; Network Analysis; Aggregates*

**20080018746** QinetiQ Ltd., Malvern, UK

**Applications of Network Visualisation in Infectious Disease Management**

Varga, Margaret; Jacobson, Zack; Visualising Network Information; December 2006, pp. 12-1 - 12-6; In English; See also 20080018732

Report No.(s): Paper 12; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The SARS outbreak during the spring of 2003 showed that any new cases can trigger rapid community and non-social cluster transmission of SARS-CoV. This created substantial health, social and economic consequences. Improved outbreak management requires that identification of such diseases must trigger an immediate public health response. Rapid detection and management of infectious diseases such as SARS and their contacts together with the prompt implementation of the appropriate control measures can arrest and contain the transmission and spread of disease. Given the likelihood and observed frequency of outbreaks of infectious diseases, there is a need to be able to detect, manage and control the disease transmission as early as possible and thus minimise the impact of the outbreaks. Effective public health surveillance can act as an early warning system by detecting microbial, environmental, behavioural, occupational, and other health threats. It can also concentrate resources, focus interventions and facilitate planning. The issues and technological solutions for infectious disease management are also applicable to Chemical, Biological, Radiological and Nuclear (CBRN) threat domains as these all share many common factors. This paper aims to discuss the use of and need for visualising the network of interconnected information for situation awareness to assist in taking effective control measures during infectious disease outbreaks.

Author

*Infectious Diseases; Early Warning Systems; Detection; Radiology; Public Health; Surveillance*

**20080018747** Applied Research and Analysis Directorate, Ottawa, Ontario, Canada

**Modeling Influenza Pandemic Response Effectiveness in Canada**

Jacobson, Zack; Houston, Ben; Visualising Network Information; December 2006, pp. 13-1 - 13-6; In English; See also 20080018732; Original contains color illustrations

Report No.(s): Paper 13; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As the risk of a global influenza pandemic increases there is growing response preparedness efforts within Canada. One question that governmental decision makers have in this context is what is the most effective distribution of anti-virals, such as oral oseltamivir, within the population of first responders, health care workers, administrators and the general public in addition to what extent should the anti-virals be used as prophylactics. To provide an answer to this question, we have developed a Canada-wide influenza pandemic simulator and visualization system that allows for the modeling of various patterns of anti-viral distribution and use.

Author

*Influenza; Antiinfectives and Antibacterials; Risk; Viruses; Health; Drugs*

**20080018748** Aalborg Univ., Aalborg, Denmark

**Investigative Data Mining Toolkit: A Software Prototype for Visualizing, Analyzing and Destabilizing Terrorist Networks**

Memon, Nasrullah; Larsen, Henrik Legind; Visualising Network Information; December 2006, pp. 14-1 - 14-24; In English; See also 20080018732; Original contains color illustrations

Report No.(s): Paper 14; Copyright; Avail.: CASI: A04, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Knowledge about the structure and organization of terrorist networks is important for both terrorism investigation and the development of effective strategies to prevent terrorists attacks. However, except for network visualization, terrorist network analysis remains primarily a manual process. Existing tools do not provide advanced structural analysis techniques that allow extraction of network knowledge from large volumes of criminal-justice data. It is a well known fact that terrorist activities consist of dispersed organizations (like non-hierarchical organizations), small groups, and individuals who communicate, coordinate and conduct their campaign in a network-like manner. There is a pressing need to automatically collect data of terrorist networks, analyze such networks to find hidden relations and groups, prune datasets to locate regions of interest, find key players, characterize the structure, trace point of vulnerability, and detect efficiency of the network. To meet this challenge, we designed and developed a knowledgebase for storing and manipulating data collected from various authenticated websites. This paper presents framework of investigative data mining toolkit, our recently introduced techniques and algorithms (which are implemented in the investigative data mining toolkit) could be useful for law enforcement agencies that need to analyze

terrorist networks and prioritize their targets. Applying recently introduced algorithms for constructing hidden hierarchy of non-hierarchical terrorist networks, we present case studies of the terrorist attacks that occurred in past, in order to construct command structure of the networks.
Author
*Data Mining; Network Analysis; Algorithms; Extraction; Law (Jurisprudence); Organizations; Prototypes; Structural Analysis*

**20080018749** Land Force Doctrine and Training System Headquarters, Kingston, Ontario, Canada
**Report of Break-Out Group 4: Situation Awareness**
Horeczy, Christopher A.; Lem, Marcus; McMullen, Sonya; Porathe, Thomas; Stamm, Joachim; Varga, Margaret; Visualising Network Information; December 2006, pp. BR-4-1 - BR-4-4; In English; See also 20080018732; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A critical aspect of situation awareness is the level of abstraction of the objects and contents, which are displayed and analysed with a visualisation tool. To get a clear picture of the situation around you do not have to see everything that has been detected/known, but only information that is relevant to your needs. As a simple example a coloured map indicating the terrain including streets and houses is useful in a tactical display, where you have to find a fast and safe way through a city. Possible enemy can be displayed as coloured dots. On the other hand when you want to display enemy positions with complex coloured symbols together with additional information about the strength, type and tactical role, a uncolored map is likely the better solution because it reduces the complexity. Therefore, it is quite obvious that different levels of abstraction of the information must be available for the user to 'zoom' in to view different information domains. This is well known for map applications where more detail shows up when you zoom in more and more (capitals, large cities, all cities, villages etc.). It is possible for other types of information to be visualized/handled similarly for network and data analysis. A good example was given during this workshop in the presentation 'Reduction of complexity: an aspect of network visualization' (Prof. Jan Terje Bj rke, Norwegian Defence Research Establishment, NOR). Here different levels of abstraction of a complex network were seen after every iteration of combining single nodes into hypernodes. With this form of abstraction one could start a situation report with a very abstract level, i.e. compressed data (showing only hypernodes in the presentation mentioned above). The ability to drill down to detailed information must be provided. With such an approach we assume that a higher level of compression is appropriate for experienced users whereas a lower level of abstraction is more convenient for less experienced users. To make sure that the user is not overwhelmed with too much information, one must be able to switch on and off different layers of information as required.
Author
*Situational Awareness; Network Analysis; Data Compression; Domains; Images; Iteration*

**20080018750** Health Canada, Canada
**Epidemiologic Considerations in Network Modeling of Theoretical Disease Events**
Lem, Marcus; Visualising Network Information; December 2006, pp. 11-1 - 11-6; In English; See also 20080018732; Original contains color illustrations
Report No.(s): Paper 11; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Social network modeling is a relatively new addition to the armament of public health and epidemiology. Epidemiologists and communicable disease control researchers have been turning to network analysis to address and understand gaps in traditional outbreak management techniques such as contact tracing. Network analysis has shown utility in the study of a range of communicable disease outbreaks affecting both health and commerce, including SARS, tuberculosis, syphilis and foot-and mouth-disease, and may have applications in automated disease surveillance systems. Visualization of these communicable disease networks is an integral component of such analysis. However, visualization of more complex relationships will require consideration of a variety of epidemiologic factors which affect these relationships, and the development of techniques to display them. Any analysis of case level health data has the potential for compromising privacy, and network visualization is no exception. Like other analysis tools such as data mining, or Geographic Information Systems (GIS), network visualization will need to incorporate techniques to ensure confidentiality. In this paper we shall discuss the role of network analysis in communicable disease outbreak control, epidemiologic considerations in visualizing networks, and the emerging issue of confidentiality.
Author
*Epidemiology; Network Analysis; Data Mining; Automatic Control; Geographic Information Systems; Public Health; Infectious Diseases; Management Methods*

**20080018751** State Univ. of New York, Buffalo, NY, USA

**Runtime Simulation for Post-Disaster Data Fusion Visualization**

Kesavadas, Thenkurussi; Visualising Network Information; December 2006, pp. 16-1 - 16-14; In English; See also 20080018732; Original contains color and black and white illustrations

Report No.(s): Paper 16; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

With regard to the threats of recent natural and man-made disasters, it is important for a control center to be aware of the situation and be able to assess the threat. However, simulating a large amount of post-disaster fused data is a complicated task, and its visualization is even more difficult to achieve with the paradigm of common geo-referencing systems. We have developed a post-disaster monitoring interface that runs in a fusion-based simulation with High Level Architecture/Run Time Infrastructure (HLA/RTI). In our visualization system, damage and recovering activities are presented in a fast GIS vector map with convenient data and display manipulation. All data that comes from the data fusion federates is displayed at run-time and stored for further analysis. In addition, the pattern of time-aggregated data has enabled dynamic visualization, which includes the morphing of the casualty clusters. This feature provides an effective way to keep track of a region so that a user can easily be aware of the emerging trends. A unique approach to multiple views by the integration of 2D and 3D displays of the fused data is also described.

Author

*Disasters; Simulation; Real Time Operation; Situational Awareness; Multisensor Fusion; Systems Engineering; Systems Integration*

**20080018752** Carnegie-Mellon Univ., Pittsburgh, PA, USA

**A Dynamic Network Approach to the Assessment of Terrorist Groups and the Impact of Alternative Courses of Action**

Carley, Kathleen M.; Visualising Network Information; December 2006, pp. KN1-1 - KN1-10; In English; See also 20080018732; Original contains color illustrations

Report No.(s): Keynote 1; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dynamic network analysis (DNA) is an emergent field centered on the collection, analysis, understanding and prediction of dynamic relations among various entities such as actors, events and resources and the impact of such dynamics on individual and group behaviour. DNA facilitates reasoning about terrorist groups as complex dynamic networked systems that evolve over time. An interoperable DNA toolchain for collecting data on, assessing the network of, and forecasting changes in that network is presented. The use of these DNA tools to asses a terrorist group is then demonstrated using open source data. Key techniques are demonstrated using a dataset collected on terror networks. Techniques demonstrated include those for identification of an actor s sphere of influence, emergent leaders, and paths among critical actors, and metrics for assessing the potential immediate and near term impact of various courses of action.

Author

*Network Analysis; Deoxyribonucleic Acid; Computer Networks; Data Acquisition; Complex Systems*

**20080018753** Pennsylvania State Univ., University Park, PA, USA

**A Three Pronged Approach for Improved Data Understanding: 3-D Visualization, Use of Gaming Techniques, and Intelligent Advisory Agents**

Hall, David L.; McNeese, Michael; Yen, John; Seif El-Nasr, Magy; Visualising Network Information; December 2006, pp. 8-1 - 8-12; In English; See also 20080018732; Original contains color illustrations

Report No.(s): Paper 8; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Applications of multi-sensor fusion span a variety of domains from crisis management, military tactical situation and treat assessment, environmental monitoring, and more recently, monitoring of information systems. Rapid advances in data collection and dissemination provide the opportunity for major improvements in the information gathering aspect. However, a fundamental paradox exists in the understanding side. The paradox is that information analysts are drowning in a sea of data but unable to obtain the knowledge that they need to address difficult problems. This has often been referred to as the data overload dilemma or more recently framed ‘cogmenutia fragmentosa . On one hand, an unprecedented capability exists to collect data via distributed sensors, commercial information providers, human sources, or Internet resources. Smart micro-scale sensors, wireless communications, and global Internet accessible resources enable the entire earth to be a potential information resource. Such information is available literally at the fingertips of the analysts. However, the wealth of data has not produced a commensurate improvement in analyst abilities. Analysts are literally swamped with data. They have a wide

variety of choices to make as to what is useful and usable, given the context of what they are trying to understand. This paper describes a three-pronged approach to improve information understanding including; (1) use of 3-D visualization and interaction techniques, (2) role-playing gaming (RPG) concepts, and (3) use of team-based intelligent advisory agents (cyber-advisors). The environment promotes rapid development and evaluation of hypotheses regarding evolving complex situations in an environment in which enormous amounts of data and information are available, but for which there is no clear mapping between observables and underlying threat conditions or activities. Use of advanced visualization techniques and gaming concepts assist in focusing the analysts attention and promotes an interactive, creative analysis process in which hypotheses are formulated, evaluated, criticized, modified, and changed. The use of gaming techniques leverages the skills of new analysts, already experienced in gaming technologies.
Author
*Data Acquisition; Internet Resources; Domains; Scientific Visualization; Multisensor Fusion; Management Methods; Wireless Communication; Information Systems*

**20080018754** PLATH Gmbh, Hamburg, Germany
**KDD - Overcoming Massive Data Streams for Intelligence Tasks**
Kamp, Vera; Visualising Network Information; December 2006, pp. 2-1 - 2-4; In English; See also 20080018732; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Actually very interesting IT systems promise to reveal connections between apparently harmless and unrelated information pieces. An article from the New York Times in February 2006 makes clear that common data mining techniques were not successful in general. Despite huge investments, correlating data from different sources did not yield satisfactory results. Transforming low-level data by aggregation to meaningful events is nevertheless the key to building the basis for succeeding decisions in the context of situation reports More realistic and manageable is an approach that includes interactions with the user along with domain specific knowledge. Gaining security relevant messages should be based on an iterative multi-level process. This process represents the core element of intelligence analysis systems which play an important role for supporting decisions in management information systems. The following example illustrates the principal automated process for discovering communication structures in the context of radio reconnaissance: A crucial part of this process is the analysis and visualisation of communication structures, or more generally, of network information. This should be embedded in spatio-temporal data analysis with geo-oriented data access and the integration of domain-specific analysis functions. The intelligent analysis of radio emission data is based on data mining techniques, cluster visualizations to validate the results, a model based communication detection (including domain-specific knowledge) and the visualisation of communications. The following use case of a simple simplex communication clarifies the problems and the applied methods. Module coupling is realised by a distributed architecture. Given are a huge amount of radio emissions which are arbitrarily distributed. Each emission is described by the attributes ID, frequency, modulation type, starting time, end time, latitude and longitude. It has to be considered that the data quality of single emissions depends on propagation conditions. Because these can vary, it can happen that single emissions or attributes are missing or on the other hand different classification level information are available. Furthermore, with a broadband collection of emissions the amount of information is extremely large and requires massive data handling which can not be processed in main memory.
Author
*Management Information Systems; Data Mining; Data Integration; Data Flow Analysis; Classifications; Memory (Computers); Intelligence; Radio Emission; Frequency Modulation; Broadband*

**20080018755** Norwegian Defence Research Establishment, Norway
**Report of Break-Out Group 2: Reliability and Uncertainty in Situation Awareness of Network Visualization**
Bjorke, Jan Terje; Jacobson, Zack; McMullen, Mac J.; Memon, Nasrullah; Opitz, Felix; Rasmussen, Lisbeth M.; Visualising Network Information; December 2006, pp. BR-2-1 - BR-2-2; In English; See also 20080018732; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The problems in reliability and uncertainty in situation awareness of network visualization can be divided into two: (1) Reliability/Validity of the presented Network (2) Uncertainty of Network Representation.
Derived from text
*Reliability; Situational Awareness; Network Analysis*

## 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*.

**20080018117** Tennessee Technological Univ., Cookeville, TN USA
**Time-Reversal Based Range Extension Technique for Ultra-Wideband (UWB) Sensors and Applications in Tactical Communications and Networking**
Qiu, Robert C; Guo, Nan; Zhang, Qiang; Zhou, Chenming; Hu, Zhen; Zhang, Peng; Singh, Dalwinder; Cooke, Corey; Jan 16, 2008; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-07-1-0529
Report No.(s): AD-A476477; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476477

This technical report (quarterly) details the work for Office of Naval Research (ONR) by Tennessee Tech. The goal of this project-jointly funded by ONR, NSF, and ARO-is to build a general purpose testbed with time reversal capability at the transmitter side. The envisioned application is for UWB sensors and tactical communications in RF harsh environments where multipath is rich and can be exploited through the use of time reversal. The report summarizes the results for each of two major tasks: theoretical research and experimental testbed.
DTIC
*Analog to Digital Converters; Broadband; Radio Waves; Test Stands*

## 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.

**20080018105** Air Univ. Press, Maxwell AFB, AL USA
**The Instruments of Power: A Computer-Assisted Game for the ACSC Curriculum**
Anderson, Lynn P; Apr 2005; 61 pp.; In English
Report No.(s): AD-A476437; AU/ACSC/STUDENT9731-4280/2004-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476437

The ACSC curriculum could benefit from the addition of wargaming that focuses on teaching students about the employment of the national instruments of power 'IOPs'. Wargames and exercises addressing the relationships among the IOPs are available from both Government and commercial sources; however, they are often complex, resource intensive, time consuming to play, and/or not well suited for use on the scale required for all ACSC students to participate. As a result, they may not fit well within a time-constrained curriculum. Creating a game to fill this need is the purpose of this joint research project. This paper examines the need for strategic-level wargaming at ACSC, proposes requirements for a game to satisfy this need, and describes the game's software design. In a companion paper, LCDR Brian Tolbert, USN, addresses development of the game's rules, the political/military principles upon which they are based, play testing of the game, and recommendations for future game enhancements. By creating and testing the prototype, the overall feasibility of the concept can be evaluated without a costly and labor-intensive software development effort. Future versions could either directly build upon this work or be expanded into a professionally developed software suite.
DTIC
*Computer Programs; Computer Techniques; Education; Game Theory*

**20080018106** National Oceanic and Atmospheric Administration, Seattle, WA USA
**Development and Support for the USGODAE Server**
Clancy, Mike; Hankin, Steve; Jan 2006; 6 pp.; In English
Contract(s)/Grant(s): N00014-03-WR-20192
Report No.(s): AD-A476444; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476444

The U.S. Global Ocean Data Assimilation Experiment (USGODAE) Monterey Data Server is envisioned as the hub for

U.S. and international GODAE projects. To meet this goal, the data server must fulfill three major roles. First, the server must act as a data server, providing reliable access to observational data and surface forcing fields to drive GODAE ocean models. Second, the server must be part of a framework to access and compare ocean model or demonstration product output so that researchers can compare, analyze, and validate ocean models. Finally, the server must have well-organized, easily accessible documentation to simplify data usage, and provide details for the many GODAE and U.S. GODAE projects. The USGODAE Monterey Data Server should eventually become the first stop for users seeking U.S. GODAE data, documentation, or model output. Through USGODAE, users will be able to locate data and documentation hosted both on and off the server. The Asia Pacific Data Research Center (APDRC), which is hosted by the International Pacific Research Center (IPRC) at the University of Hawaii, will function as a companion data center in support of GODAE climate forecasts. Over time, the two servers will be configured to appear as a single virtual data service for GODAE users. GODAE provides the context for bringing existing ocean data assimilation developments and applications together to accelerate improvements to models and the transition to the operational environment. Ready access to quality-controlled observations is necessary to achieve this. The USGODAE Monterey Data Server is designed to satisfy this requirement, and at the same time to promote interactions between observers and data assimilators and between different assimilation groups. These interactions are needed to share and extend the knowledge base that will lead to improved operational ocean models and products.
DTIC
*Assimilation; Client Server Systems; Data Processing; Multisensor Fusion; Ocean Models; Oceanographic Parameters; Oceans; Project Management; United States*

**20080018110** Maryland Univ., College Park, MD USA
**UM-Translog-2: A Planning Domain Designed for AIPS-2002**
Wu, Dan; Nau, Dana; Sep 18, 2002; 19 pp.; In English
Contract(s)/Grant(s): F30602-00-2-0505; DAAL0197K0135
Report No.(s): AD-A476451; UM-CS-TR-4402; UMIACS-TR-2002-82; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476451
This document describes UM-Translog-2, which is an extended version of the UM Translog planning domain. The extensions include some numerical-computation features to make the domain a more realistic model of transportation-logistics problems. We are proposing UM-Translog-2 as a candidate domain for AIPS-2002 planning competition.
DTIC
*Artificial Intelligence; Planning*

**20080018123** NATO Consultation, Command, and Control Agency, Brussels, Belgium
**Modelling & Simulation Support to the Effects Based Approach to Operations - Observations from Using GAMMA in MNE 4**
Dompke, Uwe; Sep 1, 2006; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476497; X5-NATO/C3/NL; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476497
No abstract available
*Computer Programs; Computerized Simulation; Military Operations; Planning; Simulation*

**20080018132** USA Joint Forces Command, Norfolk, VA USA
**The Joint Live Virtual Constructive Data Translator Framework - Interoperability for a Seamless Joint Training Environment**
Bizub, Warren; Bryan, Derek; Harvey, Edward; Sep 1, 2006; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476516; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476516
No abstract available
*Education; Interoperability; Military Operations; Protocol (Computers); Training Devices*

**20080018142** Norwegian Defence Research Establishment, Kjeller, Norway

**JADE - An Experimenting in Distributed Simulation Based Joint Tactical Training**

Mevassvik, Ole M; Brathen, Karsten; Gustavsen, Richard M; Sep 1, 2006; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476531; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476531

No abstract available

*Air Defense; Distributed Interactive Simulation; Education; Experimentation; Military Operations; Simulation; Training Devices; Warfare*

**20080018181** Naval Postgraduate School, Monterey, CA USA

**NMCI: History, Implementation, and Change**

Taylor, Gregory S; Sep 1, 2006; 201 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476617; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476617

In October of 2000, the Navy's leadership entered a multi-billion dollar IT service contract with a private company to build and maintain the Navy-Marine Corps Intranet (NMCI). The hope was to have the new intranet fully operational in just two years, but the program encountered so many difficulties that, almost six years later, the initial implementation process is still underway. Aside from the unexpectedly high number of applications that needed to be migrated to the new network and the repeated attacks by members of Congress and other government agencies, by far the largest obstacle to NMCI s success has been the end users resistance to change. The Navy s leaders underestimated the significant cultural change brought on by the implementation of NMCI, and as a result, they were not adequately prepared to deal with the negative user response. After providing a historical account on how NMCI was conceived, planned and delivered, this thesis goes deeper into NMCI s implementation process by recounting the experiences of those who used NMCI at the site level. Once the history and site case study are presented, this thesis ties in the theme of change to show how proper communication can facilitate the success of future transformation initiatives.

DTIC

*Leadership; Networks; User Requirements*

**20080018254** Army Research Lab., White Sands Missile Range, NM USA

**Sensor Performance Evaluation for Battlefield Environments (SPEBE) C++ Application Programming Interface (API) Version 1.0**

Marlin, David; Thomas, Shane; Jan 2008; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476685; ARL-TR-4363; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476685

In this report, a C++ library based on a compiled version of the Matlab-based Sensor Performance Evaluator for Battlefield Environments (SPEBE) is described. The library encapsulates the details of the Matlab infrastructure, including m-files and mxArray manipulation functions, so that the programmer can concentrate on the use of SPEBE rather than the details of compiled Matlab code. The high-level architecture of SPEBE is duplicated in the C++ class hierarchy, providing the programmer with classes that represent the functional grouping of data and computations found in SPEBE. These high-level classes are derived from low-level classes, which encapsulate the mxArrays and invoke the compiled m-files. Thus, the high-level classes are insensitive to changes in the compiled Matlab code resulting from Matlab revisions, while the low-level classes provide basic compiled Matlab functionality without regard to the overall SPEBE architecture. This greatly simplifies maintenance of the library in response to changes in either Matlab or SPEBE.

DTIC

*Application Programming Interface; C++ (Programming Language); Evaluation; Performance Tests*

**20080018264** Stottler Henke Associates, Inc., San Mateo, CA USA

**An Experimental Testbed for Tactical Command and Control**

Davis, Alex; Fu, Dan; Sarnacki, Alexander; Rushing, John; Jun 30, 2007; 11 pp.; In English

Report No.(s): AD-A476712; SHA-TR2007-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476712

Recent concepts in the field of command and control 'C2', such as Power to the Edge and Network-Centric Warfare, have

indicated the need for a testbed for experimentation. We describe a gaming testbed, populated by realistic synthetic agents, for modeling the complex human interactions comprising C2 structures, and for exploring the effectiveness of C2 concepts in a variety of tactical circumstances. A testbed for experimentation with C2 concepts must be capable of reproducing the complex, rapid, dynamic, and unpredictable unfolding of events in battle. Scenarios can be carefully limited, and realism diluted to a practical level, but enough of the complex interactions of individual and collective behavior must be preserved to capture the essentially human nature of C2. Experimentation involves the correlation of tactical events and outcomes with a host of variable parameters, such as C2 structure communication patterns and reliability, and implementation of commander's intent. This report describes the details of our testbed and experiment design and implementation, in addition to findings and lessons learned. Our approach included the integration and extension of three existing platforms: Counter-Strike, a multiplayer first-person tactical shooter; SimBionic, a visual behavior authoring and execution engine developed at Stottler Henke; and ADaM, a data mining tool suite developed at the University of Alabama, Huntsville. The testbed produced by this integration allows for the planning and execution of missions by human or synthetic agents, including specifications of different C2 structures, and the mining of experimental data for the effectiveness of the C2 concepts. We discuss the applicability of our findings to other echelons, as well as its contribution to the evaluation of new C2 concepts. DTIC

*Command and Control; Test Stands*

**20080018282** Naval Postgraduate School, Monterey, CA USA

**Learning Management Systems: Practical Considerations for the Selection and Implementation of an E-learning Platform for the Navy**

Kamel, Magdi N; Jan 28, 2007; 51 pp.; In English

Report No.(s): AD-A476768; NPS-GSBPP-08-011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476768

A key element of the Navy's Manpower Personnel Training and Education (MPT&E) mission is to recruit, develop, manage and deploy a workforce in an agile cost-effective manner. In order to accomplish its mission MPT&E strives to provide the right sailor with the right skill sets in the right job at the right time and to manage his/her career path in support of warfighting capabilities. To support this objective some form of automated learning management system or virtual learning environment is needed. A learning management system (or LMS) is a software application that enables the delivery and management of online content to learners.

DTIC

*Computer Programs; Education; Navy; Personnel Development*

**20080018299** Carnegie-Mellon Univ., Pittsburgh, PA USA

**From Indexed Lax Logic to Intuitionistic Logic**

Garg, Deepak; Tschantz, Michael C; Jan 7, 2008; 37 pp.; In English

Contract(s)/Grant(s): FA8750-07-2-0028; DAAD19-02-1-0389

Report No.(s): AD-A476798; CMU-CU-07-167; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476798

We present translations from a logic with indexed lax modalities to first-order intuitionistic logic and intuitionistic linear logic. These translations rely on a continuation passing style encoding for the lax modalities. We show that our translations preserve provability of formulas.

DTIC

*Computers; Logic Design*

**20080018306** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Coordinated Sampling: An Efficient, Network-Wide Approach for Flow Monitoring**

Sekar, Vyas; Reiter, Michael K; Willinger, Walter; Zhang, Hui; Jul 16, 2007; 30 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0389; CNS-0433540

Report No.(s): AD-A476823; CMU-CS-07-139; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476823

We present Coordinated Sampling, a new technique for improved flow-level monitoring. Our approach derives from three key design decisions: flow sampling instead of uniform packet sampling; hash-based flow selection to achieve coordination between routers without needing explicit communication channels; and an approach for distributing responsibilities across

routers to achieve network-wide monitoring objectives while taking into account resource constraints on each router. We demonstrate that Coordinated Sampling presents an attractive solution for ISPs. First, it more than doubles flow coverage to support security applications and does so without compromising the accuracy of traditional traffic engineering applications. Second, it enables network operators to directly specify and achieve fine-grained network-wide monitoring objectives. Third, it naturally load balances monitoring responsibilities across routers and at the same time efficiently leverages the available capacity on each router.
DTIC
*Sampling; Telecommunication; Wide Area Networks*

**20080018315** Carnegie-Mellon Univ., Pittsburgh, PA USA
**Checking and Measuring the Architectural Structural Conformance of Object-Oriented Systems**
Abi-Antoun, Marwan; Aldrich, Jonathan; Dec 2007; 52 pp.; In English
Report No.(s): AD-A476847; CMU-ISRI-07-119; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476847

The benefits of architectural analyses are only achieved if one can guarantee that the implementation conforms to the architecture. We propose an approach for checking and measuring the structural conformance of a software system's implementation to its execution architecture. In contrast to existing approaches, our approach uses static analyses, and works with existing Java-like programming languages, existing object-oriented designs and existing integrated development environments. We address the problem with a multi-pronged approach, as follows: 'a' express and enforce architectural intent related to object encapsulation and communication directly in code using ownership domain annotations; 'b' extract a sound execution architecture from the annotated program semi-automatically; and 'c' compare the as-built extracted architecture to the as-designed architecture semi-automatically; and 'd' obtain a measure of conformance. We present an initial evaluation of the approach on two extended examples. In both cases, we extract as- built execution architectures that convey meaningful abstractions, convert them into standard component-and-connector architectures, and obtain measures of conformance between the as-designed and the as-built architectures that seem consistent with our intuition.
DTIC
*Computer Programming; Object-Oriented Programming; Software Engineering*

**20080018540** Carnegie-Mellon Univ., Pittsburgh, PA USA
**A Formal Model for a System's Attack Surface**
Manadhata, Pratysua K; Kaynar, Dilsun K; Wing, Jeannette M; Jul 2007; 22 pp.; In English
Contract(s)/Grant(s): DAAD19-02-1-0389
Report No.(s): AD-A476799; CMS-CS-07-144; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476799

Practical software security metrics and measurements are essential to the development of secure software [18]. In this paper, we propose to use a software system's attack surface measurement as an indicator of the system's security; the larger the attack surface, the more insecure the system. We formalize the notion of a system's attack surface using an I/O automata model of the system [15] and define a quantitative measure of the attack surface in terms of three kinds of resources used in attacks on the system: methods, channels, and data. We demonstrate the feasibility of our approach by measuring the attack surfaces of two open source FTP daemons and two IMAP servers. Software developers can use our attack surface measurement method in the software development process and software consumers can use the method in their decision making process.
DTIC
*Computer Information Security; Computer Systems Programs; Software Engineering*

**20080018567** Nebraska Univ., Lincoln, NE, USA
**Lossless Video Sequence Compression Using Adaptive Prediction**
Li, Ying; Sayood, Khalid; IEEE Transactions on Image Processing; April 2007; Volume 16, No. 4, pp. 997-1007; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNG06GH64G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1109/TIP.2006.891336

We present an adaptive lossless video compression algorithm based on predictive coding. The proposed algorithm exploits temporal, spatial, and spectral redundancies in a backward adaptive fashion with extremely low side information. The

computational complexity is further reduced by using a caching strategy. We also study the relationship between the operational domain for the coder (wavelet or spatial) and the amount of temporal and spatial redundancy in the sequence being encoded. Experimental results show that the proposed scheme provides significant improvements in compression efficiencies. Author

*Algorithms; Video Compression; Coding; Pixels; Lossless Materials*

**20080018681** Carnegie-Mellon Univ., Pittsburgh, PA USA

**An Approach to Measuring a System's Attack Surface**

Manadhata, Pratyusa K; Tan, Kymie M; Maxion, Roy A; Wing, Jeannette M; Aug 2007; 30 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0389

Report No.(s): AD-A476805; CMU-CS-07-146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476805

Practical software security measurements and metrics are critical to the improvement of software security. We propose a metric to determine whether one software system is more secure than another similar system with respect to their attack surface. We use a system's attack surface measurement as an indicator of the system's security; the larger the attack surface, the more insecure the system. We measure a system's attack surface in terms of three kinds of resources used in attacks on the system: methods, channels, and data. We demonstrate the use of our attack surface metric by measuring the attack surfaces of two open source IMAP servers and two FTP daemons. We validated the attack surface metric by conducting an expert user survey and by performing statistical analysis of Microsoft Security Bulletins. Our metric can be used as a tool by software developers in the software development process and by software consumers in their decision making process.

DTIC

*Computer Security; Computer Programs; Software Development Tools; Computer Programming; Software Engineering*

**20080018767** Army Research Lab., Aberdeen Proving Ground, MD USA

**Mstack: A Lightweight Cross-Platform Benchmark for Evaluating Co-Processing Technologies**

Pellegrini, Mark; Pressel, Daniel M; Dec 2007; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-8UH3CC

Report No.(s): AD-A476689; ARL-MR-0683; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476689

Co-processing technologies are currently increasing in performance at a rate superior to Moore s law, making porting applications to them desirable. However, with so many different competing co-processing technologies, the need for a simple, lightweight cross-platform benchmark has become apparent. To fill this need, we have devised Mstack, a lightweight benchmark designed to be run on a number of different classes of co-processors. We have implemented or are in the process of implementing Mstack on a variety of different co-processor architectures: on field programmable gate arrays (FPGAs) using Mitrion-C and Dime C, graphical processing

DTIC

*Computer Programming; Field-Programmable Gate Arrays*

**20080018908** Computational Tools, Inc., Gurnee, IL USA

**Reliability Demonstration for an Eddy Current NDE Technique Using A Computational Electromagnetic Model-Assisted Approach (Postprint)**

Aldrin, John C; Knopp, Jeremy; Lindgren, Eric; Annis, Charles; Sabbagh, Harold A; Sabbagh, Elias H; Murphy, R K; Dec 2006; 8 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A476844; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476844

Reliability studies in terms of probability of detection (POD) evaluation are a critical component of nondestructive evaluation (NDE) inspection system validation. POD studies provide engineers with data on the reliability of detecting cracks across a distribution of sizes that can be used as an input to probabilistic risk assessment analysis. Traditional POD evaluation methodologies are entirely empirical. In most cases, the cost of manufacturing the number of samples required for a traditional POD study is prohibitive and may delay or prevent a new inspection procedure or new technology from being implemented. A new strategy for the design and execution of POD studies has been discussed using a model-assisted POD (MAPOD) approach. A demonstration study is presented for a class of aerospace structural inspection problems and considers the use of

computational electromagnetic models and new statistical analysis methods in the POD evaluation. The volume integral method was successfully used to simulate eddy current measurements for varying crack length around fastener holes in a two-layer aluminum structure. Good agreement was achieved between experimental and full model assisted (FMA) approaches.
DTIC
*Eddy Currents; Electromagnetic Radiation; Nondestructive Tests; Reliability*

**20080018912** Air Force Research Lab., Rome, NY USA
**High Performance Computing (HPC) for Real-Time Course of Action (COA) Analysis**
Gilmour, Duane A; McKeever, William E; Jan 2008; 72 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-RTCO
Report No.(s): AD-A476858; AFRL-RI-RS-TR-2007-273; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476858

The focus of this research project was to develop and demonstrate proof of concept technologies to assist decision makers in assessing friendly effects-based Course of Actions (COAs) against an intelligent adversary in an operational-level simulation environment, faster than real-time. The R&D activities included multiple components: a simulation test bed; a scalable, flexible simulation framework; automated scenario generation techniques with dynamic update; intelligent adversarial behavior modeling; effects-based/attrition-based behavior modeling; and real-time analysis technology for comparing and grading effectiveness of alternative simulations. The following highlights the in-house accomplishments: developed an effects-based center of gravity (COG) modeling capability and an in-house COA simulation test bed capable of simulating direct, indirect, cumulative, cascading and recovery events. The following complimentary capabilities were also developed under extramural research projects: semiautomated scenario generation that produced COAs in minutes/hours vs days, simulation cloning on HPCs for parallel COA evaluation, dynamic COA analysis incorporating an unscripted adversary, and COA simulation comparisons produced in seconds vs hours.
DTIC
*Real Time Operation; Simulation; War Games*

## 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.

**20080018130** USA Joint Forces Command, Norfolk, VA USA
**Using the Multinational Experiment 4 (MNE4) Modeling and Simulation Federation to Support Joint Experimentation**
Blank, Jim; Snyder, Daniel; Osen, David; Sep 1, 2006; 39 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476512; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476512

No abstract available
*Distributed Interactive Simulation; Military Operations; Simulation*

**20080018159** Old Dominion Univ., Norfolk, VA USA
**A Web-Portal Based Approach for Knowledge Networks in Support of the Pathfinder Programme**
Tolk, Andreas; Turnitsa, Charles D; Oehlund, Gunnar; Sursal, Gokay; Oct 2006; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476571; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476571

No abstract available
*Computer Programming; Computerized Simulation; North Atlantic Treaty Organization (NATO); Software Engineering*

**20080018160** Intelligent Automation Systems, Inc., Rockville, MD USA

**Instructional Design Consideration and Planning in Transforming Simulation Systems to Platform for Delivery for Instruction**

Haynes, Jacqueline; Bukai, Ohad; Pokorny, Robert; Ruess, Kevin C; Oct 2006; 57 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476572; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476572

No abstract available

*Computer Assisted Instruction; Computerized Simulation; Education; On-Line Systems; Simulation; Standardization*

**20080018300** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Improving Mobile Infrastructure for Pervasive Personal Computing**

Surie, Ajay; Nov 2007; 77 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0389; CNS-0509004

Report No.(s): AD-A476800; CMU-CS-07-163; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476800

The emergence of pervasive computing systems such as Internet Suspend/Resume has facilitated ubiquitous access to a user's personalized computing environment by layering virtual machine technology on top of distributed storage. This usage model poses several new challenges, such as establishing trust in unmanaged hardware that a user may access, and efficiently migrating virtual machine 'VM' state across low-bandwidth networks. This document describes Trust-Sniffer, a tool that reduces the security risks associated with transient use by helping a user to gain confidence in software on an untrusted machine. The root of trust is a small, user carried device such as a USB memory stick. Trust-Sniffer verifies the on-disk boot image of the target machine and incrementally expands the zone of trust by validating applications, including dynamically linked libraries, before they are executed. An application is validated by comparing its checksum to a list of known good checksums. If a binary cannot be validated, its execution is blocked. This staged approach to establishing confidence in an untrusted machine strikes a good balance between the needs of security and ease-of-use, and facilitates rapid transient use of hardware. This document also describes a solution to optimize the transfer of large amounts disk and memory state for VM migration, based on opportunistic replay of user actions. The term opportunistic means that replay need not be perfect to be useful. In contrast to other replay techniques, opportunistic replay captures user interactions with applications at the GUI level, resulting in very small replay logs that economize network utilization. Replay of user interactions on a VM at the migration target site can result in divergent VM state. Cryptographic hashing techniques are used to identify and transmit only the differences.

DTIC

*Computer Networks; Migration; Personal Computers; Security*

**20080018310** Texas Univ., Arlington, TX USA

**Cooperative Communication Mechanism and Architecture for Cross-Layer Coordination**

Nettles, Scott; Julien, Christine; Dec 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-1-0091; ARPA ORDER-AC37/00; Proj-AC37

Report No.(s): AD-A476829; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476829

This work is focused on three areas all of which are related to the overall theme of cooperation in wireless networks: the relay channel, architectures for cross-layer cooperation, and abstractions that allow developers to express complex communications requirements in dynamic wireless networks. A protocol was designed based on next hop neighborhoods or loose routing which was tested in a network simulator. A new layer for the network stack was specified that focuses on the local neighborhood of nodes and beyond the one hop focus of the link layer.

DTIC

*Communication Networks; Coordination; Wireless Communication*

**20080018322** Carnegie-Mellon Univ., Pittsburgh, PA USA

**A Language-based Approach to Specification and Enforcement of Architectural Protocols**

Bierhoff, Kevin; Aldrich, Jonathan; Han, Sangjin; Apr 2006; 33 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0389

Report No.(s): AD-A476872; CMU-ISRI-07-121; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476872

Software architecture research has proposed using protocols for specifying the interactions between components through ports. Enforcing these protocols in an implementation is difficult. This paper proposes an approach to statically reason about protocol conformance of an implementation. It leverages the architectural guarantees of the ArchJava programming language. The approach allows modular reasoning about implementations with callbacks, recursive calls, and multiple instances and uses model checking techniques to reason modularly about component composition. The approach is limited to static architectures but can handle multiple instances for component types and arbitrary nesting of components.

DTIC

*Protocol (Computers)*

**20080018323** Boeing Phantom Works, Seattle, WA USA

**Integrated Autonomous Network Management (IANM) Multi-Topology Route Manager and Analyzer**

Henderson, Thomas R; Bae, Kyle; Fang, Jin; Kushi, David M; Feb 2008; 38 pp.; In English

Contract(s)/Grant(s): N00014-05-C-0012

Report No.(s): AD-A476874; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476874

This report documents the Multi-Topology Routing (MTR) Route Manager and Analyzer (RMA) program for The Boeing Company under Office of Naval Research (ONR) Contract N00014-05-C-0012. The MTR RMA program ran from July 2005 through February 2008, and was part of a broader Integrated Autonomous Network Management (IANM) program funded by ONR and coordinated by Navy SPAWAR Systems Center, San Diego. The goal of Boeing's IANM MTR Route Manager and Analyzer (RMA) project was to explore the feasibility of exploiting Multi-Topology Routing (MTR) or similar technologies to perform load balancing and traffic engineering in Navy ADNS scenarios. In a previous ONR research effort, Boeing and Cisco Systems had studied the applicability of MTR in the context of Navy network scenarios, and Boeing had produced a Linux-based prototype of MTR-enhanced routing software for the Open Shortest Path First version 2 (OSPFv2) protocol. While the previous effort demonstrated the utility of MTR (which was later highlighted by a successful coalition Trident Warrior 2006 Sea Trial), a key missing component was an analytical tool that could assist the operator in generating robust and efficient routing configurations for larger networking topologies. Hence, Boeing proposed and ONR selected for funding the Multi-Topology Routing Route Manager and Analyzer (RMA) program. Boeing was instructed by ONR to coordinate its efforts with the IANM program, and Boeing therefore initially focused on building the MTR RMA capability as an IANM component.

DTIC

*Autonomous Navigation; Autonomy; Routes; Topology*

**20080018330** Naval Air Systems Command, Patuxent River, MD USA

**Collaboration Tools: Meeting Interoperability Requirements in Today's Military**

Wroblewski, Elizabeth M; Warner, Norman W; Jan 2005; 12 pp.; In English

Report No.(s): AD-A476888; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476888

Recent advances in communication and information technology have changed the face of military collaboration. The shift to network-centric operations at both the tactical and strategic levels provide the warfighter with improved abilities for sharing and leveraging information. This shift to a knowledge-based force will have a direct impact on shared situational awareness, intelligence analysis, and decision-making. Despite these improvements, however, information technology is not without its problems. Because of the tremendous amount of data available, collaboration teams are often faced with information overload. Much of that information comes from open sources such as the internet. As a result, knowledge uncertainty becomes a primary concern. In addition, military intelligence is dynamic in nature, and is, therefore, constantly changing. Military strategists and operational personnel must continually monitor the flow of information to ensure accurate and timely mission planning and execution. Geographically distributed collaboration teams face additional burdens. Co-located teams have the advantage of 'real-time' collaboration. On the other hand, distributed teams often receive information asynchronously. In addition, the widening realm of contributors often results in teams that represent a wide range of experience, knowledge, and cultural

backgrounds. To complicate the collaborative effort further, accessibility of enhanced commercial and military technology has resulted in a market flooded with diverse, often incompatible collaboration tools. Without significant oversight, this enhanced technology will serve to impede collaboration rather than improve it.
DTIC
*Client Server Systems; Defense Program; Information Management; Interoperability; Requirements*

**20080018341** Naval Postgraduate School, Monterey, CA USA
**B2B Models for DoD Acquisition**
Kamel, Magdi N; Jan 15, 2008; 37 pp.; In English
Report No.(s): AD-A476934; NPS-GSBPP-08-004; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476934

A central vision of B2B e-commerce is that of an electronic marketplace that would bring suppliers together with major buyers of goods and services for the purpose of conducting 'frictionless commerce. The hope is that these suppliers would compete on price transactions would be automated and low cost and as a result the price of goods and services would fall. Numerous Internet marketplaces came into being during the Internet boom; however an almost equal number disappeared following the Internet bubble burst. Still many survive today based on a variety of models that are quite successful. If a right model is selected it could help large organizations like the DoD achieve great efficiencies for their acquisition and procurement processes. The objective of the paper is to examine models for classifying and differentiating the business functionality provided by Internet marketplaces and to investigate the impact of the various models on government and DoD acquisition. The models will consider such variables as types of goods and services purchased how these goods and services are purchased pricing mechanisms the characteristics of the markets and ownership of marketplace.
DTIC
*Acquisition; Electronic Commerce*

**20080018370** Department of Defense, Arlington, VA USA
**Defense Finance and Accounting Service Kansas City Federal Manager's Financial Integrity Act, Federal Financial Management Improvement Act, and Federal Information Security Management Acting Reporting of FY 2005**
Granetto, Paul J; Marsh, Patricia A; Blair, Edward A; Ball, Cecelia M; Adams, Michael; Smythe, Beverly; Moore, Denny; Lane, Cassondra; Hart, Erin; Feb 19, 2008; 43 pp.; In English
Report No.(s): AD-A477031; IG/DOD-D2008-053; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA477031

Defense Finance and Accounting Service (DFAS) Headquarters, Cleveland, and Kansas City personnel responsible for the internal control program and Annual Statement of Assurance reporting; and Department of Navy and USA Marine Corps personnel responsible for financial management and reporting should read this report. This report contains recommendations that DFAS Kansas City should follow to ensure that effective internal controls are in place to assess and report on its Management Control Program. The USA Marine Corps relies on assurances made regarding the effectiveness of controls DFAS Kansas City uses to prepare the USA Marine Corps stand-alone financial statements. The USA Marine Corps financial statements are consolidated into the Department of Navy financial statements. Background. This report provides an assessment of the reliability of the DFAS Kansas City FY 2005 Annual Statement of Assurance report on internal control required by the Federal Managers' Financial Integrity Act (FMFIA) and Federal Financial Management Improvement Act (FFMIA). In addition, this report provides an assessment of DFAS Federal Information Security Management Act (FISMA) reporting on its security program. DFAS Kansas City is responsible for reporting the USA Marine Corps financial statement data to the Department of the Navy. This report discusses how DFAS Kansas City implemented policies and procedures governing internal controls over financial data. Results. DFAS Kansas City did not have adequate processes in place to determine whether material internal control weaknesses existed and were included in the FMFIA, FFMIA, and FISMA annual reports as required.
DTIC
*Accounting; Financial Management; Information Management; Management Planning; Navy; Security*

**20080018470** Space and Naval Warfare Systems Command, San Diego, CA USA
**A Review of Team Collaboration Tools Used in the Military and Government**
Seymour, George E; Cowen, Michael B; Jan 2007; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476855; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476855

The military operates today both administratively and tactically using collaboration tools. The purpose of this report is

to explore the recent past and current status of collaboration tools use in order to provide recommendations for the future with respect to crisis reaction. In other words, what are the best web-based tools to support small team interaction and work when team members cannot reside in the same physical workspace? Two methods, ad hoc research and systematic document search, were used to identify commercial and proprietary collaboration tools that deserve review and consideration for military and government crisis response. In this report we report on 64 collaboration technologies and tools, 37 in use by the U.S. Military and Government. The collaborative technologies and tools are grouped into these four categories: (a) Modern collaboration technologies for the design, development, or enhancement of collaboration tools, (b) Authorized collaboration tools being used by the military or government, (c) Other collaboration tools being used in the military or government, and (d) Collaboration tools recommended for consideration by the military or government for crisis response. The identified tools or technologies are described in terms of capabilities and are analyzed for potential to improve cognitive collaboration for crisis actions teams.
DTIC
*Software Development Tools; Words (Language); Augmentation*

**20080018539** Carnegie-Mellon Univ., Pittsburgh, PA USA
**An Authorization Logic with Explicit Time**
DeYoung, Henry; Garg, Deepak; Pfenning, Frank; Feb 2, 2008; 96 pp.; In English
Contract(s)/Grant(s): FA8750-07-2-0028
Report No.(s): AD-A476804; CMU-CS-07-166; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476804

We present an authorization logic that permits reasoning with explicit time. Following a proof-theoretic approach, we study the meta-theory of the logic, including cut elimination. We also demonstrate formal connections to proof-carrying authorization's existing approach for handling time and comment on the enforceability of our logic in the same framework. Finally, we illustrate including those with complex interactions between time, authorization, and mutable state.
DTIC
*Temporal Logic; Sequential Control; Numerical Control; Control Systems Design; Access Control*

## 63
## 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*.

**20080018143** Naval Research Lab., Bay Saint Louis, MS USA
**Automated Validation of Satellite Derived Coastal Optical Products**
Lyon, Paul; Arnone, Robert; Gould, Richard; Lee, Zhongping; Martinolich, Paul; Ladner, Sherwin; Casey, Brandon; Sosik, H; Vandemark, D; Feng, H; Morrison, R; Aug 2007; 10 pp.; In English
Report No.(s): AD-A476532; NRL/PP/7330-07-7222; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476532

Automated validation methods and a suite of tools have been developed in a Quality Control Center to analyze the stability and uncertainty of satellite ocean products. The automatic procedures analyze match-ups of near real time coastal bio-optical observations from Martha's Vineyard Coastal Observatory (MVCO) with satellite-derived ocean color products from MODIS Aqua and Terra, SeaWIFS, Ocean Color Monitor, and MERIS. These tools will be used to compare MVCO in situ data sets (absorption, backscattering, and attenuation coefficients), co-located SeaPRISM-derived water leaving radiances, and the Aerosol Robotic Network (AeroNet) derived aerosol properties with daily satellite bio-optical products and atmospheric correction parameters (aerosol model types, epsilon, angstrom coefficient), to track the long tents stability of the bio-optical products and aerosol patterns. The automated procedures will be used to compare the in situ and satellite-derived values, assess seasonal trends, estimate uncertainty of coastal products, and determine the influence and uncertainty of the atmospheric correction procedures. Additionally we will examine the increased resolution of 250m, 500m, and 1 km satellite data from multiple satellite borne scissors 50 examine the spatial variability and bow this variability affects assessing the product uncertainty of coastal match-ups of both bio-optical algorithms and atmospheric correction methods. This report describes the status of the QCC tool development and potential applications of the QCC tool suite.
DTIC
*Atmospheric Correction; Coasts; Oceans; Optical Properties; Radiance; Satellite Imagery*

**20080018261** Computational Tools, Inc., Gurnee, IL USA

**Fundamental Feature Extraction Methods for the Analysis of Eddy Current Data (Preprint)**

Knopp, Jeremy S; Aldrin, John C; Dec 2006; 10 pp.; In English

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

Report No.(s): AD-A476705; AFRL-RX-WP-TP-2008-4041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476705

The objective of this paper is to explore features in eddy current data that are sensitive to defects in airframe structures while invariant to other noise factors commonly encountered in nondestructive evaluation (NDE). In particular, one goal is to detect and quantify corrosion-induced material loss in multi-layer aircraft structures. To investigate this problem, a series of eddy current studies were performed using an analytical model for varying total subsurface thickness loss (6%, 8%, and 10%), and percentage of the thickness loss occurring in the first or second layer (0, 25, 50, 75, and 100%). Results for the simulated studies with varying frequency are presented. A novel feature involving the first and second order derivatives of the real and imaginary parts of the impedance with respect to frequency is presented. Another goal is to detect and quantify subsurface cracks around fastener holes in structures. To investigate this problem, a series of studies are conducted using numerical models and then empirical data sets are analyzed to verify the viability of feature extraction techniques developed through the use of modeling. A feature sensitive to subsurface cracks around fastener holes is shown. Studies are conducted to show that this feature is invariant to irregular.

DTIC

*Eddy Currents; Nondestructive Tests; Pattern Recognition*

**20080018284** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**The Way Ahead for Cyberspace Operations: A JCIDS Analysis**

Treat, Tim; Jun 2007; 181 pp.; In English

Report No.(s): AD-A476777; AFIT/IC4/ENG/07-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476777

As the mission of the military become increasingly interdependent on machine-to-machine operations and interoperability, the need for cyberspace superiority becomes more and more critical for our military to dominate in all domains. To achieve cyberspace superiority, our military services must field fully joint cyberspace capabilities that are designed and acquired to operate in a joint environment. Joint Capabilities Integration Development System (JCIDS) analysis can facilitate a broad focus and military leaders must understand and mandate its use to field truly joint capabilities in cyberspace.

DTIC

*Acquisition; Cybernetics; Interoperability; Military Operations*

**20080018296** Naval Research Lab., Washington, DC USA

**Human-Robot Interaction: A Survey**

Goodrich, Michael A; Schultz, Alan C; Jan 2007; 74 pp.; In English

Report No.(s): AD-A476795; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476795

Human-Robot Interaction (HRI) has recently received considerable attention in the academic community, in labs, in technology companies, and through the media. Because of this attention, it is desirable to present a survey of HRI to serve as a tutorial to people outside the field and to promote discussion of a unified vision of HRI within the field. The goal of this review is to present a unified treatment of HRI-related problems, to identify key themes, and discuss challenge problems that are likely to shape the field in the near future. Although the review follows a survey structure, the goal of presenting a coherent 'story' of HRI means that there are necessarily some well-written, intriguing, and influential papers that are not referenced. Instead of trying to survey every paper, we describe the HRI story from multiple perspectives with an eye toward identifying themes that cross applications. The survey attempts to include papers that represent a fair cross section of the universities, government efforts, industry labs, and countries that contribute to HRI, and a cross section of the disciplines that contribute to the field, such as human factors, robotics, cognitive psychology, and design.

DTIC

*Robots; Surveys*

**20080018314** Carnegie-Mellon Univ., Pittsburgh, PA USA
**Error Awareness and Recovery in Conversational Spoken Language Interfaces**
Bohus, Dan; May 2007; 279 pp.; In English
Contract(s)/Grant(s): N66001-99-1-8905
Report No.(s): AD-A476845; CMU-CS-07-124; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476845

One of the most important and persistent problems in the development of conversational spoken language interfaces is their lack of robustness when confronted with understanding-errors. Most of these errors stem from limitations in current speech recognition technology, and, as a result, appear across all domains and interaction types. There are two approaches towards increased robustness: prevent the errors from happening, or recover from them through conversation, by interacting with the users. In this dissertation we have engaged in a research program centered on the second approach. We argue that three capabilities are needed in order to seamlessly and efficiently recover from errors: (1) systems must be able to detect the errors, preferably as soon as they happen, (2) systems must be equipped with a rich repertoire of error recovery strategies that can be used to set the conversation back on track, and (3) systems must know how to choose optimally between different recovery strategies at run-time, i.e. they must have good error recovery policies. This work makes a number of contributions in each of these areas.
DTIC
*Errors; Human-Computer Interface; Policies; Speech; Speech Recognition*

**20080018320** Carnegie-Mellon Univ., Pittsburgh, PA USA
**Integrating Planning and Control for Constrained Dynamical Systems**
Conner, David C; Dec 2007; 240 pp.; In English
Contract(s)/Grant(s): DAAD19-02-01-0383
Report No.(s): AD-A476869; CMU-RI-TR-08-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476869

This thesis develops an approach to addressing the coupled navigation and control problem for wheeled mobile robots. Instead of using a top-down decoupled approach that does not respect low-level constraints, or a bottom-up approach that cannot guarantee satisfaction of high-level goals, our approach is middle-out. We develop local feedback control policies that respect the low-level constraints. The approach then uses a collection of these policies with existing formal discrete planning methods to either produce a hybrid feedback control policy that guarantees high-level goals are satisfied, or in the worst case, verifies that the high-level specification is not realizable. Our approach enables existing formal symbolic planning methods to be applied to highly constrained systems. We extend the sequential composition of local feedback control policies to wheeled mobile robots in a way that enables the automated synthesis of hybrid control policies. The thesis defines four basic 'composability' requirements that guide our design of local policies. We develop two families of generic feedback policies that induce low-level behaviors in a way that enables their formal composition. The thesis also develops a novel approach for guaranteeing that a given control policy is collision free. By design, the policies respect multiple interacting constraints including large non-circular body shapes, nonholonomic constraints, and input bounds. Given a collection of the local policies and a task specification, our approach uses existing symbolic planning methods to automatically synthesize a switching strategy among the policies. Executing the switching strategy induces continuous motion that satisfies the high-level behavioral specification. This thesis demonstrates the approach on real mobile robots.
DTIC
*Dynamical Systems; Navigation; Robots*

**20080018465** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Real-time Detection of Moving Objects from Moving Vehicles Using Dense Stereo and Optical Flow**
Talukder, Ashit; Matthies, Larry; September 28, 2004; 8 pp.; In English; IEEE/RSJ International Conference on Intelligent Robots and Systems, IROS 2004, 28 Sep.-2 Oct. 2004, Sendai, Japan; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40750

Dynamic scene perception is very important for autonomous vehicles operating around other moving vehicles and humans. Most work on real-time object tracking from moving platforms has used sparse features or assumed flat scene structures. We have recently extended a real-time. dense stereo system to include realtime. dense optical flow, enabling more comprehensive dynamic scene analysis. We describe algorithms to robustly estimate 6-DOF robot egomotion in the presence of moving objects using dense flow and dense stereo. We then use dense stereo and egomotion estimates to identify other

moving objects while the robot itself is moving. We present results showing accurate egomotion estimation and detection of moving people and vehicles under general 6DOF motion of the robot and independently moving objects. The system runs at 18.3 Hz on a 1.4 GHz Pentium M laptop. computing 160x120 disparity maps and optical flow fields, egomotion, and moving object segmentation. We believe this is a significant step toward general unconstrained dynamic scene analysis for mobile robots, as well as for improved position estimation where GPS is unavailable.
Author
*Global Positioning System; Robot Dynamics; Detection; Real Time Operation; Flow Distribution*

**20080018702**
**Clutter Removal and Inversion of Eddy-Current Impedance Data (Postprint)**
Sabbagh, Harold A; Sabbagh, Elias H; Murphy, R K; Aldrin, John C; Knopp, Jeremy S; Lindgren, Eric; Dec 2006; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-4349
Report No.(s): AD-A476939; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476939

A wide variety of problems in computational electromagnetics have been successfully solved using a volume-integral approach along with conjugate-gradient methods. The volume integral algorithm is particularly well suited to the notion of model-based inversion of eddy-current impedance data in the arena of quantitative nondestructive evaluation (NDE). The first step in preparing data for inversion is to remove 'clutter,' which can originate in systematic measurement errors, or simply be a large background signal. In this paper we develop a systematic analytical technique to remove such clutter, which then allows the resulting impedance data to be fed into a nonlinear least-squares inversion algorithm, NLSE. The computational engine for the analysis is VIC-3D , a proprietary volume-integral code.
DTIC
*Clutter; Eddy Currents; Impedance; Inversions; Signal Processing*

**20080018710** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
**Radar System Characterization Extended to Hardware-in-the-Loop Simulation for the Lab-Volt (Trademark) Training System**
Mayhew, Oscar C; Sep 2007; 196 pp.; In English
Report No.(s): AD-A476941; AFIT/GE/ENG/07-29; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476941

Modeling RADAR signals in software allows the testing of potential electronic counter measures and electronic counter counter measures without the associated RADAR hardware and test facilities. Performing a characterization process on a real world RADAR system reveals all imperfections within the system. The Lab-Volt (TM) RADAR system served as the characterized real world RADAR system. The characterization process consisted of measurements at selected front panel locations on the Lab-Volt (TM) transmitter module, antenna pedestal, receiver module, and dual channel sampler module. Due to the overwhelming influence of antenna parameters on a received signal, the characterization process also attempted to derive an antenna transfer function that described how the antenna filters a signal that is passed through it. The characterization process also determined the manner in which different adjustments influenced the signal. A MatLab simulation modeled the Lab-Volt (TM) system operating under ideal conditions. Comparing measurements from the characterization process and the MatLab simulation placed numerical values on the imperfections in the Lab-Volt (TM) system. Finally, integration of the Lab-Volt (TM) system explored an elementary hardware-in-the-loop configuration.
DTIC
*Characterization; Computerized Simulation; Education; Hardware-in-the-Loop Simulation; Radar; Simulation*

## 64
## NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

**20080018099** AETC, Inc., Arlington, VA USA
**Monte Carlo Engine for EMI Survey Analysis**
Miller, Jonathan; Sep 2006; 37 pp.; In English
Contract(s)/Grant(s): W912HQ-05-P-0038; Proj-UX-1449
Report No.(s): AD-A476424; VA-119-001-06-TR; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476424

This project produced and demonstrated proof-of-principle for a Monte Carlo tool that can calculate performance measures under any given set of survey conditions and analysis methods. The existing Monte Carlo tool at AETC was improved by incorporating more realistic noise models, inherent variability of UXO items, and the ability to utilize different discrimination algorithms. The tool was used to show the potential improvement of a hybrid approach to discrimination analysis over an unconstrained or weighted unconstrained approach. It was also used to investigate sensitivities to field survey conditions and noises and, even in the limited proof-of-principle runs, clear guidance on the strong effect of at least one system parameter (timing error) was obtained. Signal-to-noise ratio is a critical parameter for successful UXO discrimination, and accurate noise models are a key part of any Monte Carlo analysis. In this project we improved existing noise models by incorporating correlation scales observed from field data. These field data, however, typically contain only aggregate information, which makes it difficult to discover the magnitude of the various components involved. ESTCP project MM-0508 'Quantification of Noise Sources in EMI Surveys' is aimed at producing the data which will make these component determinations possible, and in fact we have used some preliminary data from that project in this work. At the start of each iteration in the Monte Carlo code, target response values (beta values) were randomly drawn from a library and synthetic data was produced using the dipole model. These synthetic data did not, therefore, exhibit non-dipolar effects, something which could be incorporated in future work using a more sophisticated forward model. Beta values were drawn from a list of 98 possible targets, representing four UXO types: 20mm, 60mm mortar, 81mm mortar, and 3 inch Stokes mortar.
DTIC
*Algorithms; Electromagnetic Interference; Monte Carlo Method; Ordnance; Signal to Noise Ratios; Surveys*

**20080018126** Centre National d'Etudes Spatiales, Toulouse, France
**Numerical Modelling of Cavitation**
Pouffary, Benoit; Nov 1, 2006; 55 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476503; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476503

No abstract available
*Cavitation Flow; Mathematical Models; Numerical Analysis*

**20080018154** Naval Research Lab., Bay Saint Louis, MS USA
**Imagery-Derived Modulation Transfer Function and its Applications for Underwater Imaging**
Hou, Weilin; Weidemann, Alan D; Gray, Deric J; Fournier, Georges R; Jan 30, 2008; 9 pp.; In English
Report No.(s): AD-A476561; NRL/PP/7330-07-7245; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476561

The main challenge working with underwater imagery results from both rapid decay of signals due to absorption, which leads to poor signal to noise returns, and the blurring caused by strong scattering by the water itself and constituents within, especially particulates. The modulation transfer function (MTF) of an optical system gives the detailed and precise information regarding the system behavior. Underwater imageries can be better restored with the knowledge of the system MTF or the point spread function (PSF), the Fourier transformed equivalent, extending the performance range as well as the information retrieval from underwater electro-optical system. This is critical in many civilian and military applications, including target and especially mine detection, search and rescue, and diver visibility. This effort utilizes test imageries obtained by the Laser Underwater Camera Imaging Enhancer (LUCIE) from Defense Research and Development Canada (DRDC), during an April-May 2006 trial experiment in Panama City, Florida. Imaging of a standard resolution chart with various spatial frequencies were taken underwater in a controlled optical environment, at varying distances. In-water optical properties during

the experiment were measured, which included the absorption and attenuation coefficients, particle size distribution, and volume scattering function.
DTIC
*Imagery; Images; Imaging Techniques; Modulation; Modulation Transfer Function; Transfer Functions; Underwater Photography*

**20080018158** Naval Research Lab., Bay Saint Louis, MS USA
**Cycling the Representer Algorithm for Variational Data Assimilation with a Nonlinear Reduced Gravity Ocean Model**
Ngodock, Hans E; Smith, Scott R; Jacobs, Gregg A; Jun 2007; 12 pp.; In English
Report No.(s): AD-A476568; NRL/JA/7320-07-7103; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476568

The representer method was used in a comparison study with the ensemble Kalman filter and smoother involving a 1.5 nonlinear reduced gravity idealized ocean model simulating the Loop Current (LC) and the Loop Current eddies (LCE) in the Gulf of Mexico. It was reported that the representer method was more accurate than its ensemble counterparts, yet it had difficulties fitting the data in the last month of the 4-month assimilation window when the data density was significantly decreased. The authors attributed this failure to increased advective nonlinearities in the presence of an eddy shedding causing the tangent linear model (TLM) to become inaccurate. In a separate study the cycling representer algorithm was applied to the Lorenz attractor and demonstrated that the cycling solution was able to accurately fit the data within each cycle and beyond the range of accuracy of the TLM, once adjustments were made in the early cycles, thus overcoming the difficulties of the non-cycling solution. The cycling algorithm is used here in assimilation experiments with the nonlinear reduced gravity model. It is shown that the cycling solution overcomes the difficulties encountered by the non-cycling solution due to a limited time range of accuracy of the TLM. Thus, for variational assimilation applications where the TLM accuracy is limited in time, the cycling representer becomes a very powerful and attractive alternative, given that its computational cost is significantly lower than that of the non-cycling algorithm.
DTIC
*Algorithms; Assimilation; Cycles; Microgravity; Multisensor Fusion; Nonlinearity; Ocean Models*

**20080018185** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
**Scaling Ant Colony Optimization with Hierarchical Reinforcement Learning Partitioning**
Dries, Erik; Sep 2007; 90 pp.; In English
Report No.(s): AD-A476631; AFIT/GCS/ENG/07-16; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476631

This research merges the hierarchical reinforcement learning (HRL) domain and the ant colony optimization (ACO) domain. The merger produces a HRL ACO algorithm capable of generating solutions for both domains. This research also provides two specific implementations of the new algorithm: the first a modification to Dietterich's MAXQ-Q HRL algorithm, the second a hierarchical ACO algorithm. These implementations generate faster results,with little to no significant change in the quality of solutions for the tested problem domains. The application of ACO to the MAXQ-Q algorithm replaces the reinforcement learning, Q-learning and SARSA, with the modified ant colony optimization method, Ant-Q. This algorithm, MAXQ-AntQ, converges to solutions not significantly different from MAXQ-Q in 88% of the time. This research then transfers HRL techniques to the ACO domain and traveling salesman problem (TSP). To apply HRL to ACO, a hierarchy must be created for the TSP. A data clustering algorithm creates these subtasks, with an ACO algorithm to solve the individual and complete problems. This research tests two clustering algorithms, k-means and G-means. The results demonstrate the algorithm with data clustering produces solutions 85-95% faster but with 5-10% decrease in solution quality.
DTIC
*Algorithms; Colonies; Hierarchies; Markov Processes*

**20080018190** Wyoming Univ., Laramie, WY USA
**Reduced Order Model Based Feedback Control of Large-Scale Aeroelastic Simulations: Residual State Filter Model Reduction Compensation and Application to F-16 Dynamic Models**
Balas, Mark J; Fagley, Casey; Jan 23, 2008; 50 pp.; In English
Contract(s)/Grant(s): FA9550-06-1-0459
Report No.(s): AD-A476664; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476664

Control of large-scale, aero-elastic models requires advanced model reduction techniques for implementation of feedback

control. New reduced order model techniques must be developed based on the concepts and physics of fluid-structure interaction. Current methods are inefficient and inaccurate when dealing with these large scale aero-elastic models. Reduced order model (ROM) based controllers may produce adverse affects on un-modeled modes causing instability in the system. The idea of compensation is introduced to correct for this problem. The primary goal of this paper is to explore three separate techniques for developing ROM based feedback controllers to aero-elastic systems. They are the following: modal truncation with residual mode filter (RMF) compensation, Schur form with residual state filter (RSF) compensation and the singular perturbation approach.
DTIC
*Aeroelasticity; Computational Fluid Dynamics; Dynamic Models; F-16 Aircraft; Feedback Control; Finite Element Method; Model Reference Adaptive Control*

**20080018192** Army Engineer Research and Development Center, Vicksburg, MS USA
**User's Guide: Fracture Mechanics Analysis of Reinforced Concrete Beams (FMARCB)**
Riveros, Guillermo A; Gopalaratnam, Vellore S; Chase, Amos; Jan 2008; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476672; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476672

A finite element package has been developed to perform nonlinear fracture mechanics analysis on reinforced concrete beams. The system consists of a graphic input/output interface and analysis routines using finite element techniques. Fracture Mechanics Analysis of Reinforced Concrete Beams (FMARCB) is a two-dimensional finite element program with triangular, isoparametric, bar, and interface elements. The system uses the discrete crack approach with a fictitious crack model to represent tensile concrete softening; a confinement concrete model to characterize compression softening; a nonlinear bondslip constitutive model for the bond-slip phenomenon, which is degraded when cracks form across the tensile reinforcement; and an elastic, perfectly plastic constitutive model to represent the yielding of the tensile reinforcement.
DTIC
*Composite Materials; Concretes; Finite Element Method; Fracture Mechanics; Manuals*

**20080018297** Carnegie-Mellon Univ., Pittsburgh, PA USA
**Efficient Craig Interpolation for Linear Diophantine (Dis)Equations and Linear Modular Equations**
Jain, Himanshu; Clarke, Edmund M; Grumberg, Orna; Feb 2008; 40 pp.; In English
Report No.(s): AD-A476796; CMU-CS-08-102; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476796

The use of Craig interpolants has enabled the development of powerful hardware and software model checking techniques. Efficient algorithms are known for computing interpolants in rational and real linear arithmetic. We focus on subsets of integer linear arithmetic. Our main results are polynomial time algorithms for obtaining proofs of unsatisfiability and interpolants for conjunctions of linear diophantine equations linear modular equations (linear congruences), and linear diophantine disequations. We show the utility of the proposed interpolation algorithms for discovering modular/divisibility predicates in a counter-example guided abstraction refinement (CEGAR) framework. This has enabled verification of simple programs that cannot be checked using existing CEGAR based model checkers.
DTIC
*Diophantine Equation; Interpolation; Linear Equations*

**20080018298** Carnegie-Mellon Univ., Pittsburgh, PA USA
**Computing Differential Invariants of Hybrid Systems as Fixedpoints**
Platzer, Andre; Clarke, Edmund M; Feb 2008; 35 pp.; In English
Contract(s)/Grant(s): FA9550-06-1-0312
Report No.(s): AD-A476797; CMU-CS-08-103; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476797

We introduce a fixedpoint algorithm for verifying safety properties of hybrid systems with differential equations that have right-hand sides that are polynomials in the state variables. In order to verify non-trivial systems without solving their differential equations and without numerical errors, we use a continuous generalization of induction, for which our algorithm computes the required differential invariants. As a means for combining local differential invariants into global system invariants in a sound way, our fixedpoint algorithm works with a compositional verification logic for hybrid systems. To

improve the verification power, we further introduce a saturation procedure that refines the system dynamics successively with differential invariants until safety becomes provable. By complementing our symbolic verification algorithm with a robust version of numerical falsification, we obtain a fast and sound verification procedure. We verify roundabout maneuvers in air traffic management and collision avoidance in train control.
DTIC
*Differential Equations; Invariance*

**20080018312** Naval Surface Warfare Center, Dahlgren, VA USA
**NSWC Library of Mathematics Subroutines**
Morris Jr, Alfred H; Jan 1990; 380 pp.; In English
Report No.(s): AD-A476840; NSWC-TR-90-21; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476840

The NSWC library is a library of general-purpose Fortran subroutines that provide a basic computational capability in a variety of mathematical activities and emphasis has been placed on the transportability of the codes. Subroutines are available in the following areas: Elementary Operations, Geometry, Special Functions, Polynomials, Vectors, Matrices, Large Dense Systems of Linear Equations, Banded Matrices, Sparse Matrices, Eigenvalues and Eigenvectors, Solution of Linear Equations, Least-Squares Solution of Linear Equations, Optimization, Transforms, Approximation of Functions, Curve Fitting, Surface Fitting, Manifold Fitting, Numerical Integration, Integral Equations, Ordinary - Differential Equations, Partial Differential Equations, and Random Number Generation.
DTIC
*FORTRAN; Libraries; Subroutines*

**20080018358** Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany
**Direction Finding Errors Induced by Plasmawaves of the Ionosphere**
Hawlitschka, Stefan; Jun 1, 2006; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476973; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476973

No abstract available
*Direction Finding; Errors; Ionospheric Propagation; Plasma Waves*

**20080018580** NASA Glenn Research Center, Cleveland, OH, USA
**The a(3) Scheme--A Fourth-Order Space-Time Flux-Conserving and Neutrally Stable CESE Solver**
Chang, Sin-Chung; April 2008; 78 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 599489.02.07.03.04.03.01
Report No.(s): NASA/TM-2008-215138; AIAA Paper 2007-4321; E-16150-2; No Copyright; Avail.: CASI: A05, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018580

The CESE development is driven by a belief that a solver should (i) enforce conservation laws in both space and time, and (ii) be built from a non-dissipative (i.e., neutrally stable) core scheme so that the numerical dissipation can be controlled effectively. To initiate a systematic CESE development of high order schemes, in this paper we provide a thorough discussion on the structure, consistency, stability, phase error, and accuracy of a new 4th-order space-time flux-conserving and neutrally stable CESE solver of an 1D scalar advection equation. The space-time stencil of this two-level explicit scheme is formed by one point at the upper time level and three points at the lower time level. Because it is associated with three independent mesh variables (the numerical analogues of the dependent variable and its 1st-order and 2ndorder spatial derivatives, respectively) and three equations per mesh point, the new scheme is referred to as the a(3) scheme. Through the von Neumann analysis, it is shown that the a(3) scheme is stable if and only if the Courant number is less than 0.5. Moreover, it is established numerically that the a(3) scheme is 4th-order accurate.
Author
*Conservation Laws; Dependent Variables; Independent Variables; Dimensionless Numbers; Scalars; Phase Error; Accuracy; Computational Grids*

**20080018695** North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
**High-Order Energy Stable WENO Schemes**
Yamaleev, Nail K.; Carpenter, Mark H.; May 05, 2008; 26 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 599489
Report No.(s): AIAA Paper 2008-2876; Copyright; Avail.: CASI: A03, Hardcopy

A new third-order Energy Stable Weighted Essentially NonOscillatory (ESWENO) finite difference scheme for scalar and vector linear hyperbolic equations with piecewise continuous initial conditions is developed. The new scheme is proven to be stable in the energy norm for both continuous and discontinuous solutions. In contrast to the existing high-resolution shock-capturing schemes, no assumption that the reconstruction should be total variation bounded (TVB) is explicitly required to prove stability of the new scheme. A rigorous truncation error analysis is presented showing that the accuracy of the 3rd-order ESWENO scheme is drastically improved if the tuning parameters of the weight functions satisfy certain criteria. Numerical results show that the new ESWENO scheme is stable and significantly outperforms the conventional third-order WENO finite difference scheme of Jiang and Shu in terms of accuracy, while providing essentially nonoscillatory solutions near strong discontinuities.
Author
*Hyperbolic Differential Equations; Essentially Non-Oscillatory Schemes; Error Analysis; High Resolution; Linear Equations; Difference Equations*

**20080018934** Florida Univ., Gainesville, FL USA
**Learning and Self-Repairing Systems**
Hammer, Jacob; Dec 2007; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-1-0175; Proj-NBGQ
Report No.(s): AD-A476883; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476883

The research covered by this grant concentrated on the development of computing algorithms for learning and self-repairing systems. During the report period, several existing and new methodologies were critically examined. The research resulted in the development of the concepts of learning blocks and association degree, which facilitate the development of learning and self-repairing systems. Methodologies based on these concepts allow a system to extract critical information from its past operation to automatically generate remedies for future malfunctions.
DTIC
*Algorithms; Machine Learning; Maintenance*

## 65
## STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

**20080018100** Maryland Univ., College Park, MD USA
**Zero Autocorrelation Waveforms: A Doppler Statistic and Multifunction Problems**
Benedetto, John J; Donatelli, Jeffrey; Konstantinidis, Joannis; Shaw, Christopher; Jan 2006; 5 pp.; In English
Contract(s)/Grant(s): DMS0504924; N00014-02-1-0398
Report No.(s): AD-A476425; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476425

Constant amplitude zero autocorrelation ‘off the dc component’ waveforms are constructed. These are called CAZAC waveforms. In the d-dimensional case they consist of N vectors, where N is given, and N is generally greater than d. The constructions are algebraic and have been implemented in user friendly software. They have the added feature that they are a spanning set for all d-dimensional signals. As such, and for N large, they are numerically stable in the presence of machine imperfections and they give good signal reconstruction in the presence of various noises. The one dimensional case provides effective thresholding to compute doppler shifts.
DTIC
*Autocorrelation; Waveforms*

**20080018177** Library of Congress, Washington, DC USA

**U.S. Forces in Iraq**

O'Bryant, JoAnne; Waterhouse, Michael; Jan 23, 2008; 7 pp.; In English

Report No.(s): AD-A476606; CRS-RS22449; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476606

Varying media estimates of military forces in Iraq have raised concerns about the actual number of troops deployed in Operation Iraqi Freedom (OIF). Interest in troop level deployments continue in 2008. Last year, a major announcement on a surge in troop deployments to Iraq by President Bush included a planned gradual increase of more than 20,000 U.S. troops on the ground in Baghdad and Anbar province over several months. Since the 'new strategy for Iraq' speech by the President on January 10, 2007, troop deployments gradually increased during the months of February through October in 2007, but decreased beginning in November 2007. This report provides solely Department of Defense (DoD) statistical information on U.S. forces serving in Iraq. It also provides brief official information on the military units scheduled for the next rotation of duty into Iraq. As of January 2, 2008, according to DoD, the USA had 155,846 troops stationed in Iraq -- 137,709 active component and 18,137 National Guard or Reserves. For security reasons, DoD does not routinely report the composition, size, or specific destination of military forces deployed to the Persian Gulf. This report will be updated upon receipt of new DoD data. For additional information on U.S. forces, see CRS Report RL31701, 'Iraq: U.S. Military Operations,' by Steve Bowman. The following figures and table are included: Active Component Personnel in Iraq (as of January 2, 2008); Reserve Component Personnel in Iraq (as of January 2, 2008); OIF Active Component Force Levels (January 2007 and January 2008); OIF Reserve Component Force Levels (January 2007 and January 2008); Comparative U.S. Force Levels in Iraq (January 2007 through December 2007, by month); Comparative U.S. Force Levels in Iraq (Years 2006, 2007, and 2008); and OIF 2008 and 2009 Rotational Units.

DTIC

*Deployment; Iraq; Reserves*

**20080018178** Library of Congress, Washington, DC USA

**U.S. Forces in Iraq**

O'Bryant, JoAnne; Waterhouse, Michael; Jun 14, 2006; 5 pp.; In English

Report No.(s): AD-A476607; CRS-RS22449; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476607

Varying media estimates of military forces in Iraq have raised concerns about the actual number of troops deployed in Operation Iraqi Freedom (OIF). This report provides solely Department of Defense (DoD) statistical information on U.S. forces serving in Iraq. As of June 1, 2006, according to DoD, the USA had 128,789 troops stationed in Iraq -- 102,709 active component and 26,080 National Guard or Reserves. For security reasons, DoD does not routinely report the composition, size, or specific destination of military forces deployed to the Persian Gulf. This report will be updated upon receipt of new DoD data. For additional information on U.S. forces, see CRS Report RL31701, 'Iraq: U.S. Military Operations,' by Steve Bowman. The following figures and table are included: Active Component Personnel in Iraq (as of June 1, 2006); Reserve Component Personnel in Iraq (as of June 1, 2006); OIF Active Component Force Levels (November 2005 and June 2006); OIF Reserve Component Force Levels (November 2005 and June 2006); Comparative U.S. Force Levels in Iraq (November 2005, February 2006, and June 2006); and OIF Rotational Units 2006.

DTIC

*Deployment; Iraq; Reserves*

**20080018611** NASA Glenn Research Center, Cleveland, OH, USA

**Probabilistic Multi-Factor Interaction Model for Complex Material Behavior**

Chamis, Christos C.; Abumeri, Galib H.; April 07, 2008; 11 pp.; In English; 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 7-10 Apr. 2008, Schaumburg, IL, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2008-1987; Copyright; Avail.: CASI: A03, Hardcopy

The Multi-Factor Interaction Model (MFIM) is used to evaluate the divot weight (foam weight ejected) from the launch external tanks. The multi-factor has sufficient degrees of freedom to evaluate a large number of factors that may contribute to the divot ejection. It also accommodates all interactions by its product form. Each factor has an exponent that satisfies only two points, the initial and final points. The exponent describes a monotonic path from the initial condition to the final. The exponent values are selected so that the described path makes sense in the absence of experimental data. In the present

investigation the data used was obtained by testing simulated specimens in launching conditions. Results show that the MFIM is an effective method of describing the divot weight ejected under the conditions investigated.
Author
*Digital to Voice Translators; External Tanks; Foams; Probability Theory; Degrees of Freedom*

**20080018768** DeVoe [Donald L.], Bethedsa, MD, USA
**Devices and Methods for Correlated Analysis of Multiple Protein or Peptide Samples**
Balgley, B. M., Inventor; Cooper, J. W., Inventor; Lee, C. S., Inventor; DeVoe, D. L., Inventor; Jul. 01, 2005; 9 pp.; In English
Contract(s)/Grant(s): NSF-0319722; NSF-R44-RR019108
Patent Info.: Filed Filed 1 Jul 05; US-Patent-Appl-SN-11-171-427
Report No.(s): PB2007-111869; No Copyright; Avail.: CASI: A02, Hardcopy

Disclosed is a system for performing multiple analyses of protein and/or peptide samples and correlating the results of the analyses. The system comprises a sample inlet, a splitter means, at least two sample delivery capillaries, at least two sample deposition tools, and at least two sample collectors, wherein said splitter means is in fluid communication with the sample inlet and the sample delivery capillaries, and wherein liquid flow entering the splitter means is split into a number of sub-flows equal to the number of sample delivery capillaries. In one preferred embodiment, at least one microenzyme reactor is interfaced to a first sample delivery capillary in order to digest a protein sample within the capillary, while a second sample delivery capillary does not contain a microenzyme reactor, thereby enabling correlated analysis of the same protein sample in digested and undigested form. Methods for performing two or more analyses of protein and/or peptide samples and correlating the results of the analyses are also disclosed.
NTIS
*Patent Applications; Peptides; Proteins*

**20080018885** Army Tank-Automotive Systems Development Center, Warren, MI, USA
**Estimation of the Parameters of the Weibull Distribution Using the Method of Least Square**
Tkatch, Ben; Apr 1966; 4 pp.; In English
Report No.(s): AD-A476423; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476423

No abstract available
*Independent Variables; Least Squares Method; Weibull Density Functions*

**20080018941** Mathematica Policy Research, Inc., Washington, DC, USA
**Effects of Marriage on Health: A Synthesis of Recent Research Evidence**
Wood, R. G.; Goesling, B.; Avellar, S.; Jun. 2007; 68 pp.; In English
Report No.(s): PB2007-111501; No Copyright; Avail.: CASI: A04, Hardcopy

Marriage has become an increasingly important topic in academic and policy research. A burgeoning literature suggests that marriage has a wide range of benefits, including improvements in individuals economic well-being and mental and physical health, as well as the well-being of their children (Lerman 2002; Ross et al. 1990; Waite and Gallagher 2000; Wilson and Oswald 2005). Inspired, in part, by these potential benefits of marriage, several large-scale federal initiatives have been launched in recent years that aim to encourage and support marriage. This synthesis focuses on recent research evidence concerning one of these potential benefits of marriage the effects of marriage on health. In general, married people are healthier than those who are not married across a wide array of health outcomes (Schoenborn 2004). The existence of an association between marriage and health does not necessarily imply that marriage causes better outcomes, however. In particular, people who marry may already be healthier than those who do not, and this may be the reason for the better health of married adults. An examination of the relevance of these patterns for public policy must include careful consideration of whether the association between marital status and various health measures indicates that getting and staying married actually improves health. To provide a broad understanding of the current research on the link between marriage and health, we have synthesized recent literature across several fields, including public health, the social sciences, and medical science. We focus on research published in peer-reviewed journals and on studies using the most rigorous methods for determining whether the link between marriage and health is a causal one. A review of all the research that examines marriage and health is beyond the scope of this project. Therefore, we have narrowed our review to examine the research of most relevance to the U.S. policy community. In particular, we focus on research conducted with U.S. populations and completed since 1990. In addition, we focus on research that uses the most sophisticated statistical methods for determining whether marriage does indeed improve health

outcomes. By focusing on the most compelling research evidence concerning the effects of marriage on health, we aim to provide an accurate portrayal of the current state of research documenting what we do and do not know about the linkages between marriage and health.
NTIS
*Health; Mental Health; Medical Science*

## 66
## SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

**20080018303** Carnegie-Mellon Univ., Pittsburgh, PA USA
**Using Online Algorithms to Solve NP-Hard Problems More Efficiently in Practice**
Streeter, Matthew; Dec 2007; 206 pp.; In English
Contract(s)/Grant(s): FA8750-05-C-0033; NSF-9900298
Report No.(s): AD-A476807; CMU-CS-07-172; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476807

This thesis develops online algorithms that can be used to solve a wide variety of NP-hard problems more efficiently in practice. The common approach taken by all our online algorithms is to improve the performance of one or more existing algorithms for a specific NP-hard problem by adapting the algorithms to the sequence of problem instance(s) they are run on. We begin by presenting an algorithm for solving a specific class of online resource allocation problems. Our online algorithm can be applied in environments where abstract jobs arrive one at a time, and one can complete the jobs by investing time in a number of abstract activities. Provided the jobs and activities satisfy certain technical conditions, our online algorithm is guaranteed to perform almost as well as any fixed schedule for investing time in the various activities, according to two natural measures of performance: 1. the average time required to complete each job, and 2. the number of jobs completed within time T, for some fixed deadline T>0. In particular, our online algorithm's guarantees apply if the job can be written as a monotone, submodular function of a set of pairs of the form (upsilon, tau), where tau is the time invested in activity upsilon. Under the 1st objective, the offline version of this problem generalizes MIN-SUM SET COVER and the related PIPELINED SET COVER problem. Under the 2nd objective, the offline version of this problem generalizes the problem of maximizing a monotone, submodular set function subject to a knapsack constraint. Our online algorithm has potential applications in a number of areas, including the design of algorithm portfolios, database query processing, and sensor placement. We apply this online algorithm to the following problem. We are given k algorithms, and are fed, one at a time, a sequence of problem instances to solve. We may solve each instance using any of the algorithms, we may interleave the execution of the algorithms, and we may restart them.
DTIC
*Algorithms; Optimization; Scheduling*

**20080018325** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
**A Heuristic Decision Making Model to Mitigate Adverse Consequences in a Network Centric Warfare/Sense and Respond System**
Alsing, III, Maurice O; May 2005; 66 pp.; In English
Report No.(s): AD-A476877; AFIT/MLM/ENS/05-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476877

The general premise of this research is that decision making will increase in importance based on the transformation of the military towards Network Centric Warfare (NCW) / Sense and Respond logistical, informational, command / control systems. Additionally, this may result in an increase of adverse consequences, potentially resulting in an increase of accidents, major mishaps or, in general, system interruptions. Being able to quickly identify and mitigate adverse consequences in decision making will be more valuable and needed for managers and leaders in the near future. In the Legacy / cold war military, the need for information and decision making was mitigated by the large excess capacities, inventories, and redundant sub-systems and personnel or resources in general. Potentially in a NCW / Sense and Respond military there is a greater need for information and for decision makers to act or use the information, resulting in an increase in decision-making requirements. These may not increase in frequencies but rather increase in importance and impact, as available resources are lessened and the information flow and amount increases, putting further demands on the decision makers. Also if the need to make decisions increases and, additionally, adverse consequences increase, the impact will be larger on the system with more implications,

accidents, and system interruptions. It may be possible to mitigate or avoid the potentially negative impact of system interruptions and adverse consequences that stem from decision making in a NCW / Sense and Respond system. A model is suggested for considering decision consequences.
DTIC
*Decision Making; Heuristic Methods; Warfare*

**20080018326** Honeywell, Inc., Brooklyn Park, MN USA
**Determination of Constitutive Model Constants From Cylinder Impact Tests**
Holmquist, T J; Johnson, G R; Dec 1988; 30 pp.; In English
Contract(s)/Grant(s): N60921-86-C-0249; Proj-RJ14W21
Report No.(s): AD-A476879; NSWC-TR-88-250; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476879

This report describes and evaluates two computational strength models: The Johnson-Cook model and the Zerilli-Armstrong model. The models are compared to tension and torsion data, and to cylinder impact test data. Various techniques to obtain constants for the models from cylinder impact test results, are also presented.
DTIC
*Coding; Computer Programs; Impact Tests; Mathematical Models; Torsion*

**20080018510** Naval Air Warfare Center, Patuxent River, MD USA
**State of the Art Review of Human-Human Collaboration Research: An Integrated, Multidisciplinary Perspective**
Warner, Norman W; Vanderwalker, Steven; Verma, Nina; Narkevicius, Jen; Oct 31, 2002; 77 pp.; In English
Report No.(s): AD-A476839; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476839

Teamwork has been essential to the military since the initiation of warfare. It is the enhancement of individual performance that makes teamwork a necessary tool for all military leaders. There are problems to be solved that require the synergy achieved in a team setting with the sum solution being greater than the parts of the solution brought by each member of the team. The time required to do this problem solving, sometimes depicted as the Observe Orient Decide Act (OODA) loop is currently identified as the limiting factor in winning military action. The team who gets their OODA loop shorter than the other team's wins the war. Seymour (2002) points out that what was once referred to as teamwork is now often named collaboration. This change in terminology reflects the change in teamwork brought about by the technological advances that make it possible to work as a team without being physically together. Jamal and Getz (1995) also explored the concept of collaboration as a team with a stake in the outcome. Teams have traditionally required meetings to ensure that all the team members work together. This also entails travel requirements to get subject matter experts together to solve a particularly complex or difficult problem. In the current economic and technical environment, it is no longer desirable to get members of a team together for meetings. While face-to-face meetings are clearly quite useful, they are resources expensive (time, money, reduced productivity for other projects while traveling). Businesses have moved to more distributed meetings. By using technology, team members are able to communicate and meet without being in the same physical location. This has meant use of telephone and video teleconferencing (VTC). This use of technology allowed an emulated face-to-face meeting of people not collocated without travel.
DTIC
*Problem Solving; Human Relations; Terminology*

**20080018640** NASA Stennis Space Center, Stennis Space Center, MS, USA
**Implementation of Integrated System Fault Management Capability**
Figueroa, Fernando; Schmalzel, John; Morris, Jon; Smith, Harvey; Turowski, Mark; April 2008; 13 pp.; In English; NASA Planetary Spacecraft Fault Management Workshop, 14-18 Apr. 2008, New Orleans, LA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNS04AB67T
Report No.(s): SSTI-2200-0096; Copyright; Avail.: CASI: A03, Hardcopy

Fault Management to support rocket engine test mission with highly reliable and accurate measurements; while improving availability and lifecycle costs. CORE ELEMENTS: Architecture, taxonomy, and ontology (ATO) for DIaK management.

Intelligent Sensor Processes; Intelligent Element Processes; Intelligent Controllers; Intelligent Subsystem Processes; Intelligent System Processes; Intelligent Component Processes.
Derived from text
*Controllers; Rocket Engines; Systems Integration; Engine Tests; Fault Detection; Management Systems*

**20080018643** NASA Stennis Space Center, Stennis Space Center, MS, USA
**Integrated Systems Health Management Conference**
Schmalzel, John L.; Morris, Jon; Turowski, Mark; Figueroa, Fernando; Oostdyk, Rebecca; August 11, 2008; 2 pp.; In English; 2008 Integrated Systems Health Management (ISHM) Conference, 11-14 Aug. 2008, Covington, KY, USA; Original contains color illustrations
Contract(s)/Grant(s): NNS04AB67T
Report No.(s): SSTI-2200-0101; Copyright; Avail.: CASI: A01, Hardcopy

There are a number of architecture models for implementing Integrated Systems Health Management (ISHM) capabilities. For example, approaches based on the OSA-CBM and OSA-EAI models, or specific architectures developed in response to local needs. NASA s John C. Stennis Space Center (SSC) has developed one such version of an extensible architecture in support of rocket engine testing that integrates a palette of functions in order to achieve an ISHM capability. Among the functional capabilities that are supported by the framework are: prognostic models, anomaly detection, a data base of supporting health information, root cause analysis, intelligent elements, and integrated awareness. This paper focuses on the role that intelligent elements can play in ISHM architectures. We define an intelligent element as a smart element with sufficient computing capacity to support anomaly detection or other algorithms in support of ISHM functions. A smart element has the capabilities of supporting networked implementations of IEEE 1451.x smart sensor and actuator protocols. The ISHM group at SSC has been actively developing intelligent elements in conjunction with several partners at other Centers, universities, and companies as part of our ISHM approach for better supporting rocket engine testing. We have developed several implementations. Among the key features for these intelligent sensors is support for IEEE 1451.1 and incorporation of a suite of algorithms for determination of sensor health. Regardless of the potential advantages that can be achieved using intelligent sensors, existing large-scale systems are still based on conventional sensors and data acquisition systems. In order to bring the benefits of intelligent sensors to these environments, we have also developed virtual implementations of intelligent sensors.
Author
*Information Analysis; Systems Integration; Data Acquisition; Actuators; Systems Management; Rocket Engines; Engine Tests*

**20080018655** Research and Technology Organization, Neuilly-sur-Seine, France
**Integration of Modelling and Simulation**
March 2007; In English; NATO Modelling and Simulation Group (NMSG), 9-10 Oct. 2006, Ljubljana, Slovenia; See also 20080018656 - 20080018663
Report No.(s): RTO-EN-MSG-043bis; AC/323(MSG-043)TP-31; Copyright; Avail.: CASI: C01, CD-ROM

Topics covered include: History and Basics of M and S [Modelling and Simulation]; Representation; General Interoperability Concepts; Interoperability Architectures; Locating M and S Information; Simulation Components; Scenario Design; and Analysis and Feedback.
Derived from text
*Interoperability; Architecture (Computers); Design Analysis; Simulation; Feedback*

**20080018656** Department of the Army, Washington, DC, USA
**Scenario Design**
Little, Daniel; Integration of Modelling and Simulation; March 2007, pp. 8-1- 8-8; In English; See also 20080018655; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The world of Modelling & Simulation remains an enigma to most, especially considering the level of technicality applied to the various sciences supporting its proliferation. Nowhere but this field does one see a confluence of algorithms, software programming, information systems, C4ISR and of late - web-based design. What is not fair however is to pigeonhole M&S professionals into laboratory clinicians because the activities are much broader than one realizes. Despite its technical connotations, M&S is also about people and processes within the context of organisational structures. It is based on these

variables that M&S is also defined by issues addressing planning, operational application and satisfying those what if? questions in analysis.
Derived from text
*Simulation; Information Systems; Convergence; Deployment; Education; Histories; Software Engineering*

**20080018657** Department of the Army, Washington, DC, USA
**History and Basics of M and S [Modelling and Simulation]**
Little, Daniel; Integration of Modelling and Simulation; March 2007, pp. 1-1 - 1-4; In English; See also 20080018655; Copyright; Avail.: CASI: A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Everything has a history. What few realize is that Modelling and Simulation or M&S predates the computer. Many of you are familiar with the concepts of chess. What makes chess significant? For one it represents rules. It also contains a strategy with infinite possibilities. While today most regard it as a commonplace game, strategic prowess was taken very seriously in the ancient world where reputations, not to mention kingdoms were won and lost to military campaigns. Figurine warriors replicating the art of battle have been dated as far back as 2500 BC in Egypt. As best as can be determined, these figurines offer us the earliest known example of formation and manoeuvre. The Chinese were no exception. Sun Tzu, Chinese strategist and military philosopher wrote about the game Wei Hei or encirclement around 500 BC. India circa 700AD added pieces, moves and strengths to Shataranja, the closest predecessor to the chess we play today. We fast forward to the 1600 s to Germany where more military detail was added to a larger board and additional pieces. This larger board now sported rivers, forest and other terrain features. The enhanced version of war-gaming called K nigspiel or the King s Game advanced a notion that war can be reduced to distinct concepts and formal rules. In 1824, Prussian Baron von Reisswitz published a book called Kriegspiel or wargame. Instead of a flat board, another revolutionary addition was made in the form of three-dimensional terrain. Dice decides the outcomes of fires, introducing both abstraction and quantification. While K nigspiel fostered the concept of reductionism, Kriegspiel gave us in due time topographical maps and the stirrings of battle calculus. If the field of M&S can claim its rightful origin chronologically, it is the 1800s where the basic concepts of M&S as we recognize them become evident. Now we go to another continent North America. In 1879, Army Major James Livermore, felt there was more to war than just battle. The new twists he added were logistics and the quantification of fatigue. A few years later, another Army Officer, Lt Totten, felt that Kriegspiel had an anomaly that prevented it from being played in a political context. His insight was that one should not jump into Kriegspiel immediately but instead proceed from the simple to the complex; adding layers to the game depicting the different facets or levels of war: tactical, operational, and strategic. This is the first time we see a hierarchy in modelling. By 1887, wargaming becomes a permanent part of the curriculum at the U.S. Naval War College due to the efforts of William McCarty-Little.
Author
*Simulation; Warfare; Terrain; Hierarchies; Anomalies*

**20080018658** Department of the Army, Washington, DC, USA
**Locating M and S Information**
Little, Daniel; Integration of Modelling and Simulation; March 2007, pp. 5-1 - 5-4; In English; See also 20080018655; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the remarkable things I notice when I go to Modelling & Simulation (M&S) forums such as this one is when three-quarters of the room is silent and the remaining quarter doing all the talking already knows most of the answers anyway. Although the retention of vast corporate knowledge is certainly a plus in our community, it does not bode well for our future when the walls we place between ourselves and key leaders are self-imposed. The purpose of this lecture is to encourage the three-quarters to meet the few of us halfway by gaining a measure of self-confidence through a professional M&S reading programme. Most of those present are not here because of a keen desire to programme; although a few can. These lecture series are conducted to empower the implementer. If you are here to gather information in support of a senior General and are unable to articulate the M&S worldview, we are doing you and ourselves a disservice. That is why I have compiled a very innocent list of answers to common questions and included the supported websites so you can have your own on-line M&S library. Whether we realize or not, those of you looking for an answer need something more instantaneous than reading an entire book. What I have done is by no means exclusive to the selection placed in your hands, but it is indeed a start. The idea is not to embarrass anyone but you would be surprised how long some of us have been around M&S and do not know the role and purpose of the NATO Research and Technology Office (RTO) or the NATO Modelling and Simulation Group (NMSG). Web links and search engines aside, here is where you will find the vision of a gentleman that served the NMSG for many years and just recently retired, Mr. Graham Burrows. Also there is a plethora of publications that may affect your

M&S dilemma or enquiry which is why I will encircle the location of the search windows. Aside from the documents available in NATO RTO s repository, particular attention should also be directed at the NATO Consultation, Command and Control Agency or NC3A for short. Aside from publications, many lectures, working group meetings and conferences relating to M&S occurs at the NC3A office at The Hague. One of the initiatives that originated from the US was the Modelling and Simulation Resource Repositories of MSRRs of which we boast quite a few. We have the Modelling and Simulation Information and Analysis Center (MSIAC), the Defense Modelling and Simulation Office (DMSO), the Army MSRR which is sponsored by my organisation: the Battle Command, Simulation & Experimentation Directorate, along with MSRRs for the Air Force and Navy.
Derived from text
*Simulation; Information Systems; Command and Control; Information Retrieval; On-Line Systems*

**20080018659** Cranfield Univ., Cranfield, UK
**Simulation Components**
Searle, Jonathan; Brennan, John; Integration of Modelling and Simulation; March 2007, pp. 6-1 - 6-12; In English; See also 20080018655; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The fundamental concept of simulation dates back thousands of years to the ancient Egyptians and the famous Chinese war strategist SunTzu. Notwithstanding these initial attempts at replicating ancient battlefields, current day machine-based modelling and simulation (M&S) found its roots in the early 20th Century. During this dawning era, the majority of M&S efforts were carried out in isolation. One may not find this so surprising when one considers the fundamental definition of a model: a representation of an element of the real world for a specific purpose. Working in isolated domains on specific applications, M&S developers created bespoke solutions to precise problems. Modelling and simulation has undergone a significant maturation process over the past few decades. Early on, the M&S realm represented only a very small portion of the real world (see Figure 1(a)). Systems such as flight simulators, SimNet1 and operational analysis (OA) models, although based on real world requirements, had no direct physical connection to the real world domains. Technology growth led to an expansion within the M&S realm, allowing practitioners to address a larger subset of real world applications with more comprehensive and complex representations (see Figure 1(b)). Today, the M&S realm has achieved an overlap with the real world wherein simulation information is viewed coincident with the real world. The advances and growth referred to above has resulted in a virtual explosion in the elements and components associated with simulation. These components can be divided into two categories: those associated with the science and technology of simulation itself; and those more closely related to the human and cultural aspects of the M&S community. The first section of this paper introduces the concept of synthetic environments as a means of establishing some common ground for further discussion. The remainder of the paper will take a closer look at some of the technical and non-technical components of simulation.
Author
*Simulation; Flight Simulators; Warfare; Growth; Explosions*

**20080018660** Department of the Army, Washington, DC, USA
**Analysis and Feedback**
Little, Daniel; Integration of Modelling and Simulation; March 2007, pp. 9-1 - 9-2; In English; See also 20080018655; Copyright; Avail.: CASI: A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the things that dismays people unfamiliar with Modeling and Simulation or M&S is that we have no perfect solution. Instead, we ask copious questions to get as close as possible to the objectives sought. Analysis supporting ill-defined requirements can be equally disastrous for the same reasons. Like M&S, the raison d' tre of analysis is built upon knowing what you want to capture and pre-determining a methodology to gauge whether you are getting it or not. Developing a simulation and exercise collection plan therefore means two things where the training audience is concerned: the simulation plan is unseen but the presence of a collection plan is mildly evident. The dilemmas with collection plans begin at their initial inception. If physical observation is necessary, then there must be a focus since a prolonged presence interferes with a staff interacting within their habitat. This requires research. Unfortunately when an officer receives a task for this mission, a senior personage or mentor has not even been appointed much less identified. This impacts critical planning and time management assuming that no professional organisation is dedicated for this purpose. Using an American figure of speech, having something 'fall in your lap' means that this is given to you whether you were expecting it or not. Assuming this is you, my recommendation is to look at the following critical areas: identify those receiving the initial taskings; look at the training

objectives; look at the doctrine in relation to these objectives. What proves insightful is to compare what is being attempted with the overall training strategy of the exercising unit. Is this headquarters being asked to do something that it never prepared for? Further, by taking a look at the order from higher and comparing it with the headquarters order, there will be instances where the continuation of actions are not complete nor nuances from the senior command fully embraced. Before the appointment of a senior mentor, it is perfectly acceptable to record any potential discrepancies for future consumption. There is nothing wrong with looking at the time-sequence of certain events during the exercise and creating a draft prioritising the events to be observed. It is also acceptable to stake an early claim over observer space and configuration as well as stating requirements for the set-up of an After Action Review or facility. Ideally this results from a physical reconnaissance of the exercise facilities in advance.
Author
*Feedback; Simulation; Measuring Instruments; Education; Collection; Physical Exercise*

**20080018661** Department of the Army, Washington, DC, USA
**Representation**
Little, Daniel; Integration of Modelling and Simulation; March 2007, pp. 2-1 - 2-2; In English; See also 20080018655; Copyright; Avail.: CASI: A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Representation is the most important yet underappreciated concepts of Modelling and Simulation (M&S). The reason this is so is due to hierarchies that we take for granted. By hierarchies I mean that there is a layer of representation of us as individuals, as military professional, as members of a military unit and as citizens of an entire nation. My purpose is to provide instances of this at every level and tie it into how all of this is represented on one form or another through history, psychology, organisational behaviour, sociology, political science and its significance to M&S. While this appears at first idealistic at best or unattainable at worst, here is why. First and foremost, we take ourselves for granted and do not realize how representation defines us. The best example is religion. Although many in the lecture hall wear a military uniform and exude common norms of professionalism, each one can walk down the streets of any city and feel different emotions when looking at houses of worship. All of us feel something different; for some absolutely nothing, for others familiarity or even a sense of kinship while others feel pangs of contemptuousness. The psychologist Carl Jung noticed this about people.1 Of the Christian cross, Jung noted that it carried a much different significance (p.81) if found after one s name in a book signifying their death as opposed to its placement on a building. Jung researched early Christianity and discovered that the crossbeam of its Latin cross was purposefully moved higher than the equilateral orthodox one to signify the otherworldliness of heaven above earth (p.271). People either in uniform or out make snap judgments whether we realize it or not. In America for example, people still respond with Gesundheit when strangers sneeze yet do not speak German nor realize that the word means health. In the event you ever travel to America and people ask how you are, you can tell each one about your aches pains and worries but you will never get much done. I have teenaged children that ask me guess what? even I haven t a clue what I am supposed to guess about. This is how my children obtain parity or making the conversation more equal than when they were smaller children. Another curious phenomenon involves status. If we saw someone in a special suit opening the door of a luxury automobile for a female, we do not know if it is because of gender, her status or because she was merely a passenger. All of us might draw different conclusions.
Author
*Words (Language); Simulation; Psychology; Sociology; Hierarchies; Conversation*

**20080018662** Cranfield Univ., Cranfield, UK
**General Interoperability Concepts**
Searle, Jonathan; Brennan, John; Integration of Modelling and Simulation; March 2007, pp. 3-1 - 3-8; In English; See also 20080018655; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Interoperability has long been the Holy Grail within defence communities world wide particularly of late with the increase in joint and coalition operations. The shift to an increased use of M&S for training and mission rehearsal has seen a transfer of similar issues across to the M&S realm. Interoperability of distributed simulation systems began wider use in the early 1980 s and has seen steady increase ever since. The concept of reuse has also become more prominent as it is closely related to, and can facilitate, interoperability - the primary question here is at what level does one focus reuse efforts. Benefits do not come without their challenges. Many technological issues have been addressed over the past two decades with a certain degree of success. One must also address non-technical challenges - those challenges that have their roots in practical and conceptual

level views of the problem domain. Finally, as the overlap between the M&S realm and the real world grows, more challenges will surface.
Author
*Interoperability; Military Operations; Simulation; Education*

**20080018663** Cranfield Univ., Cranfield, UK
**Interoperability Architectures**
Searle, Jonathan; Brennan, John; Integration of Modelling and Simulation; March 2007, pp. 4-1 - 4-8; In English; See also 20080018655; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The first paper in this series addressed the general concepts of interoperability within the modelling and simulation (M&S) realm. The next stage, within the context of the lecture series as a whole, is to examine interoperability from an integration perspective. To accomplish this, one must look at the manner in which simulations (and their components) can be bolted together. Furthermore, to ensure a complete assessment is conducted one must consider more than just the technical aspects of interoperability and integration; it is critical that one gives due attention to the organisational, cultural and economic aspects of integration as well. As such, one can state that the main challenges of interoperability and integration within the M&S realm are composed of a mix of engineering, technical and conceptual issues. The primary aim of this paper is to consider the integration and interoperability of M&S with particular emphasis on federated and distributed simulations. To address this aim it is important for one to begin with a basic understanding of the significant terms within the statement, in the context of M&S. First of all, the term interoperability is meant to imply the ability of a given system to exchange data or information, and perform its required functions in concert with other distinctly separate systems. The term integration refers to the induction or amalgamation of M&S systems into existing programmes or studies such as training and acquisition. Therefore, in simulation speak, interoperability relates to the creation of federations whereas integration relates to the application of the federations. Finally, one must also explore the issues of composability and architectures two fundamental elements underpinning interoperability and integration within the synthetic environment realm. Prior to launching into the main element of this paper, it is worth taking the time to briefly explore the concepts of federated and distributed. These two terms are related, in some cases, but they do not necessarily imply mutual dependence within the M&S realm. Federated systems are systems that contribute to a whole while each element maintains self internal management a federation is an organisation formed by merging several elements. The term distributed can have two meanings within the context of this paper. First, the term distributed computing generally refers to a collection of independent computers each performing partial elements of a greater task, which appears to any user as a single coherent system. Within the M&S realm, distributed has a similar meaning except that it normally also carries the implication of physical distribution (e.g. geographically disparate). The main reasons for employing distributed simulation are reliability, scalability, connectivity and extensibility (or composability). Essentially, it is important for one to understand that the term federation (or federated) does not imply distributed, or vice versa.
Derived from text
*Interoperability; Simulation; Federations; Reliability; Economics; Education*

**20080018771** Stottler Henke Associates, Inc., San Mateo, CA USA
**Authoring Effective Demonstrations**
Fu, Dan; Jensen, Randy; Salas, Eduardo; Rosen, Michael A; Ramachandran, Sowmya; Upshaw, Christin L; Hinkelman, Elizabeth; Lampton, Don; Jun 22, 2007; 15 pp.; In English
Report No.(s): AD-A476696; SHAI-TR2007-01; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA476696

The changing tactics of asymmetric threats present an ongoing need to disseminate lessons learned from the battlefield to a wide audience of personnel. Interactive virtual environments have been shown to be effective for team training, and distributed game-based architectures contribute an added benefit of wide accessibility. Reusable and distributable virtual training demonstrations can help minimize the cost of utilizing virtual environments to convey new knowledge, by limiting the need for new simulation behaviors or human role-players for each training event. We report our ongoing efforts to (1) research the nature and purpose of demonstration, articulating guidelines for effective demonstration within a training context, and (2) develop real world use cases where gaming technologies can produce effective training demonstrations.
DTIC
*Game Theory; Asymmetry; Human Performance; Lessons Learned; Personnel*

**20080018905** Naval Undersea Warfare Center, Newport, RI USA
**Olivo-Cerebellar Controller**
Bandyopadhyay, Promode R, Inventor; Jan 29, 2008; 83 pp.; In English
Report No.(s): AD-D020322; No Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/100.2/ADD020322

It is the general purpose and primary object of the present invention to provide control laws for the synchronization and phase angle control of multiple inferior olives (IO) used in a maneuvering controller or control system of an underwater vehicle. In order to attain the objects described, the present invention provides closed-loop control of multiple inferior olives (IOs) for maneuvering a Biorobotic Autonomous Undersea Vehicle (BAUV). A model is described where variables are associated with sub-threshold oscillations and low threshold spiking. Higher threshold spiking is also described.
DTIC
*Autonomy; Biomimetics; Cerebellum; Control; Control Systems Design; Controllers; Robotics; Underwater Vehicles*

## 67
## THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

**20080018122** Osaka Univ., Osaka, Japan
**Cavitation Instabilities in Inducers**
Tsujimoto, Yoshinobu; Nov 1, 2006; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476495; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476495

No abstract available
*Cavitation Flow; Stability*

**20080018255** Army Research Lab., Adelphi, MD USA
**Comparison of Outputs for Variable Combinations Used in Cluster Analysis on Polarmetric Imagery**
Petre, Melinda; Jan 2008; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476686; ARL-TR-4364; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476686

Polarimetric imaging provides potential for highlighting man-made objects amongst complex natural backgrounds because man-made objects emit radiation with a higher degree of polarization than natural environments. More specifically, two techniques, Cluster Analysis (CA) and Principle Component Analysis (PCA) can be combined to process Stoke s imagery by distinguishing between pixels, and producing groups of pixels with similar characteristics. In this study, an algorithm which performs PCA and CA on three to five of the Stoke s imagery at a time was run on the same image subsection for all sixteen possible combinations in order to observe the differences between the combinations. After the data was compiled, the most basic cluster image and corresponding data was compared across all combinations. It was found that the majority of the groups had significantly different mean values at the 95% confidence level, and of this majority, most remained significant at the 99.9% confidence level. In addition, 14/16 of the data sets had a significant proportion of pixels in the smaller cluster group at the 95% confidence level, with 7/14 remaining significant at the 99.9% confidence level.
DTIC
*Algorithms; Cluster Analysis; Imagery; Polarimetry*

**20080018321** Carnegie-Mellon Univ., Pittsburgh, PA USA
**An Online Algorithm for Maximizing Submodular Functions**
Streeter, Matthew; Golovin, Daniel; Dec 20, 2007; 40 pp.; In English
Contract(s)/Grant(s): FA8750-05-C-0033
Report No.(s): AD-A476871; CMU-CS-07-171; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476871

We consider the following two problems. We are given as input a set of activities and a set of jobs to complete. Our goal is to devise a schedule for allocating time to the various activities so as to achieve one of two objectives: minimizing the average time required to complete each job, or maximizing the number of jobs completed within a fixed time. Formally, a schedule is a sequence where each pair represents investing time in an activity. We assume that the fraction of jobs completed

is a monotone submodular function of the sequence of pairs that appear in a schedule. We consider these problems in the online setting, in which the jobs arrive one at a time and we must finish each job 'via some schedule' before moving on to the next. We give an efficient online algorithm for this problem whose worst-case asymptotic performance is simultaneously optimal for both objectives in the sense that its performance ratio 'with respect to the optimal static schedule' converges to the best approximation ratios for the corresponding offline problems. Finally, we evaluate this algorithm experimentally by using it to learn, online, a schedule for allocating CPU time to the solvers entered in the 2007 SAT solver competition.
DTIC
*Algorithms; On-Line Systems*

**20080018355** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
**Investigation of Radio Frequency Discharges and Langmuir Probe Diagnostic Methods in a Fast Flowing Electronegative Background Gas**
Lockwood, Nathaniel P; Dec 2007; 326 pp.; In English
Report No.(s): AD-A476968; AFIT/DS/ENP/DSP-04J; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476968

Discharges in a flowing background gas are used to produce charged and excited species for numerous applications including etching semiconductors and pumping gas discharge lasers (Pinhero and others, 1998). The effect of a flowing background gas on the charged and excited neutral species generation by an RF discharge in a flow tube and the diagnostics of the resulting plasma with a Langmuir probe have been investigated for pressures between 0.001 to 1 Torr and flow velocities up to 1000 m/s. This investigation was performed using a fluid method coupled to a chemical kinetic model and a hybrid Particle-In-Cell/Monte Carlo Collision modeling method based on the approaches of Boeuf, 1987 and Cartwright and others, 2000. A factor of two reduction in the sheath length was realized for an increase in flow velocity from 25 m/s to 500 m/s. This resulted in an increased average ionization rate and factor of ten increases in positive and negative ion densities, while the electron densities remained approximately constant. At pressures less than 0.01 Torr, existing probe theory was adequate for performing diagnostics, however, at pressures of 1 Torr convection limited probe theory underestimated the positive ion density of the flowing electronegative plasma by up to 50%.
DTIC
*Electrostatic Probes; Gas Discharges; Gas Flow; Ion Density (Concentration); Plasma Sheaths; Plasmas (Physics); Radio Frequencies*

## 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*.

**20080018170** Missouri Univ., Columbia, MO USA
**Ferroelectric Plasma Thruster**
Kovaleski, Scott D; Kemp, Mark A; Feb 29, 2008; 10 pp.; In English
Contract(s)/Grant(s): FA9550-05-1-0421
Report No.(s): AD-A476588; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476588

The Ferroelectric Plasma Thruster (FEPT) has been developed as an electrostatic micropropulsion thruster for the smallest classes of spacecraft. The FEPT consists of a thin wafer of lithium niobate ferroelectric material, with a solid electrode on one side, and an electrode with an aperture on the other. When radiofrequency high voltage is applied between the electrodes, through the thickness of the crystal, a combination of triple point and piezoelectric effects produce dense plasma on the crystal surface. The ions from this plasma are accelerated by the applied field on the positive half cycle producing thrusts measured to be between 61 and 87 microNewtons, depending on applied voltage. Electrons are emitted during the negative half cycle, making the device potentially self-neutralizing. The ion beam consisted of silver ions applied to the crystal surface and crystal materials. Ion energies were measured to be about 97 eV with 12 nC in each ion pulse. The specific impulse was measured

to be between 183-587 5, with some neutral flow. Thrust efficiency was between 1-4%, with power input between 4 and 20 W.
DTIC
*Electrostatics; Ferroelectric Materials; Ferroelectricity; Lithium Niobates; Piezoelectricity; Plasmas (Physics)*

**20080018196** North Carolina State Univ., Raleigh, NC USA
**Model Development and Model-Based Control Design for High Performance Nonlinear Smart Systems**
Smith, Ralph C; Nov 20, 2007; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0203
Report No.(s): AD-A476681; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476681

We have developed a unified energy-based framework for quantifying hysteresis and constitutive nonlinearities inherent to piezoelectric, magnetic, and shape memory compounds which is amenable to inversion and subsequent use as an inverse filter for linear control designs. We have also developed stochastic modeling techniques which quantify the highly complex stiffness properties of ionic polymers in a manner which facilitates design in applications ranging from biological/chemical detection to robotic design for aerospace structures. The control component has focused on the development of robust linear designs exploiting nonlinear filters and fully nonlinear algorithms which incorporate modeled physics directly into the control design. Open loop control experiments have been performed and present investigations are focused on closed loop experimental validation of the control theories.
DTIC
*Hysteresis; Model Reference Adaptive Control; Models; Nonlinear Systems*

**20080018499** Fermi National Accelerator Lab., Batavia, IL, USA; Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands
**Measurement of Masses and Lifetimes of B Hadrons**
Filthaut, F.; Jan. 01, 2006; 4 pp.; In English
Report No.(s): DE2007-903134; FERMILAB-CONF-07-111-E; No Copyright; Avail.: National Technical Information Service (NTIS)

We present recent measurements by the CDF and D0 Collaborations at the Tevatron Collider on the masses and lifetimes of B hadrons. The results are compared to predictions based on Heavy Quark Effective Theory, lattice gauge theory, and quark models.
NTIS
*Hadrons; Gauge Theory; Quark Models*

**20080018564** Naval Observatory, Washington, DC USA
**Characterizing Three Candidate Magnetic Cataclysmic Variables From SDSS: XMM-Newton and Optical Follow-Up Observations**
Homer, Lee; Szkody, Paula; Henden, Arne; Chen, Bing; Schmidt, Gary D; Fraser, Oliver J; West, Andrew A; The Astronomical Journal; Aug 29, 2006; 132, pp. 2743-2754; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNGO4GG66G; AST-03-06080; P.S. AST 02-05875
Report No.(s): AD-A458936; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/100.2/ADA458936

In the latest in our series of papers on XMM-Newton and ground-based optical follow-up of new candidate magnetic cataclysmic variables (mCVs) found in the Sloan Digital Sky Survey, we report classifications of three systems: SDSS J144659.95+025330.3, SDSS J205017.84 053626.8, and SDSS J210131.26+105251.5. Both the X-ray and optical fluxes of SDSS J1446+02 are modulated on a period of 48:7 0:5 minutes, with the X-ray modulation showing the characteristic energy dependence of photoelectric absorption seen in many intermediate polars ( IP). A longer period modulation and radial velocity variation is also seen at around 4 hr, although neither data set is long enough to constrain this longer, likely orbital, period well. SDSS J2050 05 appears to be an example of the most highly magnetized class of mCV, a diskless, stream-fed polar. Its 1.57 hr orbital period is well constrained via optical eclipse timings; in the X-ray it shows both eclipses and an underlying strong, smooth modulation. In this case broadly phase resolved spectral fits indicate that this change in flux is the result of

a varying normalization of the dominant component (a 41 keV MEKAL plasma), plus the addition of a partial covering absorber during the lower flux interval. SDSS J2101+10 is a more perplexing system to categorize: its X-ray and optical fluxes exhibit no large periodic modulations; there are only barely detectable changes in the velocity structure of its optical emission lines; the X-ray spectra require only absorption by the interstellar medium; and the temperatures of the MEKAL fits are low, with maximum temperature components of either 10 or 25 keV. We conclude that SDSS J2101+10 cannot be an IP, nor likely a polar, but is rather most likely a disk accretor a low-inclination SW Sex star.
Author
*Cataclysmic Variables; Detection; Magnetic Fields; Magnetic Stars; Magnetization; Optical Measurement; Optical Properties; Photoelectricity; Visual Observation*

**20080018595** Lawrence Livermore National Lab., Livermore, CA USA
**LCLS XTOD Fixed Mask**
Duffy, P.; Fong, K.; January 2006; 10 pp.; In English
Contract(s)/Grant(s): DE-AC02-76SF00515
Report No.(s): DE2007-897938; UCRL-TR-225257; No Copyright; Avail.: National Technical Information Service (NTIS)
The fixed mask consists of a block of specified-composition tungsten heavy alloy (WHA) located at 723.335 meters (LCLS coordinates), and is upstream of the x-ray slit, primary wide-field-of-view systems, and diagnostics. The fixed mask will have a defined aperture, to limit radiation surrounding the free electron laser (FEL) from entering the front end enclosure (FEE).
NTIS
*Coherent Light; X Rays; Free Electron Lasers; Tungsten Alloys; Electron Beams; Linear Accelerators*

**20080018596** National Academy of Sciences - National Research Council, Washington, DC, USA
**AMO2010: Decadal Assessment and Outlook Report on Atomic, Molecular and Optical Science. Final Progress Report to the Deparment of Energy for August 1, 2005 to December 31, 2006**
January 2006; 55 pp.; In English
Contract(s)/Grant(s): DE-FG02-04ER15610
Report No.(s): DE2007-897476; No Copyright; Avail.: National Technical Information Service (NTIS)
The committee was charged to produce a comprehensive report on the status of AMO Science. The committee was charged to produce a report that: (1) Reviewed the field of AMO science, emphasize recent accomplishments, and identify new opportunities and compelling scientific questions; (2) Identified the impact of AMO science on other scientific fields, emerging technologies, and national needs; (3) Identified future workforce, societal and educational needs for AMO science; and (4) Made recommendations on how the U.S. research enterprise might realize the full potential of AMO science. The committee also produced an intermediate report addressing key research issues and themes facing the research community.
NTIS
*Atomic Physics; Atoms; Periodic Variations*

**20080018597** Boston Univ., Boston, MA USA; Columbia Univ., New York, NY, USA; Brookhaven National Lab., Upton, NY USA; Fermi National Accelerator Lab., Batavia, IL, USA
**National Computational Infrastructure for Lattice Gauge Theory: Final Report**
Brower, R.; Christ, N.; Creutz, M.; Mackenzie, P.; Negele, J.; January 2006; 28 pp.; In English
Contract(s)/Grant(s): DE-FC02-01ER41182; DE-FC02-01ER41180
Report No.(s): DE2007-896058; No Copyright; Avail.: National Technical Information Service (NTIS)
This is the final report of Department of Energy SciDAC Grant 'National Computational Infrastructure for Lattice Gauge Theory.' It describes the software developed under this grant, which enables the effective use of a wide variety of supercomputers for the study of lattice quantum chromodynamics (lattice QCD). It also describes the research on and development of commodity clusters optimized for the study of QCD. Finally, it provides some high lights of research enabled by the infrastructure created under this grant, as well as a full list of the papers resulting from research that made use of this infrastructure.
NTIS
*Measuring Instruments; Field Theory (Physics)*

**20080018675** Colorado Univ., Boulder, CO, USA

**Measurements of CKM Angle Beta from BaBar**

Ulmer, K. A.; May 01, 2007; 6 pp.; In English

Report No.(s): DE2007-907955; SLAC-PUB-12519; No Copyright; Avail.: Department of Energy Information Bridge

We present recent results of hadronic B meson decays related to the CKM angle Beta. The data used were collected by the BABAR detector at the PEP-II asymmetric-energy e(sup +)e(sup -) collider operating at the Gamma(4S) resonance located at the Stanford Linear Accelerator Cent.

NTIS

*Mesons; Particle Decay*

**20080018677** General Electric Co., Schenectady, NY, USA

**Design and Development of a 100 MVA HTS Generator for Commercial Entry. Final Technical Report September 27, 2001-September 30, 2006**

Dec. 30, 2006; 164 pp.; In English

Report No.(s): DE2007-907950; No Copyright; Avail.: National Technical Information Service (NTIS)

In 2002, General Electric and the US Department of Energy (DOE) entered into a cooperative agreement for the development of a commercialized 100 MVA generator using high temperature superconductors (HTS) in the field winding. The intent of the program was to: (1) Identify and develop technologies that would be needed for such a generator. (2) Develop conceptual designs for generators with ratings of 100 MVA and higher using HTS technology. (3) Perform proof of concept tests at the 1.5 MW level for GE's proprietary warm iron rotor HTS generator concept. (4) Design, build, and test a prototype of a commercially viable 100 MVA generator that could be placed on the power grid. This report summarizes work performed during the program and is provided as one of the final program deliverables.

NTIS

*Electric Generators; High Temperature Superconductors*

**20080018678** Brown Univ., Providence, RI, USA; Fermi National Accelerator Lab., Batavia, IL, USA; Indiana State Univ., Terre Haute, IN, USA; Northwestern Univ., Chicago, IL, USA

**D0 Experiment's Integrated Luminosity for Tevatron Run IIa**

Andeen, T.; Casey, B. C. K.; DeVaughan, K.; Enari, Y.; Gallas, E.; Apr. 18, 2007; 10 pp.; In English

Report No.(s): DE2007-907791; FERMILAB-TM-2365; No Copyright; Avail.: National Technical Information Service (NTIS)

An essential ingredient in all cross section measurements is the luminosity used to normalize the data sample. In this note, we present the final assessment of the integrated luminosity recorded by the DO experiment during Tevatron Run IIa. The luminosity measurement is derived from hit rates from the products of inelastic proton-antiproton collisions registered in two arrays of scintillation counters called the luminosity monitor (LM) detectors. Measured LM rates are converted to absolute luminosity using a normalization procedure that is based on previously measured inelastic cross sections and the geometric acceptance and efficiency of the LM detectors for registering inelastic events. During Run IIa, the LM detector performance was improved by a sequence of upgrades to the electronic readout system and other factors summarized in this note. The effects of these changes on the reported luminosity were tracked carefully during the run. Due to the changes, we partition the run into periods for which different conversions from measured LM rates to absolute luminosity apply. The primary upgrade to the readout system late in Run IIa facilitated a reevaluation of the overall normalization of the luminosity measurement for the full data sample.

NTIS

*Luminosity; Particle Accelerators*

## 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*.

**20080018103** Office of Naval Research, Arlington, VA USA
**Novel Acoustic Techniques for Assessing Fish Schooling in the Context of an Operational Ocean Observatory**
Schofield, Oscar; Glenn, Scott; Quinlan, John; Jan 2006; 8 pp.; In English
Contract(s)/Grant(s): N00014-05-1-0650
Report No.(s): AD-A476431; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476431

Fish aggregation is important in terms of biology, fisheries, and measurement, quantitative analyses of gregarious movement behaviors remain relatively rare (Turchin 1989). Fish aggregation has most often been studied in easily accessed fish or fish easily maintained in the laboratory such as minnows and dace (see a review in Pitcher and Parrish 1993). Measurements of fish aggregations are often difficult, particularly in pelagic environments. Our goal is to develop new acoustic techniques that have the potential to serve as measurement tools to quantify this ubiquitous and important behavior.
DTIC
*Acoustic Measurement; Fishes; Observatories; Oceans*

**20080018146** Naval Research Lab., Bay Saint Louis, MS USA
**Determination of Primary Spectral Bands for Remote Sensing of Aquatic Environments**
Lee, Zhongping; Carder, K L; Arnone, Robert A; He, MingXia; Dec 20, 2007; 15 pp.; In English
Report No.(s): AD-A476537; NRL/JA/7330-07-8033; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476537

About 30 years ago, NASA launched the first ocean-color observing satellite: the Coastal Zone Color Scanner. CZCS had 5 bands in the visible-infrared domain with an objective to detect changes of phytoplankton (measured by concentration of chlorophyll) in the oceans. Twenty years later, for the same objective but with advanced technology, the Sea-viewing Wide Field-of-view Sensor (SeaWiFS, 7 bands), the Moderate-Resolution Imaging Spectrometer (MODIS, 8 bands), and the Medium Resolution Imaging Spectrometer (MERIS, 12 bands) were launched. The selection of the number of bands and their positions was based on experimental and theoretical results achieved before the design of these satellite sensors. Recently, Lee and Carder (2002) demonstrated that for adequate derivation of major properties (phytoplankton biomass, colored dissolved organic matter, suspended sediments, and bottom properties) in both oceanic and coastal environments from observation of water color, it is better for a sensor to have IS bands in the 400 - 800 nm range. In that study, however, it did not provide detailed analyses regarding the spectral locations of the IS bands. Here, from nearly 400 hyperspectral ( 3- nm resolution) measurements of remote-sensing reflectance (a measure of water color) taken in both coastal and oceanic waters covering both optically deep and optically shallow waters, first- and second-order derivatives were calculated after interpolating the measurements to I-nm resolution. From these derivatives, the frequency of zero values for each wavelength was accounted for, and the%distribution spectrum of such frequencies was obtained. Furthermore, the wavelengths that have the highest appearance of zeros were identified.
DTIC
*Coasts; Environmental Monitoring; Marine Biology; Marine Environments; Ocean Bottom; Remote Sensors; Spectral Bands*

**20080018171** Army Engineer Research and Development Center, Vicksburg, MS USA
**Experimental Effects of Lime Application on Aquatic Macrophytes: 3. Growth Response Versus Exposure Time**
James, William F; Jan 2008; 6 pp.; In English
Report No.(s): AD-A476589; ERDC/TN-APCRP-EA-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476589

This research investigates the effects of exposure time to lime-induced high pH and inorganic carbon limitation on the growth, survivorship, and reproductive success of Sago Pondweed (Stuckenia pectinatus).
DTIC
*Aquatic Plants; Calcium Oxides; Exposure*

**20080018333** Washington Univ., Seattle, WA USA

**Bubble Plumes and Breaking Waves: Measurements from R/P FLIP, January 1992**

Dahl, Peter H; Jessup, Andrew T; May 1992; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00039-91-C-0072

Report No.(s): AD-A476904; TM 2-92; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476904

This report is the first in a series of three covering APL-UW measurements of bubble plumes and breaking waves from R/P FLIP off the coast of California in January 1992. The overall objective of the experiment was to obtain realistic parameterizations of bubble plumes for use in modds that predict low-frequency surface reveberation. The principal measurement objective was achieved: simultaneous, in situ measurements of bubble plumes and breaking waves using acoustic, microwave, and video systems trained on the same surface patch of the ocean. This report briefly summarizes the experiment, the range of environmental conditions encountered, the method of aligning the instruments, and the type and quantity of data gathered. Examples of acoustic data are given which clearly show bubble field growth; the appearance of one of these plumes was coincident with a wave-breaking event that was simultaneously detected with the microwave and video systems.

DTIC

*Acoustic Properties; Bubbles; Plumes; Sound Waves*

**20080018589** NASA Langley Research Center, Hampton, VA, USA

**Configuration Effects on Acoustic Performance of a Duct Liner**

Gerhold, Carl H.; Brown, Martha C.; Jones, Michael G.; Nark, Douglas; Howerton, Brian M.; May 05, 2008; 30 pp.; In English; 14th AIAA/CEAS Aeroacoustic Conference, 5-7 May 2008, Vancouver, Canada; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.18.03; Copyright; Avail.: CASI: A03, Hardcopy

Continued success in aircraft engine noise reduction necessitates ever more complete understanding of the effect that flow path geometry has on sound propagation in the engine. The Curved Duct Test Rig (CDTR) has been developed at NASA Langley Research Center to investigate sound propagation through a duct of comparable size (approximately the gap of GE90) and physical characteristics to the aft bypass duct of typical aircraft engines. The liner test section is designed to mimic the outer/inner walls of an engine exhaust bypass duct that has been unrolled circumferentially. Experiments to investigate the effect of curvature along the flow path on the acoustic performance of a test liner are performed in the CDTR and reported in this paper. Flow paths investigated include both straight and curved with offsets from the inlet to the discharge plane of and 1 duct width, respectively. The test liners are installed on the side walls of the liner test section. The liner samples are perforate over honeycomb core, which design is typical of liners installed in aircraft nacelles. In addition to fully treated side walls, combinations of treated and acoustically rigid walls are investigated. While curvature in the hard wall duct is found not to reduce the incident sound significantly, it does cause mode scattering. It is found that asymmetry of liner treatment causes scattering of the incident mode into less attenuated modes, which degrades the overall liner attenuation. It is also found that symmetry of liner treatment enhances liner performance by eliminating scattering into less attenuated modes. Comparisons of measured liner attenuation with numerical results predicted by an analytic model based on the parabolic approximation (CDUCT-LaRC) have also been made and are reported in this paper. The effect of curvature in the rigid wall configuration estimated by CDUCT-LaRC is similar to the observed results, and the mode scattering seen in the measurements also occurs in the analytic model results. The analytic model and experiment show similar differences of overall attenuation between one wall treated and both walls treated.

Author

*Acoustic Properties; Noise Reduction; Ducts; Curvature; Sound Propagation; Engine Noise*

**20080018646** NASA Langley Research Center, Hampton, VA, USA

**Application of Fast Multipole Methods to the NASA Fast Scattering Code**

Dunn, Mark H.; Tinetti, Ana F.; May 05, 2008; 13 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color illustrations

Contract(s)/Grant(s): NNL07AA24C; WBS 561581.02.08.07.18.03; Copyright; Avail.: CASI: A03, Hardcopy

The NASA Fast Scattering Code (FSC) is a versatile noise prediction program designed to conduct aeroacoustic noise reduction studies. The equivalent source method is used to solve an exterior Helmholtz boundary value problem with an impedance type boundary condition. The solution process in FSC v2.0 requires direct manipulation of a large, dense system

of linear equations, limiting the applicability of the code to small scales and/or moderate excitation frequencies. Recent advances in the use of Fast Multipole Methods (FMM) for solving scattering problems, coupled with sparse linear algebra techniques, suggest that a substantial reduction in computer resource utilization over conventional solution approaches can be obtained. Implementation of the single level FMM (SLFMM) and a variant of the Conjugate Gradient Method (CGM) into the FSC is discussed in this paper. The culmination of this effort, FSC v3.0, was used to generate solutions for three configurations of interest. Benchmarking against previously obtained simulations indicate that a twenty-fold reduction in computational memory and up to a four-fold reduction in computer time have been achieved on a single processor.
Author
*Noise Prediction; Aerodynamic Noise; Noise Reduction; Boundary Conditions; Conjugate Gradient Method; Excitation; Multipoles; Aeroacoustics; Impedance*

**20080018647** NASA Langley Research Center, Hampton, VA, USA
**Validation of Ray Tracing Code Refraction Effects**
Heath, Stephanie L.; McAninch, Gerry L.; Smith, Charles D.; Conner, David A.; May 05, 2008; 11 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 877868.02.07.07.04.01
Report No.(s): AIAA Paper-2008-2994; Copyright; Avail.: CASI: A03, Hardcopy

NASA's current predictive capabilities using the ray tracing program (RTP) are validated using helicopter noise data taken at Eglin Air Force Base in 2007. By including refractive propagation effects due to wind and temperature, the ray tracing code is able to explain large variations in the data observed during the flight test.
Author
*Ray Tracing; Refraction; Aircraft Noise; Flight Tests; Wind (Meteorology); Refractivity; Noise Prediction*

**20080018648** NASA Langley Research Center, Hampton, VA, USA
**Noise Radiation from a Continuous Mold-Line Link Flap Configuration**
Hutcheson, Florence V.; Brooks, Thomas F.; Humphreys, William M.; May 05, 2008; 18 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.07.18.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018648

The results of an experimental study of the noise from a Continuous Mold-Line Link (CML) flap are presented. Acoustic and unsteady surface pressure measurements were performed on a main element wing section with a half-span CML flap in NASA Langley s Quiet Flow Facility. The acoustic data were acquired with a medium aperture directional array (MADA) of microphones. The Deconvolution Approach for the Mapping of Acoustic Sources (DAMAS) method is applied to determine the spatial distribution and strength of the noise sources over the surface of the test model. A Coherent Output Power (COP) method which relates the output from unsteady surface pressure sensors to the output of the MADA is also used to obtain more detailed characteristics of the noise source distribution in the trailing edge region of the CML. These results are compared to those obtained for a blunt flap to quantify the level of noise benefit that is achieved with the CML flap. The results indicate that the noise from the CML region of the flap is 5 to 17 dB lower (depending on flap deflection and Mach number) than the noise from the side edge region of the blunt flap. Lower noise levels are obtained for all frequencies. Spectral analysis of the noise from the cove region of the CML and blunt flap models also reveal a spectral peak in the high frequency range that is related to noise scattering at the trailing edge of the main element. The peaks in the CML and blunt flap cove noise spectra are close in level and often exceed blunt side edge noise. Applying a strip of serrated tape to the trailing edge of the CML flap model main airfoil, reduced the peak but increased other noise somewhat. Directivity measurements show that the CML flap can be more directional than the blunt flap.
Author
*Flapping; Aeroacoustics; Sound Waves; Noise Generators; Wing Flaps; Trailing Edges; Sound Pressure; Noise Reduction; Airfoils; Pressure Sensors*

**20080018649** NASA Langley Research Center, Hampton, VA, USA

**Preliminary Analysis of Acoustic Measurements from the NASA-Gulfstream Airframe Noise Flight Test**

Khorrami, Mehdi R.; Lockhard, David D.; Humphreys, Willliam M.; Choudhari, Meelan M.; Van De Ven, Thomas; May 05, 2008; 19 pp.; In English; 14th AIAA/CEAS Acoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868; Copyright; Avail.: CASI: A03, Hardcopy

The NASA-Gulfstream joint Airframe Noise Flight Test program was conducted at the NASA Wallops Flight Facility during October, 2006. The primary objective of the AFN flight test was to acquire baseline airframe noise data on a regional jet class of transport in order to determine noise source strengths and distributions for model validation. To accomplish this task, two measuring systems were used: a ground-based microphone array and individual microphones. Acoustic data for a Gulfstream G550 aircraft were acquired over the course of ten days. Over twenty-four test conditions were flown. The test matrix was designed to provide an acoustic characterization of both the full aircraft and individual airframe components and included cruise to landing configurations. Noise sources were isolated by selectively deploying individual components (flaps, main landing gear, nose gear, spoilers, etc.) and altering the airspeed, glide path, and engine settings. The AFN flight test program confirmed that the airframe is a major contributor to the noise from regional jets during landing operations. Sound pressure levels from the individual microphones on the ground revealed the flap system to be the dominant airframe noise source for the G550 aircraft. The corresponding array beamform maps showed that most of the radiated sound from the flaps originates from the side edges. Using velocity to the sixth power and Strouhal scaling of the sound pressure spectra obtained at different speeds failed to collapse the data into a single spectrum. The best data collapse was obtained when the frequencies were left unscaled.

Author

*Aerodynamic Noise; Aircraft Noise; Flight Tests; Noise Generators; Acoustic Measurement; Acoustic Properties; Airframes; Sound Pressure; Airspeed*

**20080018650** NASA Langley Research Center, Hampton, VA, USA

**Uncertainty and Sensitivity Analyses of Duct Propagation Models**

Nark, Douglas M.; Watson, Willie R.; Jones, Michael G.; May 05, 2008; 13 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.18.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080018650

This paper presents results of uncertainty and sensitivity analyses conducted to assess the relative merits of three duct propagation codes. Results from this study are intended to support identification of a 'working envelope' within which to use the various approaches underlying these propagation codes. This investigation considers a segmented liner configuration that models the NASA Langley Grazing Incidence Tube, for which a large set of measured data was available. For the uncertainty analysis, the selected input parameters (source sound pressure level, average Mach number, liner impedance, exit impedance, static pressure and static temperature) are randomly varied over a range of values. Uncertainty limits (95% confidence levels) are computed for the predicted values from each code, and are compared with the corresponding 95% confidence intervals in the measured data. Generally, the mean values of the predicted attenuation are observed to track the mean values of the measured attenuation quite well and predicted confidence intervals tend to be larger in the presence of mean flow. A two-level, six factor sensitivity study is also conducted in which the six inputs are varied one at a time to assess their effect on the predicted attenuation. As expected, the results demonstrate the liner resistance and reactance to be the most important input parameters. They also indicate the exit impedance is a significant contributor to uncertainty in the predicted attenuation.

Author

*Ducts; Sound Pressure; Reactance; Static Pressure; Grazing Incidence; Impedance; Linings; Sensitivity Analysis*

**20080018651** NASA Langley Research Center, Hampton, VA, USA

**Initial Integration of Noise Prediction Tools for Acoustic Scattering Effects**

Nark, Douglas M.; Burley, Casey L.; Tinetti, Ana; Rawls, John W.; May 05, 2008; 17 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.18.03; Copyright; Avail.: CASI: A03, Hardcopy

This effort provides an initial glimpse at NASA capabilities available in predicting the scattering of fan noise from a non-conventional aircraft configuration. The Aircraft NOise Prediction Program, Fast Scattering Code, and the Rotorcraft Noise Model were coupled to provide increased fidelity models of scattering effects on engine fan noise sources. The integration of these codes led to the identification of several keys issues entailed in applying such multi-fidelity approaches.

In particular, for prediction at noise certification points, the inclusion of distributed sources leads to complications with the source semi-sphere approach. Computational resource requirements limit the use of the higher fidelity scattering code to predict radiated sound pressure levels for full scale configurations at relevant frequencies. And, the ability to more accurately represent complex shielding surfaces in current lower fidelity models is necessary for general application to scattering predictions. This initial step in determining the potential benefits/costs of these new methods over the existing capabilities illustrates a number of the issues that must be addressed in the development of next generation aircraft system noise prediction tools.
Author
*Noise Prediction; Acoustic Scattering; Aerodynamic Noise; Engine Noise; Sound Pressure; Noise Generators; Rotary Wing Aircraft*

**20080018652** NASA Glenn Research Center, Cleveland, OH, USA
**Foam-Metal Liner Attenuation of Low-Speed Fan Noise**
Sutliff, Daniel R.; Jones, Michael G.; May 05, 2008; 17 pp.; In English; 14th AIAA/CEAS Aeroacoustics Conference, 5-7 May 2008, Vancouver, Canada; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.07
Report No.(s): AIAA Paper 2008-2897; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018652

A foam-metal liner for attenuation of fan noise was developed for and tested on a low speed fan. This type of liner represents a significant advance over traditional liners due to the possibility for placement in close proximity to the rotor. An advantage of placing treatment in this region is the modification of the acoustic near field, thereby inhibiting noise generation mechanisms. This can result in higher attenuation levels than can be achieved by liners located in the nacelle inlet. In addition, foam-metal liners could potentially replace the fan rub-strip and containment components, ultimately reducing engine components and thus weight, which can result in a systematic increase in noise reduction and engine performance. Foam-metal liners have the potential to reduce fan noise by 4 dB based on this study.
Author
*Noise Generators; Foams; Linings; Aerodynamic Noise; Acoustics; Sound Fields; Noise Reduction*

**20080018665** Lawrence Livermore National Lab., Livermore, CA USA; California Univ., Berkeley, CA, USA
**System and Method for Characterizing Voiced Excitations of Speech and Acoustic Signals, Removing Acoustic Noise from Speech, and Synthesizing Speech**
Burnett, G. C., Inventor; Holzrichter, J. F., Inventor; Ng, L. C., Inventor; Aug. 03, 2005; 25 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-48
Patent Info.: Filed Filed 3 Aug 05; US-Patent-Appl-SN-11-198-287
Report No.(s): PB2007-109434; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention is a system and method for characterizing human (or animate) speech voiced excitation functions and acoustic signals, for removing unwanted acoustic noise which often occurs when a speaker uses a microphone in common environments, and for synthesizing personalized or modified human (or other animate) speech upon command from a controller. A low power EM sensor is used to detect the motions of windpipe tissues in the glottal region of the human speech system before, during, and after voiced speech is produced by a user. From these tissue motion measurements, a voiced excitation function can be derived. Further, the excitation function provides speech production information to enhance noise removal from human speech and it enables accurate transfer functions of speech to be obtained. Previously stored excitation and transfer functions can be used for synthesizing personalized or modified human speech. Configurations of EM sensor and acoustic microphone systems are described to enhance noise cancellation and to enable multiple articulator measurements.
NTIS
*Signal Transmission; Sound Waves; Speech Recognition; Noise (Sound)*

**20080018679** Washington Univ., Seattle, WA USA
**Note on the Calculation of the Spherically Aberrated Field of an Acoustic Lens**
Cornelius, Terence A; Williams, Kevin L; Sep. 1992; 42 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NOOO39-91-C-O072
Report No.(s): AD-A476908; APL-UW-TM-7-92; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476908

A treatment of the propagation of plane sound waves into a hemispherical acoustic lens is presented - first, in terms of

geometrical acoustics, showing the utility and the limitations of that approach, and then in terms of a hybrid approach that incorporates geometrical acoustics and wave acoustics. The nature of the spherical aberration that characterizes such systems is investigated, and special attention is paid to the caustics formed. The main result is the determination of the pressure field in the vicinity of the focusing region of the lens. The spherically aberrated field has an ellipsoidal shaped focusing region; its shape is determined by the relative sound speeds of the water external to the lens and the lens fluid.
DTIC
*Acoustics; Lenses; Sound Waves*

**20080018709** Brimrose Corp. of America, Baltimore, MD, USA
**A New Kind of Laser Microphone Using High Sensitivity Pulsed Laser Vibrometer**
Wang, Chen-Chia; Trivedi, Sudhir; Jin, Feng; Swaminathan, V.; Prasad, Narasimha S.; May 04, 2008; 2 pp.; In English; CLEO 2008, 4-9 May 2008, San Jose CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 478643.02.02.02.15; Copyright; Avail.: CASI: A01, Hardcopy

We demonstrate experimentally a new kind of laser microphone using a highly sensitive pulsed laser vibrometer. By using the photo-electromotive-force (photo-EMF) sensors, we present data indicating the real-time detection of surface displacements as small as 4 pm.
Author
*Pulsed Lasers; Microphones; Vibration Meters; Electromotive Forces*

**20080018859** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands
**Sound Exposure Level of F-16 Crew Chiefs Using Communications Earplugs**
Houben, M. M. J.; Verhave, J. A.; Geurtsen, F. W .M.; March 2008; 28 pp.; In Dutch; Original contains color and black and white illustrations
Report No.(s): TD2008-0020; TNO-DV 2008 A054; Copyright; Avail.: Other Sources

For communication in noisy environments, communications earplugs (CEPs) are increasingly used. CEPs are earplugs that incorporate a miniature speaker through which communication can be presented to the user unattenuated while the earplugs do attenuate environmental sounds. To assess the sound exposure level of CEP users, not only environmental sounds should be taken into account, but also the sound exposure resulting from communication through the CEP. For this, a measurement method has been developed. It uses loudness matching to establish the relation between electric level to the CEP and perceived sound level. During activities, both the environmental noise and the electric signal to the CEP are recorded. The level of the environmental sounds, after attenuation by the hearing protection, is combined with the sound level produced by the CEP, which is determined from the electric level. This method is applied to F-16 crew chiefs at Air Base Volkel, a population that uses CEPs extensively in extremely noisy conditions. Our calculations show that communication through CEP significantly contributes to the sound exposure level of the crew chiefs. The estimated day dose, based on two launches and recoveries, is 79 dB(A), which is just below the maximum allowed level of 80 dB(A).
Author
*Aircraft Noise; Loudness; F-16 Aircraft; Ear Protectors; Exposure*

## 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*.

**20080018088** Library of Congress, Washington, DC USA
**Nuclear Power Plant Security and Vulnerabilities**
Holt, Mark; Andrews, Anthony; Jan 18, 2008; 11 pp.; In English
Report No.(s): AD-A476400; CRS-RL34331; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476400

The physical security of nuclear power plants and their vulnerability to deliberate acts of terrorism was elevated to a national security concern following the events of September 11, 2001. Title VI of the Energy Policy Act of 2005 regarding nuclear security amended the Atomic Energy Act with the addition of new provisions for security evaluations and rule making to revise the 'Design Basis Threat.' The act included provisions for fingerprinting and criminal background checks of security

personnel, their use of firearms, and the unauthorized introduction of dangerous weapons. The designation of facilities subject to enforcement of penalties for sabotage expanded to include treatment and disposal facilities. As part of security response evaluations, the act requires the Nuclear Regulatory Commission (NRC) to conduct 'force-on-force' security exercises at nuclear power plants at least once every three years, and revise the 'design-basis threat' to consider a wider variety of potential attacks. The NRC has strengthened its regulations on nuclear power plant security, but critics contend that implementation by the industry has been too slow and that further measures are needed. Vulnerability to a deliberate aircraft crash remains an outstanding issue, as the latest NRC rule making addresses only newly designed plants. Shortcomings in the performance of security contractors has drawn the attention of Congress. This report will be updated as events warrant.
DTIC
*Law (Jurisprudence); Nuclear Power Plants; Security; Terrorism; Vulnerability*

**20080018335** Naval Surface Weapons Center, Silver Spring, MD USA
**Dependence of the Electron Energy Distribution on the Vibrational Temperature in the Electrically Excited N2**
Chen, H C; Ali, A W; Phelps, A V; May 1985; 23 pp.; In English
Report No.(s): AD-A476909; NSWC MP 85-206; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476909

The effects of the vibrational excitation and deexcitation of nitrogen molecules in an electrical discharge on the electron energy distributions and transport coefficients are investigated theoretically. The electrons collide with vibrationally excited molecules either gain or lose energy which results in the redistribution of the electron energy. The distribution function is calculated numerically by solving the Boltzmann equation, using a complete set of elastic momentum transfer and inelastic cross sections. The presence of vibrationally excited molecules which collide and exchange energy with the electrons has a strong effect on the electron energy distribution function. This effect is demonstrated for various vibrational temperatures. The energy distributions are calculated at the ratio of electric field to gas density E/N which ranges from 10(-16) to 20 x 10(-16) V cm2 . Generally, as the vibrational temperature increases, the electrons become richer in the high-energy tail of the distribution function.
DTIC
*Diatomic Gases; Electric Discharges; Electron Energy; Molecular Excitation; Nitrogen; Vibration*

## 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*.

**20080018148** Naval Research Lab., Bay Saint Louis, MS USA
**Forecasting Coastal Optical Properties using Ocean Color and Coastal Circulation Models**
Arnone, Robert A; Casey, Brandon J; Ko, Dong S; Flynn, Peter M; Carrolo, L; Ladner, Sherwin; Feb 1, 2008; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476539; NRL/PP/7330-07-7241; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476539

Coupling the 3-D ocean optical imagery with 3-D circulation models provides a new capability to understand coastal processes. Particle distribution derived from ocean color optical properties were coupled with numerical circulation models to determine a 24 hour forecast of particle concentrations. A 3-D particle concentration field for the coastal ocean was created by extending the surface satellite bio-optical properties vertically by parameterzing an expediential Gaussian depth profile. The shape of the vertical particle profile was constrained by I) the depth of the 1% light level 2) the mixed layer depth 3) the intensity of the layer stratification and 4) subsurface current field and the surface bio-optical properties were obtained by MODAS ocean optical products (phytoplankton absorption and backscattering) and the Intra-Americal Sea Nowcast Forecast System- Naval Coastal Ocean Model....
DTIC
*Coasts; Forecasting; Ocean Surface; Optical Properties; Water Color*

**20080018151** Naval Research Lab., Bay Saint Louis, MS USA

**A Practical Point Spread Model for Ocean Waters**

Hou, Weilin; Gray, Deric; Weidemann, Alan D; Arnone, Robert A; Feb 4, 2008; 7 pp.; In English

Report No.(s): AD-A476543; NRL/PP/7330-07-7210; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476543

The scattering properties of the medium ultimately determine the outcome of the image transmission. For ocean optics research the scattering properties are often conveniently described and measured in general by the scattering coefficient (b), which determines the possibility of a photon to be scattered away from its original traveling direction per unit length by the medium molecules, constituents within (i.e. particles) and turbulence. As we know, this parameter (b) is an integration of the volume scattering or phase function, Beta, which details such probability by the relative directions of incoming and out-going photons. These inherent optical properties (IOP), although measured frequently due to their important applications in ocean optics, especially in remote sensing, cannot be applied to underwater imaging issues directly, since they inherently reflect the chance of the single scattering.

DTIC

*Oceans; Optical Properties; Point Spread Functions*

**20080018152** Naval Research Lab., Bay Saint Louis, MS USA

**Development of Finer Spatial Resolution Optical Properties from MODIS**

Ladner, S D; Sandidge, J C; Lyon, P E; Arnone, R A; Gould, R W; Lee, Z P; Martinolich, P M; Feb 4, 2008; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476546; NRL/PP/7330-07-7242; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476546

Typical MODIS ocean color products are at 1 kilometer (km) spatial resolution, although two 250 meter (m) and five 500 m bands are also available on the sensor. We couple these higher resolution bands with the 1km bands to produce pseudo-250m resolution MODIS bio-optical properties. Finer resolution bio-optical products from space significantly improve our capability for monitoring coastal ocean and estuarine processes. Additionally, increased resolution is required for validation of ocean color products in coastal regions due to the shorter spatial scales of coastal processes and greater variability compared to open-ocean regions. Using the 250m bands coupled with the 1 km and 500m bands (which are bi-linearly interpolated to 250m resolution), we estimate remote sensing reflectances (Rrs) at 250m resolution following atmospheric correction. The aerosol correction makes use of the 1km near infrared (MR) bands at 748 nanometers (nm) and 869 nm to determine aerosol type and concentration. The water leaving radiances in the MR bands are modeled from retrieved water leaving radiances in the visible bands using the short wave infrared (SWIR) channels at 1240 nm and 2130 nm. The increased resolution spectral Rrs channels are input into bio-optical algorithms (Quasi. Analytical Algorithm (QAA), Water Mass Classification, OC2, etc.) that have traditionally used the 1 km reflectances resulting in finer resolution products. Finer resolution bio-optical properties are demonstrated in bays, estuaries, and coastal regions providing new capabilities for MODIS applications in coastal areas. The finer resolution products of total absorption (at), phytoplankton absorption (aph), Color-Dissolved Organic Matter (CDOM) absorption (ag) and backscattering (bb) are compared with the 1 km products and in situ observations. We demonstrate that finer resolution is required for validation of coastal products in order to improve match ups of in situ data with the high spatial variability.

DTIC

*Color Vision; Imaging Spectrometers; MODIS (Radiometry); Optical Properties; Radiance; Resolution; Spatial Resolution*

**20080018318** Naval Surface Warfare Center, Dahlgren, VA USA

**Vibration Testing of Fiber Optic Components**

Brown, G D; Ingold, J P; Spence, S E; Mar 1990; 26 pp.; In English

Report No.(s): AD-A476861; NSWC-TR-90-41; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA476861

This report documents the results of vibration testing of fiber optic connectors and splices conducted at the Naval Surface Warfare Center (NSWC) from 22 July to 1 August 1988. The objective of this report is to evaluate the performances of these components in a vibration environment according to their generic construction. Additionally, the detailed fiber optic component test procedures, the test facilities, and the component preparation and test setup are evaluated. A brief review of previous vibration testing is included and general trends in the performance of generic designs are expanded upon. The test results are compared to current specifications for fiber optic components aboard naval surface ships and recommendations are made for the concluded best generic designs. The Naval Sea Systems Command (NAVSEA) Fiber Optic program Office was

established to accelerate the introduction of fiber optic technology into the U.S. Navy, concentrating primarily on surface combatants. The fiber optic environmental test program was developed to assist the Fiber Optic Program Office in the development of fiber optic component specifications and standards. NSWC was tasked by the Fiber Optic Program Office to develop an overall fiber optic component test plan, review the literature for previous test documentation and results, develop detailed environmental test procedures, and perform environmental testing of fiber optic components and analysis of the results, providing recommendations for the component specifications and standards. This report delivers the recommendations for the fiber optic connector and splice designs and their associated performances, based on the vibration tests conducted and information available from published literature. Additional reports detailing component performances in other environments are in process.
DTIC
*Connectors; Fiber Optics; Performance Tests; Vibration*

**20080018437** Lawrence Livermore National Lab., Livermore, CA USA; California Univ., Berkeley, CA, USA
**Sensor-Guided Threat Countermeasure System**
Stuart, B. C., Inventor; Hackel, L. A., Inventor; Hermann, M. R., Inventor; Armstrong, J. P., Inventor; 30 Jun 04; 25 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-48
Patent Info.: Filed Filed 30 Jun 04; US-Patent-Appl-SN-10-883-240
Report No.(s): PB2007-109449; No Copyright; Avail.: CASI: A03, Hardcopy

A countermeasure system for use by a target to protect against an incoming sensor-guided threat. The system includes a laser system for producing a broadband beam and means for directing the broadband beam from the target to the threat. The countermeasure system comprises the steps of producing a broadband beam and directing the broad band beam from the target to blind or confuse the incoming sensor-guided threat.
NTIS
*Countermeasures; Laser Applications; Patent Applications*

**20080018482** Los Alamos National Lab., NM USA
**Planar Optical Waveguide Based Sandwich Assay Sensors and Processes for the Detection of Biological Targets Including Early Detection of Cancers**
Martinez, J. S., Inventor; Swanson, B. I., Inventor; Shively, J. E., Inventor; Li, L., Inventor; Jun. 29, 2005; 12 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-36
Patent Info.: Filed Filed 29 Jun 05; US-Patent-Appl-SN-11 172 244
Report No.(s): PB2007-111864; No Copyright; Avail.: CASI: A03, Hardcopy

An assay element is described including recognition ligands adapted for binding to carcinoembryonic antigen (CEA) bound to a film on a single mode planar optical waveguide, the film from the group of a membrane, a polymerized bilayer membrane, and a self-assembled monolayer containing polyethylene glycol or polypropylene glycol groups therein and an assay process for detecting the presence of CEA is described including injecting a possible CEA-containing sample into a sensor cell including the assay element, maintaining the sample within the sensor cell for time sufficient for binding to occur between CEA present within the sample and the recognition ligands, injecting a solution including a reporter ligand into the sensor cell; and, interrogating the sample within the sensor cell with excitation light from the waveguide, the excitation light provided by an evanescent field of the single mode penetrating into the biological target-containing sample to a distance of less than about 200 nanometers from the waveguide thereby exciting any bound reporter ligand within a distance of less than about 200 nanometers from the waveguide and resulting in a detectable signal.
NTIS
*Assaying; Cancer; Detection; Diagnosis; Optical Waveguides; Patent Applications; Proteins; Target Acquisition; Thin Films*

**20080018664** Geological Survey, Reston, VA USA; South Carolina Sea Grant Program, Charleston, SC, USA
**Morphology and Textures of Modern Sediments on the Inner Shelf of South Carolina's Long Bay from Little River Inlet to Winyah Bay**
Denny, J. F.; Baldwin, W. E.; Schwab, W. C.; Gayes, P. T.; Morton, R. A.; Jan. 01, 2005; 64 pp.; In English
Report No.(s): PB2007-112160; USGS-OFR-2005-1345; No Copyright; Avail.: National Technical Information Service (NTIS)

High-resolution sea-floor mapping techniques, including sidecan-sonar, seismic-reflection, swath bathymetric systems,

and bottom sampling, were used to map the geologic framework offshore of the northern South Carolina coast in order to provide a better understanding of the physical processes controlling coastal erosion and shoreline change. Four general sea floor environments were identified through analysis of sidescan-sonar, swath bathymetry, and surface sediment texture: inlet shoal complexes, shore-detached shoals, hardground, and mixed zones. Inlet shoal complexes generally lie offshore of modern inlet systems, with the exception of a shore-detached shoal lying offshore of Myrtle Beach. The shoals show 1 - 3 m in relief and comprise the largest accumulations of modern sediment within the inner shelf survey area. Surficial sediments within the shoal complexes are characterized by a low-backscatter, moderately sorted fine sand. Hardground areas are characterized by exposures of Cretaceous and Tertiary strata and Pleistocene channel-fill deposits. These areas display little to no bathymetric relief and are characterized by high-backscatter, coarser grained sand. Mixed zones show small-scale spatial variations in bathymetry, surface texture and backscatter. These areas are characterized by a thin layer of modern sediment (< 1 m) and exposures of Cretaceous strata and Pleistocene channel-fill deposits. Textural and geomorphic variations suggest a long-term net southerly flow within the study area. The general acoustic and textural character of the inner shelf within Long Bay suggests long-term erosion, reworking and continued modification of inner-shelf deposits by modern nearshore processes.
NTIS
*Coasts; Morphology; Rivers; Shorelines; South Carolina; Textures*

**20080018896** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Mie Scattering of Growing Molecular Contaminants**
Herren, Kenneth A.; Gregory, Don A.; Optical Engineering; March 2007; Volume 46, Issue 3, pp. 033602-1 - 033602-9; In English; Original contains black and white illustrations
Report No.(s): Paper 060397RR; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1117/1.2715944

Molecular contamination of optical surfaces from outgassed material has been shown in many cases to proceed from acclimation centers and to produce many roughly hemispherical 'islands' of contamination on the surface. The mathematics of the hemispherical scattering is simplified by introducing a Virtual source below the plane of the optic, in this case a mirror, allowing the use of Mie theory to produce a solution for the resulting sphere .in transmission. Experimentally, a fixed wavelength in the vacuum ultraviolet was used as the illumination source and scattered light from the polished and coated glass mirrors was detected at a fixed angle as the contamination islands grew in time.
Author
*Mie Scattering; Contaminants; Outgassing; Far Ultraviolet Radiation; Acclimatization; Mirrors; Optical Materials*

## 75
## PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**20080018619** Department of Energy, Washington, DC USA
**Final Report on Tech-X NTCC Activity**
Cary, J. R.; Carlsson, J.; Apr. 28, 2006; 28 pp.; In English
Report No.(s): DE2007-883700; No Copyright; Avail.: Department of Energy Information Bridge

The Tech-X contribution to the NTCC project was completed on 03/31/06. Below are some of the highlights of the final year. A TEQ users' meeting was held at the Sherwood 2005 conference and a tech-support mail list was created. The stand-alone separatrix module was added to the NTCC repository and is available on the web. For the main TEQ module a portable build system was developed (based on GNU Autotools and similar to the the separatrix build system). Especially IBM xlf had problems with mixed code (F77 with F90 snippets) in the same file and approximately 6000 lines of code was rewritten as pure F90. Circular dependencies between F90 modules were resolved to robustly allow correct compilation order. Exception handling was implemented in both the separatrix and TEQ modules and an user manual was written for TEQ.
NTIS
*Plasma Physics; Tokamak Devices*

## 77
## 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*.

**20080018497** Istituto Nazionale di Fisica Nucleare, Frascati, Italy; Stanford Linear Accelerator Center, Menlo Park, CA, USA; Paris Univ., Orsay, France

**SuperB: A High-Luminosity Heavy Flavour Factory**

Mar. 01, 2007; 479 pp.; In English

Report No.(s): DE2007-907708; INFN/AE-07/02; SLAC-R-856,LAL-07-15; No Copyright; Avail.: National Technical Information Service (NTIS)

Elementary particle physics in the next decade will be focused on the investigation of the origin of electroweak symmetry breaking and the search for extensions of the Standard Model (SM) at the TeV scale. The discovery of New Physics will likely produce a period of excitement and progress recalling the years following the discovery of the radical emissivity. In this new world, attention will be riveted on the detailed elucidation of new phenomena uncovered at the LHC; these discoveries will also provide strong motivation for the construction of the ILC. High statistics studies of heavy quarks and leptons will have a crucial role to play in this new world.

NTIS

*Luminosity; Standard Model (Particle Physics); Elementary Particles; Particle Theory; Linear Accelerators; Flavor (Particle Physics); Particle Interactions*

**20080018501** California Univ., Los Angeles, CA, USA

**Precise Measurement of the Top Quark Mass**

Mohr, B. N.; Jan. 01, 2007; 246 pp.; In English

Report No.(s): DE2007-902873; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a measurement of the mass of the top quark using data from proton-antiproton collisions recorded at the CDF experiment in Run II of the Fermilab Tevatron. Events are selected from the single lepton plus jets final state. The top quark mass is extracted using a calculation of the probability density for a tt(bar) final state to resemble a data event. This probability density is a function of both top quark mass and energy scale of calorimeter jets, constrained in situ with the hadronic W boson mass.

NTIS

*Quarks; Particle Mass; Quark Models*

**20080018671** Rutgers - The State Univ., Camden, NJ, USA

**Searches for Higgs Bosons at the Tevatron**

Anastassov, A.; Jan. 01, 2007; 8 pp.; In English

Report No.(s): DE2007-908059; FERMILAB-CONF-06-492-E; No Copyright; Avail.: National Technical Information Service (NTIS)

We present the results of searches by the CDF and DO Collaborations for Higgs boson production in p(bar p) collisions at radical(s) = 1:96 TeV. The searches are performed in a range of production and decay channels predicted by the Standard Model and its minimal supersymmetric extension (MSSM) with data samples corresponding to 200-950 pb(sup-1). In the absence of signal, the results are used to set upper limits on Higgs production cross sections times branching fractions.

NTIS

*Higgs Bosons; High Energy Interactions; Elementary Particle Interactions*

## 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*.

**20080018711** NASA Langley Research Center, Hampton, VA, USA
**Sense and Sensibility: The Case for the Nationwide Inclusion of Engineering in the K-12 Curriculum**
Lindberg, Robert E.; Pinelli, Thomas E.; Batterson, James G.; April 06, 2008; 10 pp.; In English; ASEE Southeastern Section Annual Conference, 6-8 Apr. 2008, Memphis, TN, USA
Contract(s)/Grant(s): WBS 292.487.04.07.01; Copyright; Avail.: CASI: A02, Hardcopy

The competitive status of the USA is inextricably linked to innovation just as innovation is inseparable from science, technology, engineering, and mathematics. To stay competitive in innovation requires that the USA produce a 21st century workforce complete with requisite education, training, skills, and motivation. If we accept a priori that science, technology, engineering, and mathematics education are crucial to competitiveness and innovation and that, in terms of innovation, mathematics, science, and engineering are interdependent, why are mathematics and science uniformly ubiquitous in the K-12 curriculum while engineering is conspicuously absent? We are passionate in our belief that the uniform addition of engineering to the K-12 curriculum will help ensure that the nation has 'the right' 21st Century workforce. Furthermore, we believe that a nationwide effort, led by a coalition of engineering academics, practitioners, and societies is required to turn this goal into reality. However, accomplishing this goal necessitates, as we are reminded by the title of Jane Austen's timeless novel, 'Sense and Sensibility', a workable solution that seeks the 'middle ground' between passion and reason. We begin our paper by making two essential points: Engineers are not scientists. Engineering exists separate from science, has its own specialized knowledge community apart from science, and it is largely responsible for many of the most significant advancements and improvements in the quality of our life. Our workable solution requires that K-12 education, nationwide, accommodate the inclusion of engineering as a stand alone curriculum and we offer three reasons to support our position: (1) workforce development, (2) stimulating interest in STEM (science, technology, engineering, and mathematics) courses and careers, and (3) creating a technologically literate society. We conclude with some thoughts on how this important goal can be accomplished.
Author
*Engineering; Education*

## 81
## ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**20080018922** NASA Marshall Space Flight Center, Huntsville, AL, USA
**NASA's Agency-Wide Strategy for Environmental Regulatory Risk Analysis and Communication**
Scroggins, Sharon; March 19, 2008; 12 pp.; In English; 18th Annual Cleaner Sustainable Industrial Materials and Processes Workshop, 17-20 Mar. 2008, Coronado, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

NASA's Agency-wide.resource for identifying and managing risks associated with changing environmental regulations Goals of the RRAC PC: 1) Proactively. detect, analyze and communicate environmental regulatory risks to NASA Programs and facilities; 2) Communicate with regulators and participate in the mitigation of such risks; and 3) Provide centralized support on emerging regulations to NASA HQ Environmental Management Division. When significant regulatory changes are identified, timely communication is essential. Communication of changing requirements to the regulatory stakeholders - NASA Programs and Facilities. Communication of potential issues to management and, when appropriate, back to the regulating agency.
Author
*Identifying; NASA Programs; Risk; Regulations; Risk Assessment*

## 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*.

**20080018092** Social Sectors Development Strategies, Inc., Boston, MA USA
**A Tale of Two Disability Coding Systems: The Veterans Administration Schedule for Rating Disabilities (VASRD) vs. Diagnostic Coding Using the International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM)**
Bell, Nicole S; Hollander, Ilyssa E; Williams, Jeffrey O; Amoroso, Paul J; Jan 2008; 62 pp.; In English
Report No.(s): AD-A476409; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476409

Disability rates have increased by approximately 10% per year over the past 25 years. Little is known about the etiology, in part because Veterans Administration Schedule for Rating Disabilities (VASRD) codes are not clinical diagnoses. This report describes results from analyses linking VASRD disability codes to International Classification of Disease, 9th Rev., Clinical Modification (ICD-9-CM) clinical diagnoses captured in hospital administrative records during disability case processing. Results suggest that while the primary ICD-9-CM codes generally correspond logically to VASRD codes in the associated disability discharge records, some VASRD categories lack homogeneity, substantially reducing their value for research and surveillance purposes. 'Infectious disease, immune disorder, or nutritional deficiency;' 'hemic and lymphatic systems;' and 'gynecological conditions and disorders of the breast' are either extensively heterogeneous or lack specificity which may result in only partial capture of cases with the same etiology in that particular VASRD group (e.g., breast disorders may logically be placed in more than one VASRD category). Primary clinical conditions experienced by soldiers discharged with 'musculoskeletal' disabilities, the most common VASRD disability group, were pain in joint, lumbago, joint derangement, chondromalacia patellae, and osteoarthrosis--all diseases of the musculoskeletal system and connective tissue (ICD-9-CM 710-739). Overall concordance between ICD-9-CM clinical conditions and VASRD codes for 'musculoskeletal' disability suggest good face validity. All ICD-9-CM diagnoses associated with the two major VASRD subgroups within 'musculoskeletal' disability--'Injury' or 'Disease'--fall within the ICD-9-CM 710-739 group suggesting there may be little clinical value in differentiating between 'Injury' vs. 'Disease.'
DTIC
*Classifications; Clinical Medicine; Coding; Disabilities; Diseases; Infectious Diseases; Ratings; Schedules*

**20080018108** Air Command and Staff Coll., Maxwell AFB, AL USA
**Global ISR - A Process-Oriented Approach to Achieving Decision Superiority**
Welch, Paul A; Apr 18, 2005; 41 pp.; In English
Report No.(s): AD-A476446; AU/ACSC/1799/2004-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476446

This paper focuses on leveraging current technology in a process-oriented approach to leveraging capabilities resident in global intelligence, surveillance, and reconnaissance (ISR) assets to meet the increasing demands of Joint Force Commanders (JFCs). The pace of current military operations often requires information and intelligence to be available to the JFC faster than supporting communities are capable of providing it. As a result, a seam exists that hinders the ability of today's military commanders to achieve decision superiority over the nation's adversaries. Recent changes in Department of Defense policy and guidance are aimed at closing this seam with a renewed focus on ISR support to warfighters and changes in Combatant Commander (COCOM) missions to highlight this focus. USA Strategic Command (USSTRATCOM) has been tasked with integrating global ISR capabilities in an effort to build mechanisms by which JFC requirements can be met in the timelines needed. Concurrently, USA Joint Forces Command (USJFCOM) has developed the Standing Joint Force Headquarters (SJFHQ) construct with subsequent fielding to each of the regional COCOMs. The mission of the SJFHQ is to be a center of excellence that understands the JFC's intent given a specific region or event and can create a collaborative planning and execution environment that can integrate the knowledge available from a variety of subject matter experts to provide the best possible situational awareness to the JFC. By combining these two staffs' efforts and focusing on the processes required to integrate them, the seam between national capabilities and operational problem sets can be eliminated using today's technology to meet today's warfighter requirements.
DTIC
*Decision Support Systems; Intelligence; Military Operations; Multisensor Fusion; Reconnaissance; Surveillance*

**20080018260** Capraro Technologies, Inc., Utica, NY USA
**Integrated End-to-End Radar Signal and Data Processing with Over-Arching Knowledge-Based Control**
Capraro, Gerard T; Jun 1, 2007; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476701; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476701

No abstract available

*Airborne Radar; Arches; Controllers; Data Processing; Knowledge Based Systems; Radar Data; Signal Processing; Systems Integration*

**20080018270** Army Combined Arms Center, Fort Leavenworth, KS USA
**Combined Arms Sufficiency Study**
Gibson, Richard L; Sep 23, 1981; 101 pp.; In English
Report No.(s): AD-A476737; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476737

Combined Arms training is at the core of an officer's education. The Combined Arms Sufficiency Study was initiated to determine in a systematic fashion which subjects should be identified as combined arms subjects and what constitutes a sufficient level of proficiency in these combined arms subjects for lieutenants and captains in the U.S. Army. For the purposes of this study combined arms sufficiency was defined as the knowledge required by the combat, combat support, and combat service support officer that enables him to work effectively with his fellow officers on the modern battlefield. The study was conducted between May and August 1981 at the direction of the Commander, Combined Arms Center. Participants are listed-at Annex A. Methodology is described at Annex F. The study was designed to systematically assess the status of combined arms training at TRADOC schools by obtaining the collective judgment of the branch school commandants on what subjects should be on a combined arms subject list and what constitutes a sufficient level of instruction for each subject. This approach did not allow the use of rigorous statistical techniques for data analysis; nevertheless, the use of a few simple statistical methods and close inspection of the results allowed us to make several useful, if somewhat subjective, observations about the current state of combined arms training. The data collected are consolidated at Annex B, with the exception of those concerning pre-commissioning. The responses on pre-commissioning are discussed in Annex H.
DTIC

*Education; Personnel*

**20080018281** Naval Postgraduate School, Monterey, CA USA
**Information Technology Diffusion: A Comparative Case Study of Intranet Adoption**
Zolla, Jr, George A; Jul 1999; 6 pp.; In English
Report No.(s): AD-A476764; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476764

This exploratory study identifies factors that influence the adoption and diffusion of intranet technology. A comparative case study of bipolar organizations is used to identify crucial implementation factors and create an innovation adoption model. A strategic approach for the adoption and diffusion of intranet technology is then presented.
DTIC

*Computer Networks; Information Systems; Technology Assessment*

**20080018292** Naval War Coll., Newport, RI USA
**Command Decision-Making and Information Superiority Vulnerability: Addressing the Emerging Threat**
Thieme, Aaron M; Nov 6, 2007; 25 pp.; In English
Report No.(s): AD-A476790; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476790

Information superiority rests on a technological foundation that, until now, remained unchallenged. China's anti-satellite test is one example of an emerging threat to USA military dominance in the information domain. Understanding the relationship between information and decision-making enables commanders to understand the implications of threats to information superiority. This paper analyzes 'information' in the context of decision-making theory at the operational level. It explores observed trends in command and control caused by the evolution of network-centric warfare and supporting technologies and exposes negative effects. Finally, the paper draws conclusions concerning ways to minimize exposure to

vulnerabilities in information technology infrastructure and recommends implementation of measures to optimize decision-making and minimize risk in a disruptive C2 environment.
DTIC
*Decision Making; Information Systems; Security; Threat Evaluation; Vulnerability*

**20080018305** Mitre Corp., McLean, VA USA
**Defining Useful Technology Evaluations**
Herceg, Paul M; Sep 13, 2007; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W15P7T-08-C-F600
Report No.(s): AD-A476811; MTR070061R1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476811

Information technology executives and managers at MITRE sponsors are the decision-makers who direct the selection and adoption of new technologies. Nonetheless, they often lack a systematic method for assessing technology value. Although best practices are well documented in academic literature, decision-makers may unknowingly fall victim to or use haphazard approaches that fail to meet business needs and bypass more effective technologies. This paper explains to executives and managers why they need a systematic approach to technology evaluation. Then, it distills for them the evaluation methods and technology investigation processes proposed by experts in empfrical software engineering. This paper has not aimed to add novel ideas to the academic discussion of technology evaluation. Rather, the intent here is to allow MITRE sponsors to access, understand, and apply these concepts.
DTIC
*Information Systems; Technology Assessment*

**20080018338** Air War Coll., Maxwell AFB, AL USA
**Communicating with Intent: DOD and Strategic Communication**
Borg, Lindsey J; Apr 2007; 93 pp.; In English
Report No.(s): AD-A476924; AU/AIR FORCE FELLOW/NNN/2007; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476924

The Department of Defense's (DoD's) development of strategic communication processes, a supporting organizational structure, and an institutional culture change began in earnest in 2006. The broad, operational view of communication presents many opportunities for DoD; it also presents many areas demanding attention if the department is to realize its aim of positive strategic effects in the information domain. This paper examines DoD's development of strategic communication with a specific examination of the implications, opportunities, and threats associated with the public information environment. The paper does not present a prescription for tactics to win near-term battles, but rather a review of current efforts to build a strategic communication capacity and considerations that demand attention to advance this capability for long-term, strategic successes. The primary research methodology used for the paper was personal interviews with people either engaged in DoD's development of strategic communication processes, or able to give a perspective from another part of the U.S. government. The paper also relies heavily on published information from the academic and open press environments.
DTIC
*Communicating; Defense Program; Public Relations*

**20080018342** California Univ., Davis, CA USA
**Cognitive Agents for Knowledge Discovery**
Vemuri, V R; Feb 5, 2008; 5 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0159
Report No.(s): AD-A476944; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476944

Discovery of new knowledge, that is, knowledge that we do not already possess, is the focus of this research. This problem can be formulated as an inverse problem, where the new knowledge can be represented by the parameters of a black box model. The solution can then be viewed as the culmination of a sequence of problem solving steps: search, composition, integration and discovery. A well designed cognitive agent capable of learning, adaptation and optimization can accomplish this task.
DTIC
*Bayes Theorem; Data Acquisition; Data Mining; Information Retrieval; Machine Learning; Nets*

**20080018458** Air Force Flight Test Center, Edwards AFB, CA USA
**AFFTC Users' Handbook**
Apr 1978; 72 pp.; In English
Report No.(s): AD-A476903; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476903

This handbook is provided as an overall guide and convenient source of information concerning the Air Force Flight Test Center, its mission and support capabilities, and the procedures by which these are provided. The Introduction sets forth AFFTC's origin, mission, concept of operations, general policies, and official relationships that govern activities or apply at the Center. The remainder of the book summarizes the technical and support services and facilities which AFFTC provides and tells how to obtain these services.
DTIC
*Handbooks; Flight Tests; Mission Planning*

**20080018486** Naval War Coll., Newport, RI USA
**The New Wizard War: Challenges and Opportunities for Electronic Warfare in the Information Age**
Anderson, Jon M; Nov 6, 2007; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476476; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476476

The emergence of distributed electronic warfare (EW) in Iraq as a response to the improvised explosive device threat has led to serious issues with electronic fratricide and frequency management. This paper assesses the roots of the information technology transformation that has benefited US adversaries in unexpected ways, and shows that the continued growth of information technology will result in spectrum management becoming necessary but insufficient for solving the electronic fratricide problem.. Finally, the paper concludes that operational commanders can alleviate the problems caused by distributed EW while effectively utilizing EW capabilities by aligning joint doctrine with new realities, ensuring planning staffs have sufficient expertise, establishing boundaries for decentralized execution, and implementing distributed EW in test, training, and exercises.
DTIC
*Electronic Warfare; Explosive Devices*

**20080018489** Office of Management and Budget, Washington, DC USA
**Report to Congress on the Benefits of the President's E-Government Initiatives, Fiscal Year 2007**
Jan. 01, 2007; 248 pp.; In English
Report No.(s): PB2007-111782; No Copyright; Avail.: National Technical Information Service (NTIS)

The Federal government is delivering results through expansion and adoption of electronic government principles and best practices in managing information technology, and is increasingly providing timely and accurate information to the citizens and government decision makers while ensuring security and privacy. In the fall of 2001, the Office of Management and Budget (OMB) and Federal agencies identified 24 E-Government Initiatives which were approved by the President's Management Council. Operated and supported by agencies, these Initiatives provide high-quality and well-managed common solutions such as citizen tax filing, Federal rulemaking, and electronic training. Beneficiaries include citizens, businesses, and Federal and state government employees. In the spring of 2004, OMB announced the formation of five Line of Business (LoB) task forces. Additional LoBs were established in 2005 and 2006, bringing the total number of LoBs to nine. The LoBs were identified through a comprehensive analysis of agencies enterprise architecture data seeking to determine common solutions and methodologies in order to decrease unnecessary duplication, increase operational efficiencies, and improve service delivery to agencies in common administrative areas.
NTIS
*Management Planning; Information Dissemination; Internets; United States; Information Systems*

**20080018513** National Inst. of Information and Communications Technology, Tokyo, Japan
**Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3**
Kurihara, Noriyki, Editor; Okano, Naoki, Editor; Kadowaki, Naoto, Editor; Wakana, Hiromitsu, Editor; September 2007; ISSN 1349-3205; 191 pp.; In English; See also 20080018514 - 20080018532; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Special Issue on Human Communications; Construction of the Corpus of Spontaneous Japanese

and Annotation Techniques; Information Access Technologies for Processing a Very Large Number of Natural Language Documents; Automatic Construction Technology for Parallel Corpora; Acquisition of Taxonomic Relations among Words from Huge Corpora and Its Application; Development of a System to Point Out Misuse of Japanese Honorific; Development of Language Resources for Natural Language Processing in Deep Level; Fusion of Communication Content and Broadcast Content; Digital Content Embedded in Real World Environment and Its Utilization Technologies; Basic Study for Cognition and Manipulation of the Body Image; Cognitive Mechanisms of Preverbal Communication; Interaction Analysis at the Dialog by Nonverbal Behavior; Outdoor Environment Recognition and Semi-Autonomous Mobile Vehicle for Supporting Mobility of the Elderly and Disabled People; Barrier-Free on the Mobility and the Information for Visually Impaired People and Hearing Impaired People; Universal Designed Mobility Support Geographic Information System for All Pedestrians; Experiences in UKARI Project; Distributed and Cooperative Service Platforms for Home Network Services; Real Living Experiments with Conversational Robots at Ubiquitous-Home; and A Looking-for-Objects Service in Ubiquitous Home.
Derived from text
*Natural Language (Computers); Geographic Information Systems; Support Systems; Words (Language); Information Systems; Disabilities; Autonomy; Natural Language Processing; Hearing*

**20080018514** National Inst. of Information and Communications Technology, Koganei, Japan
**Acquisition of Taxonomic Relations among Words from Huge Corpora and Its Application**
Kanzaki, Kyoko; Yamamoto, Eiko; Isahara, Hitoshi; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 33-43; In English; See also 20080018513; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The goals of this research are to automatically acquire system of Japanese lexical concepts from a corpus and to demonstrate the effectiveness of the lexical relations thus extracted for use in applications such as information retrieval. Dictionaries systematizing lexical semantic relations form a very important foundation for the extraction of needed information, making use of efficient induction by computer. Specifically, a dictionary structuring lexical semantic relations is one that structures a wide range of information such as similarity relations and hierarchical relations between words, relations between parts and the whole, and ownership relations. Armed with this sort of information, it becomes possible to use a given word as a clue to discover related words.
Author
*Information Retrieval; Words (Language); Taxonomy; Extraction; Analogies*

**20080018515** Hakodate National Coll. of Technology, Tokura, Japan
**Barrier-Free on the Mobility and the Information for Visually Impaired People and Hearing Impaired People**
Oyama, Sin'ya; Igi, Seiji; Nishimura, Takuichi; Yairi, Ikuku Eguchi; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 125-133; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

We have been developing Robotic Communication Terminals (RCT) which support the selfmobility of the elderly and disabled people. One of the terminals we developed is 'user-carried mobile terminal' which gives the information such as the navigation to visually and hearing impaired people who can walk by themselves. In this paper, we introduce the animation system to show the sign language for hearing impaired people and the voice guidance system for visually' impaired people with the infrared communication and AM radio communication.
Author
*Mobility; Disabilities; Hearing; Radio Communication; Robotics; Age Factor*

**20080018516** Kyoto Univ., Japan
**Experiences in UKARI Project**
Minoh, Michihiko; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 147 - 154; In English; See also 20080018513; Original contains color illustrations; Copyright; Avail.: Other Sources

The UKARI project was promoted in NICT Keihanna Center from May, 2003 to March, 2006, which was aiming to build

a ubiquitous environment at home and to verify usefulness and effectiveness of life in such home. In this article, not only the research result but also the process to have promoted the research project is described based on the experiences.
Author
*Surveillance; Internets; Electronic Mail; Commerce; Research; Image Processing; Information Systems*

**20080018517** National Inst. of Information and Communications Technology, Tokyo, Japan
**Interaction Analysis at the Dialog by Nonverbal Behavior**
Yoshimoto, Jun; Mizukami, Etsuo; Yamashita, Koji; Yano, Hiroyuki; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 103-112; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Aiming to address the challenges inherent in the diversity and ambiguity of nonverbal behavior, we will first describe the role of such behavior in face-to-face communication in the introduction below, followed by a discussion of our findings based on related research. What sort of structure is formed by the information we transmit and receive when we attempt to establish communication with another person? It is generally assumed that in face-to-face communication, this structure consists of three layers. First, there is the language layer, which consists of words arranged in an order that conforms to grammatical rules. This layer forms the core of the information to be communicated, and its formation allows information to be relayed to and shared with another person. This is the layer employed when we perform general activities such as reading and writing, and the facility with which the information within this layer may be converted into text form is one of the main features that characterizes this layer. Next, there is the paralanguage layer. This layer accompanies the speech act performed by the language layer. In other words, this layer corresponds to that portion of voice information created by speech minus the language layer, and includes the pitch and volume of the voice as well as the pacing and pauses of speech. Using voice communication tools such as telephones, multi-layered information consisting of the language and paralanguage layers may be exchanged reciprocally. Generally, since the speech act requires no tools and is easier to learn relative to the act of writing, the physical load placed on the user is smaller. The paralanguage layer enables modification of the language layer and permits the speaker to relay his intentions and describe his state;
Author
*Voice Communication; Ambiguity; Loads (Forces); Texts; Reading; Words (Language)*

**20080018518** National Inst. of Information and Communications Technology, Tokyo, Japan
**Development of a System to Point Out Misuse of Japanese Honorific**
Shirado, Tamotsu; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 45-51; In English; See also 20080018513; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The use of honorifics is an important characteristic of the Japanese language. Japanese honorifics appear not simply in requests and demands and in pronouns indicating people but have become widely embedded in the language's linguistic structures and behaviors. However, in today's Japanese society a wide range of errors in use of Japanese honorifics can be noted. This misuse of honorifics can negatively affect the recognition and structure of appropriate social relationships between individuals. To avoid such misuse, it is essential to have an accurate understanding of honorific norms. The development of computing systems to support the study of honorifics promises to assist in the efficient development of such understanding. With the foregoing in mind, we have constructed a system to point out misuse of honorifics in Japanese speech. When Japanese-language speech and the social relationships between the persons involved in the conversation are input, the system returns information on whether the input speech includes any misuse of honorifics, and if so, the locations and types of such misuse. To verify the effectiveness of this system, the authors prepared test data and had linguists specializing in Japanese within another research group prepare test data as well. The authors used these sets of test data in experiments in which the computer system judged the use of honorifics included in the data. With the exception of a very small number of cases, for the most part we were able to confirm that the system provided reliably appropriate output.
Author
*Languages; Embedding; Range Errors; Linguistics; Conversation; Computers*

**20080018519** National Inst. of Information and Communications Technology, Tokyo, Japan

**Basic Study for Cognition and Manipulation of the Body Image**

Maekawa, Satoshi; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 83-91; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

In recent years, it becomes clear that the body image is not inherent, but have plasticity. This fact suggests that the body image can be manipulated. With the progress of the computer, virtual external world can be built with reality, but the ability of the body image manipulation suggests virtual self with reality. Although the cognitive ability of human is limited, the world of virtual self with reality, which means freedom from physical body, may be very vast. However, the comprehension level about virtual self is just low so far, and a basic study of it is conducted as before. In this paper, estimation methods of amputee's motor intention from surface electromyography measured noninvasively, are proposed, and the results of psychological experiments about body image are shown.

Author

*Electromyography; Cognition; Human Body; Mental Performance*

**20080018520** National Inst. of Information and Communications Technology, Tokyo, Japan

**Cognitive Mechanisms of Preverbal Communication**

Kozima, Hideki; Nakagawa, Cocoro; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 93-101; In English; See also 20080018513; Original contains color illustrations; Copyright; Avail.: Other Sources

The goals of 'understanding humanity' and 'humanizing robots' tightly relate to each other. Infanoid Project has related robotics to human sciences in order to understand the underlying mechanism of social communication specific to humans and some species of primates. Early communication between a child and caregiver is mainly embodied through touch and eye contact. By investigating the developmental mechanism of the preverbal interaction, especially through our longitudinal observation of children with communication disorders, we investigated the core human communication capabilities and design principles for future info-communication systems with which we can make symbiotic relationships.

Author

*Cognition; Human Performance; Robotics; Touch; Eye (Anatomy); Children*

**20080018521** National Inst. of Information and Communications Technology, Tokyo, Japan

**Automatic Construction Technology for Parallel Corpora**

Utiyama, Masao; Tanimura, Midori; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 25-31; In English; See also 20080018513; Copyright; Avail.: Other Sources

A Japanese-English parallel corpus is a necessary element in the study of natural language processing - including studies relating to machine translation, for example - and represents an invaluable linguistic resource in areas such as English-language studies, comparative linguistics, and English and Japanese language education. However, to date no large-scale Japanese-English parallel corpus has been available for public use. Given this background, we undertook to construct a large-scale Japanese-English parallel corpus based on a relatively large-scale collection of Japanese-language newspaper articles, in addition to English-language newspaper articles partially corresponding to the content of the Japanese-language articles. Our approach consisted of aligning the Japanese and English newspaper articles by content, and then aligning sentences within the corresponding articles. When the contents of a subject English newspaper article corresponded to those of a subject Japanese newspaper article, in many cases the English newspaper article had been written based on the Japanese newspaper article. However, even in such cases the Japanese newspaper article was not necessarily translated directly. The English newspaper article often included non-literal translations, and in some cases omitted some of the content of the corresponding Japanese newspaper article or included content that was not in the Japanese article. In addition, the collection of English newspaper articles used for this alignment process was relatively small: less than 6% the number of corresponding Japanese articles. In aligning articles and sentences it is critical to identify the appropriate alignments from collections of articles that contain a great deal of 'noise"; as a result the measures used to judge the quality of these alignments must be highly reliable. In this paper we propose a number of such measures in the alignment of both articles and sentences, and evaluate the reliability of these measures.

Author

*Natural Language Processing; Education; Sentences; Machine Translation; Alignment; Linguistics*

**20080018522** Universal City Group, Japan; Nanzan Univ., Aichi, Japan; Ritsumeikan Univ., Kusatsu, Shiga, Japan; NEC Communication Systems, Ltd., Japan

**Distributed and Cooperative Service Platforms for Home Network Services**

Yamazaki, Tatsuya; Sawada, Atsushi; Nishimura, Toshikazu; Takaoka, Masanori; Tajika, Yosuke; Minoh, Michihiko; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 155 - 164; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

In the UKARI (Universal Knowledgeable Architecture for Real-life appliances) project, we studied and developed distributed and cooperative service platforms for home network services, which provide services by cooperating functions from networked appliances (NAs). The NAs include consumer appliances as well as sensors, robots, and so on. Main research results were 'UKARI-Core' and 'UKARI-Kernel', which constitute the platforms. UKARI-Core is a middleware with must and core modules of distributed function cooperation. UKARI-Kernel is, moreover, another middleware as an extension of UKARI-Core with additional functions for flexible user adaptation. We implemented the middleware into various kinds of real appliances and constructed home network services in a real environment to evaluate the efficiency of the proposed service platforms.

Author

*Applications Programs (Computers); Kernel Functions; Robots*

**20080018523** Kyoto Sangyo Univ., Japan

**Real Living Experiments with Conversational Robots at Ubiquitous-Home**

Ueda, Hirotada; Minoh, Michihiko; Chikama, Masaki; Satake, Junji; Kobayashi, Akihiro; Miyawaki, Kensaburo; Matsumoto, Naoko; Kidode, Masatsugu; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 165-173; In English; See also 20080018513; Copyright; Avail.: Other Sources

We have seen a number of prototypes of rooms equipped with numerous sensors embedded in the living space. Such studies date back to the Xanadu House[ll in the US, and more recently, active R&D efforts are underway at the Georgia Institute of Technology [2],th e University of Tokyo[3], and the Digital Human Research Center of the National Institute of Advanced Industrial Science and Technology (AIST) [4]. However, when viewed from the perspective of our actual daily lives, none of the results to date have been able to present any obvious or significant benefits for inhabitants, and it may be said that no one yet has a clear outlook on what sort of 'killer app' to expect. A new concept and framework is required in order to dispel these uncertainties for the future. In the UKARI Project, a new concept was proposed in which new developments in human-robot interactions would be promoted by enhancing the context recognition capacities of robots, by connecting conversational robots to a home ubiquitous network, and also by enhancing the ability of these robots to explain, with reference to information they could acquire through the network. Based on this concept, a system offering various services has been designed using a conversational robot as the interface in the Ubiquitous Home. Long-term real-life validation experiments have been performed to evaluate the system; here we will give an overview of the prototype and report on the results and findings of the experiment.

Author

*Robots; Technologies; Research and Development; Embedding; Real Time Operation*

**20080018524** National Inst. of Information and Communications Technology, Tokyo, Japan

**Construction of the Corpus of Spontaneous Japanese and Annotation Techniques**

Uchimoto, Kiyotaka; Isahara, Hitoshi; Takanashi, Katsuya; Takeuchi, Kazuhiro; Nobata, Chikashi; Morimoto, Ikuyo; Yamada, Atsushi; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 5-14; In English; See also 20080018513; Original contains color illustrations; Copyright; Avail.: Other Sources

This paper introduces the Corpus of Spontaneous Japanese (CSJ) and the technologies used to create this corpus. As part of a project to establish a science of spontaneous speech engineering based on elucidation of the linguistic and paralinguistic structures of spontaneous speech (FY 1999-FY 2003) - an open, joint research project funded by the Japanese government's Special Coordination Funds for Promoting Science and Technology - this corpus has been constructed jointly with the National Institute for Japanese Language. The CSJ is a large-scale corpus for spontaneous Japanese, primarily covering monologues such as lectures. This corpus includes not just audio data but also transcribed text. Moreover, the transcribed text has been annotated with a wide range of verbal information. Figure 1 shows an outline of the verbal annotations used with the CSJ. Data collection and transcription, and annotation with morphemes and prosodic information, was conducted chiefly at the

National Institute for Japanese Language. The National Institute of Information and Communications Technology (NICT; formerly the Communications Research Laboratory) annotated the transcribed text with a wide range of verbal information, including morphemes, clause units, dependency structures, summaries, and discourse structures.
Author
*Verbal Communication; Linguistics; Information Systems; Audio Data; Annotations; Data Acquisition; Texts; Coordination*

**20080018525** National Inst. of Information and Communications Technology, Tokyo, Japan
**Special Issue on Human Communications**
Wakana, Hiromitsu; Matsuyama, Takashi; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 1-5; In English; See also 20080018513; Copyright; Avail.: Other Sources

This special issue, entitled 'Human Communications', summarizes the results of research conducted in the First Middle Term Target Period (from FY 2001 to FY 2005) at the Keihanna Human Info-Communication Research Center, the predecessor of the Knowledge Creating Communication Research Center. The Keihanna Human Info-Communication Research Center was founded in July 2000 in the Keihanna Area (at the Culture and Science City, located on the site at which the prefectures of Kyoto, Nara, and Osaka meet) as a new establishment to gather and strengthen research and development related to content and interface technologies. The Center set as its goals the creation of basic user-friendly information and communications technologies (including so-called 'human communications') that will enrich the lives of all people, including the old and the impaired, in the course of our transformation to an advanced information society. Further, the Center aims specifically to apply these technologies throughout society with the development of applications for public use. In accordance with these goals, we have aggressively promoted collaboration with third parties, particularly with private research institutions (including the Advanced Telecommunications Research Institute International (ATR) and NTT Communication Science Laboratories in the Keihanna Area), with universities (Kyoto University, Osaka University, Nara Institute of Science and Technology, and others), and with advanced research institutions in other fields.
Author
*Telecommunication; Technologies; Research and Development; Enrichment*

**20080018526** National Inst. of Information and Communications Technology, Tokyo, Japan
**Development of Language Resources for Natural Language Processing in Deep Level**
Zhang, Yujie; Kuroda, Kow; Izumi, Emi; Nozawa, Hajime; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 52-62; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Techniques for both text analysis and speech transcription are still in an unsatisfactory state even though they cannot be dispensed with Natural Language Processing. To achieve high performance techniques, a large amount of language resources are urgently required. To resolve this problem, Computational Linguistics Group at NICT has been constructing language resources of several sorts, targeting different cases of application. This paper presents some of such resources, including Corpus Annotated for Semantic Frames and their Elements, Japanese Learner's Corpus, and Japanese-Chinese Parallel Corpus.
Author
*Natural Language Processing; Linguistics; Annotations; Extraction; Texts; Statistical Analysis; Mathematical Models*

**20080018527** National Inst. of Information and Communications Technology, Tokyo, Japan
**Fusion of Communication Content and Broadcast Content**
Miyamori, Hisashi; Kumamoto, Tadahiko; Nadamoto, Akiyo; Sumi, Kaoru; Nakamura, Satoshi; Ma, Qiang; Minakuchi, Mitsuru; Tanaka, Katsumi; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 63-71; In English; See also 20080018513; Original contains color illustrations; Copyright; Avail.: Other Sources

This paper explains an overview of research results of 'Fusion of Communication Content and Broadcast Content', one of the two main pillars of 'Content Fusion' research project conducted at the Interactive Communication and Media Contents Group of NICT. 'Fusion of Communication and Broadcast' is a conventional keyword which means technology of converging communication and broadcasting networks as an infrastructure, whereas 'Fusion of Communication and Broadcast Content' represents a technology of converging Web content and TV programs at content level. Fundamental technologies and model systems were established which can efficiently utilize Internet and TV programs without complicated operations even for

people who are not familiar with computer operation, such as efficient methods of accessing information and utilization methods of newly added value of information, towards the age of multitude content of TV programs and Web content available in daily lives.
Author
*Communication Networks; Television Systems; Broadcasting; Information*

**20080018528** National Inst. of Information and Communications Technology, Tokyo, Japan
**Digital Content Embedded in Real World Environment and Its Utilization Technologies**
Kidawara, Yutaka; Kadobayashi, Rieko; Oh, Sooyeon; Kawai, Yukiko; Kanjo, Daisuke; Nakamura, Satoshi; Minakuchi, Mitsuru; Jatowt, Adam; Zettsu, Koji; Tanaka, Katsumi; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 73-82; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The interactive Media and Contents Group focused on exploring fundamental technologies for fusion of contents in the WWW, broadcasting, and real world environment over the past five years of this NICT project. Especially, in this research, the authors focused on the transition of the network environment from broadband to ubiquitous, and explored many related technologies. The research group mainly concentrated on the research of fundamental technologies, publishing of research papers, and any significant technical and sociological impacts worldwide. We have published 246 journals and refereed papers. Some of our papers were accepted, and appeared at key conferences such as the WWW Conference and ACM Multimedia. Additionally, the outcomes were not only academic, but also practical, such as 51 patents and 2 technical transfers to private companies, which demonstrates that we have made an impact on the industry. In this paper, we describe our research results on digital content merged into the real-world and its utilization technology, which are selected from research activities in the Interactive Media and Contents group.
Author
*Digital Systems; World Wide Web; Multimedia; Embedding; Broadcasting; Broadband*

**20080018529** National Inst. of Information and Communications Technology, Tokyo, Japan
**Outdoor Environment Recognition and Semi-Autonomous Mobile Vehicle for Supporting Mobility of the Elderly and Disabled People**
Kayama, Kentaro, Author; Yairi, Ikuko Eguchi, Author; Igi, Seiji, Author; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 113-123; See also 20080018513; Original contains color illustrations; Copyright; Avail.: Other Sources

For human beings, freedom of movement is an essential part of living independently and comfortably. However, at present, elderly and disabled people - with impaired vision, hearing, or movement in the lower extremities - still suffer difficulty in some or all of the three elemental aspects of mobility: recognition of one's environment, actuation of movement by the legs, and ready access to information required for navigation. Consequently, these individuals are required to expend a great deal of effort simply to move about independently. Against this background, we have proposed and promoted the Robotic Communication Terminals (RCT) Project involving a system supporting the three elemental abilities of recognition, actuation, and information access. RCT consists of various components, including a system for surveying general roads and detecting and recognizing moving objects, an intelligent outdoor mobile vehicle, various information devices intended for the disabled, and the Mobility Support Geographic Information System (GIs). The components operate in coordination and provide efficient support for pedestrian mobility - mainly of the elderly and disabled - in outdoor environments. Diverse research activities have taken place in Europe with the aim of supporting the elderly and disabled including TIDE, the VAHM Project (France), the Bremen autonomous 'Rolland' wheelchair, the 'Maid' wheelchair, and the SIAMO Project (Spain). However, most of these devices are intended for indoor use [ i I. A number of research activities are also underway targeting mobility support in outdoor urban and residential areas, including research and development by Kotani and Mori, et al. of the Robotic Travel Aid (ROTA), designed to replace a guide dog. This system stores various image characteristics along the intended route in advance and recognizes various boundaries as it moves along the road: the road itself, walls, steps, and landmarksr21. RCT is not a single system but instead is designed to provide comprehensive support for pedestrians by combining a number of component systems.
Author
*Disabilities; Age Factor; Support Systems; Geographic Information Systems; Mobility; Wheelchairs; Telecommunication; Robotics; Pattern Recognition; Hearing; Coordination*

**20080018530** National Inst. of Information and Communications Technology, Tokyo, Japan

**Universal Designed Mobility Support Geographic Information System for All Pedestrians**

Yairi, Ikuko Eguchi; Igi, Seiji; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 135-145; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

This paper introduces Mobility Support GIs which provides the accessibility information of routes for all pedestrians including the disabled and elderly people. We have developed universal- designed data of barrier/barrier-free terrains and facilities which satisfies all pedestrians' needs for routes and area accessibility information retrieval, and collected the data of barrierlbarrier-free objects in Korana City (approx. 12 km2) and famous sight-seeing area of Kyoto (approx. 2 km2) by exploring roads. These prototype systems have intelligent user interface which offers suitable accessibility information to all pedestrians with different physical difficulties and preferences. Our final goal is to publish the GIs development knowhow as a guideline, to release software tools for developing and managing the GIs and to propose the universal database as a Japanese standard.

Author

*Geographic Information Systems; Visual Perception; Mobility; Disabilities; Age Factor; Support Systems; Information Retrieval*

**20080018531** National Inst. of Information and Communications Technology, Tokyo, Japan

**A Looking-for-Objects Service in Ubiquitous Home**

Fujii, Tetsuya; Ueda, Hirotada; Minioh, Michihiko; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 175-181; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Recent advances in ubiquitous technology have enabled the provision of user-adaptive information suited to a range of human needs, using various types of sensors to observe people's daily surroundings, actions, and behaviors. Studies on context-aware information services have also become popular. Further, by embedding wired and wireless sensors and various types of computers in the daily environment, we are now able to create a ubiquitous environment inside the home. These developments will allow people to enjoy a new range of information services provided by such computers, with richer lives as a result. Under the auspices of the UKARI Project, our group has studied the creation of a collaborative and distributed functional network using the 'UKARI Core' and investigated new information services that will use the distributed environmental/behavior database constructed using information obtained by the network platform and sensors. These information services correspond to the context-aware services to be provided through home robots based on extensive integration of context-aware information on people and objects - acquired as raw data by sensors installed inside the house - and stored in the distributed environment1 behavior database. We have created a framework for these services that will enable each user to evaluate the information services provided, in order to provide feedback for the development of future services. A conceptual diagram of the context-aware services developed in the UKARI Project is presented in Fig. 1. As part of this project, we undertook experiments in which a family unrelated to the project was asked to live inside the Ubiquitous Home for two weeks and to evaluate the various information services actually provided in the facility, as our team collected data from the sensors.

Author

*Data Bases; Information Systems; Computers*

**20080018532** National Inst. of Information and Communications Technology, Tokyo, Japan

**Information Access Technologies for Processing a Very Large Number of Natural Language Documents**

Murata, Masaki; Journal of the National Institute of Information and Communications Technology. Special Issue on Human Communications; Volume 54, No. 3; September 2007, pp. 15-23; In English; See also 20080018513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

As the number of existing electronic documents grows day by day, there is a corresponding increase in the need for technologies that will enable access to the information within these documents. To respond to this need, the authors have developed a variety of natural- language information-access techniques for applications including information retrieval, information extraction, question answering, and automatic document classification. The effectiveness of these techniques was confirmed through demonstration of many instances of highest level of precision in an NTCIR evaluation workshop. This paper presents a description of these techniques.

Author

*Information Retrieval; Extraction; Classifications*

**20080018533** Naval War Coll., Newport, RI USA
**Public Affairs: Maintaining Credibility While Evolving with Strategic Communication**
McCarthy, Carla M; Nov 6, 2007; 28 pp.; In English
Report No.(s): AD-A476728; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476728

Public affairs has been identified as a key component of strategic communication, but incorporating public affairs within a strategic communication framework within the military, without compromising credibility, has been a source of friction as commanders have tried dealing with the war on terrorism from different angles, especially in the information environment. In light of the turmoil over strategic communication, public affairs must maintain credibility as the operational commander's principal spokesperson, while also evolving to support strategic communication. This paper examines the issue through a review of what strategic communication is, examples of conflicts with credibility, the existing joint doctrine, and the current outlook of strategic communication as it is being used at the combatant command and joint force command levels and at the Department of Defense level. The paper concludes with some recommendations as strategic communication continues to evolve.
DTIC
*Public Relations; Military Operations; Warfare*

**20080018557** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**The Art and Science of Storytelling in Presenting Complex Information to the Public, or, Give 'Em More Than Just the Facts**
Sohus, Anita M.; Wessen, Alice S.; June 20, 2004; 2 pp.; In English; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40740

In communicating science to the public, just the facts can leave the public baffled, bewildered, and bored. In communicating science to the public, we need to learn to tell the story, not just the facts. Science and engineering is serious business, requiring precise language and rigorous reporting of 'just the facts.' Yet, we believe this very code of integrity has contributed to a public image, at best, of scientists as eccentrics and engineers as geeks, and at worst, as elitist snobs who speak in secret codes. The very heart of the science process - open discussion and disagreement - often leaves the public with the impression that scientists don't know which way is up.
Derived from text
*Engineers; Communication; Information; News Media; Periodicals; Scientists*

**20080018909** Joint Military Intelligence Coll, Washington, DC USA
**Intelligence Professionalism in the Americas (profesionalismo de inteligencia en las americas)**
Swenson, Russell G; Lemozy, Susana C; Nov 2004; 586 pp.; In English
Report No.(s): AD-A476850; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476850

Numerous individuals contributed directly and indirectly to the development and completion of this supranational project. It is impossible to name them all, but those who deserve special mention are Major Clif Prat, (U.S. Army) and senior DIA official Rix Mills, both of whom contributed substantially to the accurate translation of South American varieties of Spanish. U.S. State Department foreign service officer and distinguished JMIC faculty member Jon Wiant volunteered his deft pen to create the memorable illustrations. His work offers a welcome complement to the text. Finally, the editors wish to acknowledge Margaret Daly-Hayes, Director of the Center for Hemispheric Defense Studies, for her support of the concept of producing a book on intelligence, and the CHDS itself, which has offered a meeting place for professionals dedicated to the study of government intelligence. The editors also appreciate the continuous support of the leaders, faculty colleagues and students at their respective Joint Military Intelligence Colleges in Argentina and the U.S. The continued exchange of professional experiences within these collegial environments, so long as some written record of these exchanges is created, will ensure that these institutions will remain seedbeds for the growth and flowering of an ever more mature intelligence literature. Finally, the editors wish to express their appreciation to Fara Abrams, 2005 Intelligence Community Scholar at the JMIC, for expertly compiling the changes to this revised edition.
DTIC
*Education; Intelligence; Students*

**20080018942** Howrey, Simon, Arnold and White, LLP-OC, Menlo Park, CA, USA
**Persistent Archives**
Moore, R. W., Inventor; Rajasekar, A., Inventor; 30 Dec. 2004; 138 pp.; In English
Contract(s)/Grant(s): F19628-96-C-0020
Patent Info.: Filed Filed 30 Dec 04; US-Patent-Appl-SN-11 027 924
Report No.(s): PB2007-110155; No Copyright; Avail.: CASI: A07, Hardcopy

A persistent archive of a collection of data objects comprises a self-describing, infrastructure-independent representation of a logical structure for the collection and a self-describing, infrastructure-independent representation of the data objects. The archive is persistent in that it may be instantiated at an indefinite point in time in the future regardless of the state of technology at that time. A knowledge-based persistent archive of a collection of data objects comprises the foregoing two elements but also a self-describing,infras tructure-independent representation of knowledge relevant to the collection. Another embodiment of a knowledge-based persistent archive comprises at least one representation of a collection or the data objects, at least one self-describing, infrastructure-independent, or executable specification of one or more transformations relevant to the collection, and at least one self-describing, infrastructure-independent, or executable specification of one or more rules relevant to the collection.

NTIS

*Data Acquisition; Documents; Patent Applications*

## 88
## SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93.*

**20080018556** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
**Kite: Status of the External Metrology Testbed for SIM**
Dekens, Frank G.; Alvarez-Salazar, Oscar; Azizi, Alireza; Moser, Steven; Nemati, Bijan; Negron, John; Neville, Timothy; Ryan, Daniel; June 21, 2004; 13 pp.; In English; SPIE Conference on Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40739

Kite is a system level testbed for the External Metrology system of the Space Interferometry Mission (ESA). The External Metrology System is used to track the fiducial that are located at the centers of the interferometer's siderostats. The relative changes in their positions needs to be tracked to tens of picometers in order to correct for thermal measurements, the Kite testbed was build to test both the metrology gauges and out ability to optically model the system at these levels. The Kite testbed is an over-constraint system where 6 lengths are measured, but only 5 are needed to determine the system. The agreement in the over-constrained length needs to be on the order of 140 pm for the ESA Wide-Angle observing scenario and 8 pm for the Narrow-Angle observing scenario. We demonstrate that we have met the Wide-Angle goal with our current setup. For the Narrow-Angle case, we have only reached the goal for on-axis observations. We describe the testbed improvements that have been made since our initial results, and outline the future Kite changes that will add further effects that ESA faces in order to make the testbed more ESA like.

Author

*Interferometers; Measuring Instruments; Angles (Geometry); Metrology; Space Missions; SIM*

**20080018717** Research and Technology Organization, Neuilly-sur-Seine, France
**Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights**
July 2007; In English; AVT-142 RTO AVT/VKI Lecture Series, 6-10 Feb. 2006, Genese, Belgium; See also 20080018718 - 20080018731
Report No.(s): RTO-EN-AVT-142; AC/323(AVT-142)TP/111; Copyright; Avail.: CASI: C01, CD-ROM

Topics covered include: Ab Initio Atomistic Thermodynamics for Surfaces: A Primer; Introduction to Theoretical Surface Science; Simulation of Gas-Surface Dynamical Interactions; Molecular Dynamics Simulations of Surface Processes: Oxygen Recombination on Silica Surfaces at High Temperature; Detailed and Simplified Kinetic Schemes for High Enthalpy Air Flows and their Influence on Catalycity Studies; Theory and Computing of Gas Phase Chemical Reactions: From Exact Quantum to Approximate Dynamical Treatments; Theoretical Estimates of Reaction Observables vis-a-vis Modern Experiments; Laboratory Determination of Thermal Protection System Materials Surface Catalytic Properties; Interaction of Reactive Gas

Flows and Ceramics at High Temperature - Experimental Methods for the Measurement of Species Recombination during Planetary Entry; Experimental Studies on Hypersonic Stagnation Point Chemical Environment; Reacting Flows Simulation with Applications to Ground to Flight Extrapolation; Determination of Effective Recombination Probability: Detailed Aspects of a Macroscopic Methodology; Numerical Implementation of Surface Catalysis, Reaction, and Sublimation; and A Risk-Based Approach for Aerothermal/TPS Analysis and Testing.
Derived from text
*Aerothermodynamics; Thermal Protection; Thermal Analysis; Molecular Dynamics; Gas-Solid Interactions; Vapor Phases; Surface Reactions; Oxygen Recombination; Enthalpy; Catalysis*

**20080018718** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium
**Experimental Studies on Hypersonic Stagnation Point Chemical Environment**
Chazot, O.; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 13-1 - 13-32; In English; See also 20080018717; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Development of space transportation is a very challenging task for the aerospace research and industry. Hypersonic flight should be investigated in details to allow designing spacecraft according to the severe environment of their flight conditions. Typically during a planetary re-entry, when a capsule or a space vehicle approaches the relatively dense atmosphere a strong bow shock takes place ahead of the vehicle detached from its nose. It is subjected to wide range of pressure, heat transfer and shear levels. Several features, specific of hypersonic regime appear, as thin shock layer, entropy layer, viscous interaction, which are described in classical textbook [1-3]. Among those phenomena one could remark the high temperature effects since they appear as one of the critical points in the design phase of the vehicle mission. Indeed across the shock a large amount of kinetic energy is converted into thermal energy. This large energy density leads to high temperature of the gas mixture where dissociation and ionization take place. It results into a plasma flow which impinges on the vehicle wall. To sustain this important heattransfer the spacecraft must be equipped with suitable Thermal Protection System (TPS). Their role is essential for the success of the re-entry manoeuvre, but their design is difficult due to the complexity of the heat-transfer phenomena. This later can be described with two main contributions [4]: a conductive heat-flux from the very high temperature flow reaching the wall, and a diffusion one due to chemical recombination at the wall activated by the catalytic properties of the TPS. The radiative part is left aside in this description, but one should remember that it could be important in certain condition. Author
*Hypersonics; Stagnation Point; Thermal Protection; Gas Mixtures; Heat Transfer; Heat Flux; Magnetohydrodynamic Flow; Shock Waves; Temperature Effects*

**20080018719** Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany
**Ab Initio Atomistic Thermodynamics for Surfaces: A Primer**
Rogal, Jutta; Reuter, Karsten; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 2-1 - 2-18; In English; See also 20080018717; Original contains color and black and white illustrations
Contract(s)/Grant(s): NMP3-CT-2003-505670
Report No.(s): Paper 2; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Rational design and advancement in materials science will ultimately rely on an atomic-scale understanding of the targeted functionality. Corresponding modeling must then address the behavior of electrons and the resulting interactions (often expressed in the terminology of chemical bonds) that govern the elementary processes among the atoms and molecules in the system. Modern electronic structure theory methods like density-functional theory (DFT) [1-5] have matured to a standard tool for this task, allowing a description that is often already accurate enough to allow for a modeling with predictive character. These techniques are referred to as first-principles (or in latin: ab initio) to indicate that they do not rely on empirical or fitted parameters, which then makes them applicable for a wide range of realistic conditions, e.g. realistic environmental situations of varying temperatures and pressures [6]. The latter type of application seems at first sight at variance with the frequent argument describing DFT as a zero-temperature, zero-pressure technique. Such a confusion arises, when thinking that DFT provides (apart from a wealth of information about the electronic structure) only the total energy of the system. Instead, it is crucial to realize that this kind of energetic information can be obtained as a function of the atomic configuration {RI}. This leads to the so-called potential energy surface (PES) E({RI}), which then contains the relevant information needed to describe the effect of temperature on the atomic positions. Obviously, a (meta)stable atomic configuration corresponds to a (local) minimum of the PES. The forces acting on the given atomic configuration are just the local gradient of the PES, and

the vibrational modes of a (local) minimum are given by the local PES curvature around it. One possibility to go from this to situations of finite temperature and finite pressure is to achieve a matching with thermodynamics. This is the general idea behind ab initio atomistic thermodynamics, namely to employ the information on the first-principles PES to calculate appropriate thermodynamic potential functions like the Gibbs free energy [7-10]. Once such a quantity is known, one is immediately in a position to evaluate macroscopic system properties using the standard methodology of thermodynamics. Apart from bridging to any (T,p)-conditions, this methodology is particularly useful for larger systems, which may readily be divided into smaller subsystems that are mutually in equilibrium with each other. Each of the smaller and thus potentially simpler subsystems can then be first treated separately, and the contact between the subsystems is thereafter established by relating their corresponding thermodynamic potentials. Such a 'divide and conquer' type of approach can be especially efficient, if infinite, but homogeneous parts of the system like bulk or surrounding gas phase can be separated off, and are then merely represented by corresponding reservoirs [11-16]. Although not further discussed here, another aspect could be to consider situations of 'constrained equilibria' [14,15], where not all, but only some of the subsystems are in thermodynamic equilibrium.
Author
*Thermodynamic Equilibrium; Ambient Temperature; Electronic Structure; Density Functional Theory; Chemical Bonds; Temperature Effects; Vapor Phases; Potential Energy; Gibbs Free Energy*

**20080018720** Ulm Univ., Ulm, Germany
**Introduction to Theoretical Surface Science**
Gross, Axel; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 3-1 - 3-22; In English; See also 20080018717; Original contains color and black and white illustrations
Report No.(s): Paper 3; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent years have seen a tremendous progress in the microscopic theoretical treatment of surfaces and processes on surfaces. While some decades ago a phenomenological thermodynamic approach was dominant, a variety of surface properties can now be described from first principles, i.e. without invoking any empirical parameters. Consequently, the field of theoretical surface science is no longer limited to explanatory purposes only. It has reached such a level of sophistication and accuracy that reliable predictions for certain surface science problems have become possible. Hence both experiment and theory can contribute on an equal footing to the scientific progress. In this lecture, the theoretical concepts and computational tools necessary and relevant for theoretical surface science will be introduced. A microscopic approach towards the theoretical description of surface science will be presented. Based on the fundamental theoretical entity, the Hamiltonian, a hierarchy of theoretical methods will be introduced in order to describe surface structures and processes at different length and time scales. But even for the largest time and length scales, all necessary parameters will be derived from microscopic properties.
Author
*Surface Properties; Phenomenology; Hamiltonian Functions; Thermodynamics*

**20080018721** Ulm Univ., Ulm, Germany
**Simulation of Gas-Surface Dynamical Interactions**
Gross, Axel; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 4-1 - 4-26; In English; See also 20080018717; Original contains color and black and white illustrations
Report No.(s): Paper 4; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The interaction of atoms and molecule with surfaces is of great technological relevance. Both advantageous and harmful processes can occur at surfaces. If an atom or molecule impinges on a surface, it can either scatter back into the gas phase or become adsorbed on the surface. Molecules can furthermore undergo chemical reactions at the surface. All these processes are accompanied by energy transfer between the impinging projectile and the substrate. The simulation of the dynamics of the gas-surface interaction still represents a considerable challenge since the coupling of a low-dimensional object, the impinging atom or molecule, to the substrate with in principle infinitely many degrees of freedom has to be modeled. Furthermore, depending on the mass of the atom or molecule, quantum effects both in the molecular motion as well as in the excitation of the substrate have to be taken into account. In this lecture, the quantum and classical methods required for the simulation of gas-surface dynamical interactions will be reviewed. Furthermore, the main processes occurring in the interaction of atoms and molecules with substrates will be illustrated using quantum calculations and classical molecular dynamics simulations.
Author
*Gas-Solid Interactions; Surface Reactions; Molecular Dynamics; Chemical Reactions; Energy Transfer; Simulation; Vapor Phases*

**20080018722** NASA Ames Research Center, Moffett Field, CA, USA

**A Risk-Based Approach for Aerothermal/TPS Analysis and Testing**

Wright, Michael J.; Grinstead, Jay H.; Bose, Deepak; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 17-1 - 17-24; In English; See also 20080018717; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The current status of aerothermal and thermal protection system modeling for civilian entry missions is reviewed. For most such missions, the accuracy of our simulations is limited not by the tools and processes currently employed, but rather by reducible deficiencies in the underlying physical models. Improving the accuracy of and reducing the uncertainties in these models will enable a greater understanding of the system level impacts of a particular thermal protection system and of the system operation and risk over the operational life of the system. A strategic plan will be laid out by which key modeling deficiencies can be identified via mission-specific gap analysis. Once these gaps have been identified, the driving component uncertainties are determined via sensitivity analyses. A Monte-Carlo based methodology is presented for physics-based probabilistic uncertainty analysis of aerothermodynamics and thermal protection system material response modeling. These data are then used to advocate for and plan focused testing aimed at reducing key uncertainties. The results of these tests are used to validate or modify existing physical models. Concurrently, a testing methodology is outlined for thermal protection materials. The proposed approach is based on using the results of uncertainty/sensitivity analyses discussed above to tailor ground testing so as to best identify and quantify system performance and risk drivers. A key component of this testing is understanding the relationship between the test and flight environments. No existing ground test facility can simultaneously replicate all aspects of the flight environment, and therefore good models for traceability to flight are critical to ensure a low risk, high reliability thermal protection system design. Finally, the role of flight testing in the overall thermal protection system development strategy is discussed.

Author

*Aerothermodynamics; Risk; Thermal Analysis; Ground Tests; Sensitivity Analysis; Reliability; Monte Carlo Method; Flight Tests*

**20080018723** Korea Advanced Inst. of Science and Technology, Daejeon, Korea, Republic of

**Numerical Implementation of Surface Catalysis, Reaction, and Sublimation**

Park, Chul; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 16-1 - 16-20; In English; See also 20080018717; Original contains color and black and white illustrations

Report No.(s): Paper 16; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This lecture consists of three parts: 1) quantification of rates of gas-surface interaction, 2) formulation of gas-surface balance conditions, and 3) survey of the gas-surface interaction problems in the entry flights of various planets. The first part reviews the role of surface rates and flow parameters in Goulard s theory, the catalytic rates for Martian entry problem, the reaction rates for oxidation and nitridation of carbon, rough surfaces, and the relationship between forward and reverse surface rates. The second part covers the method of expressing the diffusion flux at wall, derivation of the mass balance condition at wall, and its implementation in the boundary layer and computational-fluid-dynamics formulations. In the third part, a brief survey is made of the gas-surface interaction problems occurring in entry flights into Earth, Mars, Venus, Titan, and outer planets.

Author

*Catalysis; Surface Reactions; Reaction Kinetics; Sublimation; Gas-Solid Interactions; Computational Fluid Dynamics; Flow Characteristics*

**20080018724** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium; Free Univ., Brussels, Belgium

**Determination of Effective Recombination Probability: Detailed Aspects of a Macroscopic Methodology**

Rini, P.; Degrez, G.; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 15-1 - 15-46; In English; See also 20080018717; Original contains color and black and white illustrations

Report No.(s): Paper 15; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The purpose of the present Lecture Series is to provide an up-to-date review of the experimental techniques, the theoretical models, as well as the numerical simulation strategies involved in the treatment of the chemical character of high temperatures gases. To this end, aspects of both materials and high temperatures fluid sciences are discussed together, with

the aim of enhancing the improvements in the understanding of the processes of heat release on solid surfaces close to reactive gases taking place in re-usable hypersonic flight vehicles, ballistic missiles, and rockets exhaust nozzles. In addition, further details are given concerning the modeling and the experimental investigation of gas-surface interactions. This latter aspect is strongly related to the diffusive component of the heat flux experienced by a vehicle entering the atmosphere. In particular, the way in which the Thermal Protection Material (TPM) influences the gas particle recombination on its surface has a tremendous effect on the wall heat flux. As will be shown later on, the heat flux measured in the stagnation point of a probe held in a plasma wind tunnel can simply double when materials enhancing complete recombination are used instead of inert material. Therefore, the role played by the modelling of gas/surface interactions is of fundamental importance in the understanding of heat-transfer and as a consequence in the design of Thermal Protection Systems (TPS). When analyzing the interaction between a gas and a non ablating surface, at least two approaches can be put in evidence. A microscopic and a macroscopic approach. Recent years have seen a very important progress in the microscopic theoretical treatment of surfaces and processes on surfaces described by the so called theoretical surface science [31]. The aim of theoretical surface science is to contribute significantly to the fundamental understanding of the underlying principles governing the geometric and electronic structure of surfaces, together with the processes taking place on these surfaces such as growth of surface layers, gas-surface scattering, friction or reaction at surfaces [30]. In the framework of atmospheric (re)entry, theoretical surface science could provide a very attractive tool for the improvement of the current techniques used to estimate the catalytic activity of thermal protection materials. Some research is ongoing in this direction and published data are already available providing values of recombination probabilities of oxygen on Silica based materials computed using Molecular Dynamics techniques [54]. The main advantage of this microscopic approach is that a variety of surface properties can be described from first principles, i.e. without invoking any empirical parameters. On the other hand, this approach, based on expensive computations, has not yet been used to investigate complicated flow conditions like those typical of high enthalpy facilities. It will certainly be worth to investigate this possibility in the future.
Author
*Reactivity; Probability Theory; Heat Flux; Thermal Protection; Surface Reactions; Silicon Dioxide; Molecular Dynamics; Mathematical Models; Atmospheric Chemistry; Catalytic Activity; Heat Transfer; Surface Properties*

**20080018725** Perugia Univ., Perugia, Italy
**Theoretical Estimates of Reaction Observables vis-a-vis Modern Experiments**
Lagana, A.; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 10B-1 - 10B-26; In English; See also 20080018717; Original contains black and white illustrations
Report No.(s): Paper 10B; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent advances in experimental chemical reaction dynamics are examined. The paper focuses on crossed beam technologies because the detailed single collision information they provide is a stringent test of the adopted molecular interaction. In this respect some prototypal atom-diatom and diatom-diatom elementary reactions are analyzed.
Author
*Molecular Dynamics; Atomic Collisions; Molecular Collisions; Reactivity; Vapor Phases; Shock Waves; Equations of Motion*

**20080018726** Politecnico di Milano, Milan, Italy
**Reacting Flows Simulation with Applications to Ground to Flight Extrapolation**
Barbante, P. F.; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 14-1 - 14-20; In English; See also 20080018717; Original contains black and white illustrations
Report No.(s): Paper 14; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The development of next generation reusable space vehicles requires a precise qualification of their Thermal Protection System materials. The catalytic properties are usually determined in plasma wind tunnels for sets of test conditions relevant to the planned flight mission program. Therefore, for such a situation, it is important to have a methodology that allows for the correct extrapolation of the ground test conditions to the real flight ones and vice-versa. The Local Heat Transfer Simulation concept presented in this paper is a possible strategy to accomplish such a task. The computational results show that the ground test conditions are indeed correctly extrapolated to the flight ones and a simple method to account for possible discrepancies between the two configurations is presented.
Author
*Extrapolation; Reacting Flow; Thermal Protection; Heat Transfer; Ground Tests; Plasmas (Physics)*

**20080018727** Centre National de la Recherche Scientifique, Odeillo, France

**Interaction of Reactive Gas Flows and Ceramics at High Temperature - Experimental Methods for the Measurement of Species Recombination during Planetary Entry**

Balat-Pichelin, Marianne; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 12-1 - 12-26; In English; See also 20080018717; Original contains color and black and white illustrations

Report No.(s): Paper 12; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During the atmospheric re-entry phase of aerospace vehicles, several physico-chemical phenomena taking place on the hot parts (nose cap and wing leading edges) can lead to an important excess of heating and a possible damage of the protective materials. PROMES-CNRS laboratory has developed since several years experimental methods to study oxidation and catalytic recombination of atomic oxygen under conditions of atmospheric re-entry on Earth and on Mars. The most important conditions for the ground simulation of re-entry (high temperature, low pressure plasma ) have been realized in the MESOX set-up associating a reactor placed at the focus of a solar radiation concentrator and a microwave generator. Concerning the dynamic contribution, only low enthalpy flow can be reproduced on this set-up. A multi-scale experimental and theoretical approach has been developed to evaluate the recombination parameters. On one hand, the study of the atomic oxygen recombination on partially catalytic based -silicon or - aluminum ceramic materials, at high temperature (850-2000 K) has been done at different pressures (200-2000 Pa) by a thermal approach, at a mesoscopic scale and leads to the determination of the thermal flux of recombination transferred to the material and to the chemical energy accommodation coefficient . Influences of total pressure, surface temperature and material microstructure are studied. On the other hand, a chemical approach, at a microscopic scale is developed for the evaluation of the recombination coefficient using optical emission spectroscopy and actinometry technique on the same device. The values obtained by this method are complementary of the ones of the thermal approach. At the atomic scale, a simulation by Molecular Dynamics is performed in collaboration with Cacciatore from IMIP-CNR, Bari in order to predict atomic oxygen recombination process over silica-based ceramics at high temperatures.

Author

*High Temperature Plasmas; Oxygen Recombination; Recombination Coefficient; Surface Temperature; Molecular Dynamics; Gas Flow; Heat Flux; Optical Emission Spectroscopy*

**20080018728** SRI International Corp., Menlo Park, CA, USA

**Laboratory Determination of Thermal Protection System Materials Surface Catalytic Properties**

Marschall, Jochen; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 11-1 - 11-32; In English; See also 20080018717; Original contains color and black and white illustrations

Report No.(s): Paper 11; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Different experimental approaches to measuring catalytic reaction efficiencies on thermal protection system materials are reviewed. Special emphasis is given to the theory and application of the diffusion tube side-arm reactor technique. In this technique, reactants diffuse into a dead-end tube and are progressively removed from the gas phase by surface reactions on the walls, establishing unique steady-state concentration profiles along the length of the tube. Reactant loss probabilities are determined by matching experimentally measured species profiles to calculated solutions of a reaction-diffusion model. The advantages of laser-based methods for species concentration measurements are summarized and different approaches to reactor modeling and the extraction of reaction efficiencies from measured data are presented. The advantages and limitations of the diffusion-tube side-arm technique, the associated uncertainties in derived loss probabilities, and the prospects for further laboratory development, are presented.

Author

*Thermal Protection; Surface Properties; Concentration (Composition); Diffusion; Extraction; Probability Theory; Vapor Phases; Surface Reactions*

**20080018729** Consiglio Nazionale delle Ricerche, Bari, Italy

**Molecular Dynamics Simulations of Surface Processes: Oxygen Recombination on Silica Surfaces at High Temperature**

Cacciatore, M.; Rutigliano, M.; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 5-1 - 5-22; In English; See also 20080018717; Original contains black and white illustrations

Report No.(s): Paper 5; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The interaction between a molecule and a solid surface can lead to a great variety of elementary processes such as elastic, inelastic and reactive. Of particular importance is the dissociative chemisorption of a diatomic molecule, where a molecule chemisorbed at the surface in a specific roto-vibrational state (v,j) dissociates with the two atoms adsorbed or scattered into the gas-phase. Of great importance is also the atom recombination on surfaces: Here two atoms recombine thus forming a diatomic molecule that can be either chemisorbed or reflected in the gas-phase in a given internal energy state. Reactions (1)-(2) are very often the rate determining step of complex heterogeneous systems of interest in different branches of industrial and technological applications, as for example in the ammonia synthesis, hydrocarbon production, chemical vapour deposition, etching and thin solid film deposition via plasma, nuclear rector technologies [1]. Both processes are of central importance in aerothermodynamics and the chemistry of interstellar media. Thus, the recombination of atomic O and N on silica and UHTC materials plays a central role for the thermal protection system of the space shuttles entering into the terrestrial atmosphere, whereas the recombination of hydrogen atoms on ice grains covered by carbon is, very likely, the main source of molecular hydrogen observed in the interstellar media. The interaction of chemical species with surfaces can lead to other non-reactive chemico-physical processes such as the inelastic processes and adsorption. The adsorption processes occur when the particle is trapped in a chemisorption site and its available energy is not enough to escape from the chemisorption potential well. The inelastic processes can be of two types: direct and indirect. In the first case the molecule hits the surface and it is scattered in the gas-phase after few bounces. Due to the interaction, the internal energy state of the molecule leaving the surface is different with respect to its state before the collision. In the indirect scattering, or adsorption/desorption collisions, the interaction occurs on a longer time scale and the collision is more involved: in fact, the molecule hits the surface several times, it is temporarily adsorbed eventually forming a surface activated complex before desorbing in the gas-phase. The energy distribution of the scattered molecules is different according to the different mechanism followed in the interaction.

Author

*Molecular Dynamics; Oxygen Recombination; Solid Surfaces; High Temperature; Aerothermodynamics; Atomic Recombination; Diatomic Molecules; Hydrocarbons; Interstellar Chemistry; Molecular Gases*

**20080018730** Centre National de la Recherche Scientifique, Chatenay-Malabry, France; Centre National de la Recherche Scientifique, Saint-Etienne du Rouvray, France

**Detailed and Simplified Kinetic Schemes for High Enthalpy Air Flows and their Influence on Catalycity Studies**

Bourdon, Anne; Bultel, Arnaud; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 9-1 - 9-60; In English; See also 20080018717; Original contains black and white illustrations

Report No.(s): Paper 9; Copyright; Avail.: CASI: A04, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The thorough understanding of the formation and the relaxation of the plasma produced in the shock layer developed during the re-entry of a spacecraft in the upper layers of the earth s atmosphere is crucial in order to prevent damaging of its outer surface. Among the different points to be studied, the chemical aspects are particularly important: the mechanical characteristic time scale of the flow being short, the flow is indeed in chemical nonequilibrium. In addition, the inner storage of energy of the different species of the flow leads to other mechanical behaviors than those observed in classical low temperature flows. These nonequilibrium effects have to be taken into account accurately in codes devoted to the study of the interaction between the plasma and the surface. In this paper, we propose to focus our attention on the detailed kinetics of an air plasma under nonequilibrium conditions. First, we present a time-dependent collisional-radiative (CR) model for atomic oxygen to study in detail ionization and three-body recombination rates of oxygen in high temperature air plasma flows. Second we present a time-dependent CR model for air taking into account 13 species and numerous excited states and working over a wide range of pressure and temperature. For typical conditions encountered in reentry flows, we compare this detailed CR scheme for air with simplified schemes (proposed by Park, Dunn & Kang and Gupta et al.) usually implemented in high

enthalpy air flow codes. Finally, a 1D code simulating the stagnation point boundary layer near the wall of the spacecraft is presented and the influence of the gas chemistry on the wall catalycity is discussed.
Author
*Shock Layers; Plasmas (Physics); Reentry; Oxygen Plasma; Boundary Layers; Nonequilibrium Conditions; Air Flow; Kinetics; Simulation*

**20080018731** Perugia Univ., Perugia, Italy
**Theory and Computing of Gas Phase Chemical Reactions: From Exact Quantum to Approximate Dynamical Treatments**
Lagana, A.; Experiment, Modeling and Simulation of Gas-Surface Interactions for Reactive Flows in Hypersonic Flights; July 2007, pp. 10A-1 - 10A-24; In English; See also 20080018717
Report No.(s): Paper 10A; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A realistic simulator of complex gas phase systems needs to handle accurately processes spanning different scales of space and time. The paper outlines the key theoretical and computational features of modern a priori treatments of the dynamics of elementary processes in these systems with particular emphasis on reactive processes.
Author
*Vapor Phases; Rarefied Gas Dynamics; Shock Waves; Reactivity; Electronic Structure; Wave Functions; Simulation; Quantum Chemistry; Molecular Collisions; Complex Systems*

## 89
## ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

**20080018290** Naval Observatory, Washington, DC USA
**Water Maser Kinematics in the Jet of OH 12.8-0.9**
Boboltz, David A; Marvel, Kevin B; Aug 10, 2007; 11 pp.; In English
Report No.(s): AD-A476787; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476787

We present Very Long Baseline Array observations of the kinematics of the water masers associated with OH 12.8-0.9, the fourth member of the so-called water-fountain class of sources. We find that the masers occupy two distinct regions at the ends of a bipolar jetlike structure oriented north-south, with the blue-shifted masers located to the north and the red-shifted masers to the south. The masers are distributed along arc-like structures 12-20 mas across that are oriented perpendicular to the separation axis with an angular separation of ~110 mas on the sky. Our multi-epoch observations show the two maser arcs to be expanding away from each other along the axis of separation. The relative proper motions of the two maser regions is 2.7 mas yr-1 (~105 km s-1 at the assumed distance of 8 kpc). The measured radial velocity difference between the northern blue-shifted masers and the southern red-shifted masers is 48.4 km s-1. The radial velocity, when combined with the proper motion, yields a three-dimensional expansion velocity of 58 km s-1 and an inclination angle of 24-deg for the jet. By combining our radial velocities with historical values, we estimate the three-dimensional acceleration of the masers to be ~0.63 km s-1 yr-1 and a dynamical age for the collimated outflow of ~90 yr.
DTIC
*Masers; Water Masers*

**20080018356** Los Alamos National Lab., NM USA
**Theoretical and Observational Studies of Meteor Interactions with the Ionosphere**
Colestock, P; Close, S; Zinn, John; Jun 1, 2006; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476971; LAUR-06-113; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476971

No abstract available
*Ionospheres; Ions; Metals; Meteoroids; Spacecraft Charging*

**20080018462** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Design and Performance of the Terrestrial Planet Finder Coronagraph**

White, Mary L.; Shaklan, Stuart; Lisman, P. Doulas; Ho, Timothy; Mouroulis, Pantazis; Basinger, Scott; Ledeboer, Bill; Kwack, Eug; Kissil, Andy; Mosier, Gary; Liu, Alice; Bowers, Chuck; Blaurock, Carl; Cafferty, Terry; June 20, 2004; 11 pp.; In English; SPIE Conference on Astronomical Telescopes and Instrumentation, 21-23 Jun. 2004, Glasgow, Scotland, UK; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40758

Terrestrial Planet Finder Coronagraph, one of two potential architectures, is described. The telescope is designed to make a visible wavelength survey of the habitable zones of at least thirty stars in search of earth-like planets. The preliminary system requirements, optical parameters, mechanical and thermal design, operations scenario and predicted performance is presented. The 6-meter aperture telescope has a monolithic primary mirror, which along with the secondary tower, are being designed to meet the stringent optical tolerances of the planet-finding mission. Performance predictions include dynamic and thermal finite element analysis of the telescope optics and structure, which are used to make predictions of the optical performance of the system.

Author

*Coronagraphs; Performance Prediction; Terrestrial Planets; Thermal Analysis; Telescopes; Mechanical Engineering*

**20080018555** Keck Observatory, Mauna Kea, HI, USA

**Baseline Monitoring for Astrometry in Interferometry**

Hrynevych, Michael A.; Ligon, E. Robert; Colavita, M. Mark; June 21, 2004; 12 pp.; In English; SPIE Conference on Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40749

One of the science goals of NASA's Navigator program is ground-based narrow-angle astrometry for extra-solar planet detection, which could be done as part of the proposed Outrigger Telescopes Project. The narrow-angle measurement process, which would use the outrigger telescopes, starts with the determination of the conventional interferometer astrometric baseline, determined from wide-angle astrometry of Hipparcos stars. A baseline monitor system would be employed at each outrigger telescope. This system monitors the pivot point of each telescope - the end point of the astrometric baseline - to measure telescope imperfections that would cause the baseline to vary with telescope rotation. The baseline monitor includes azimuth and elevation cameras that monitor runout along the azimuth and elevation axes of the telescopes. In conjunction with the baseline monitor system, a pivot monitor camera in the dual-star module is used to register the laser metrology corner-cube reflector to the telescope pivot, tying the narrow-angle baseline, which applies to the narrow-angle astrometric measurement, to the wide-angle baseline. In this paper we present the proposed designs for the baseline monitor and pivot-point camera.

Author

*Astrometry; Extrasolar Planets; Planet Detection; Interferometers; Telescopes; Hipparcos Satellite*

**20080018558** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The DART Cylindrical, Infrared, 1 Meter Membrane Reflector**

Morgan, Rhonda M.; Agnes, Greg S.; Barber, Dan; Dooley, Jennifer; Dragovan, Mark; Hatheway, Al E.; Marcin, Marty; June 21, 2004; 12 pp.; In English; SPIE Conference on Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40744

The Dual Anamorphic Reflector Telescopes (DART) is an architecture for large aperture space telescopes that enables the use of membranes. A membrane can be readily shaped in one direction of curvature using a combination of boundary control and tensioning, yielding a cylindrical reflector. Two cylindrical reflectors (orthogonal and confocal) comprise the 'primary mirror' of the telescope system. The aperture is completely unobstructed and ideal for infrared and high contrast observations.

Author

*Hubble Space Telescope; Membrane Structures; Reflectors; Cylindrical Shells; Field of View; Infrared Astronomy; Apertures*

**20080018559** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Terrestrial Planet Finder Interferometer: Architecture, Mission Design and Technology Development**

Henry, Curt; Lay, Oliver; Aung, MiMi; Gunter, Steven M.; Dubovitsky, Serge; Blackwood, Gary; June 21, 2004; 10 pp.; In English; SPIE Conference on Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40745

This overview paper is a progress report about the system design and technology development of two interferometer concepts studied for the Terrestrial Planet Finder (TPF) project. The two concepts are a structurally-connected interferometer (SCI) intended to fulfill minimum TPF science goals and a formation-flying interferometer (FFI) intended to fulfill full science goals. Described are major trades, analyses, and technology experiments completed. Near term plans are also described. This paper covers progress since August 2003 and serves as an update to a paper presented at that month's SPIE conference, 'Techniques and Instrumentation for Detection of Exoplanets.

Author

*Terrestrial Planets; Interferometers; Extrasolar Planets; Systems Engineering; Formation Flying*

**20080018570** Naval Research Lab., Washington, DC USA

**Directions for Space-Based Low Frequency Radio Astronomy. 1. Systems Considerations**

Basart, J. P.; Burns, J. O.; Dennison, B. K.; Weiler, K. W.; Kassim, N. E.; Castillo, S. P.; McCune, B. M.; Radio Science; Feb 1997; Volume 32, No. 1, pp. 251-263; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-396

Report No.(s): AD-A464315; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/100.2/ADA464315

Although observations at the low end of the radio astronomy spectrum were the pre- cursor of all work in radio astronomy, this portion of the spectrum has languished for decades while research at the upper radio frequencies has flourished. Previous work at low frequencies (below 30 MHz) has clearly shown that sensitive high-resolution ground-based observations are extremely difficult to make, if not impossible. Observation quality at low frequencies can leap forward using space-based interferometers. Radio telescopes such as these can be built principally from 'off-the-shelf' components. A relatively low cost space program can make great strides in deploying arrays of antennas and receivers that would produce data contributing significantly to our understanding of galaxies and galactic nebulae. This paper discusses the various aspects of low-frequency telescopes such as past history and significant issues like sensitivity, interference, baseline calibration, wave scattering, and mapping. All aspects of the first stages of space-based, low-frequency radio telescopes can be accomplished with no dependencies on new types of hardware. The time has come to open the final electromagnetic frontier in astronomy.

Author

*Atmospheric Scattering; Low Frequencies; Radio Astronomy; Radio Frequencies; Radio Telescopes*

**20080018574** Naval Research Lab., Washington, DC USA

**Atmospheric Correction Algorithm for Hyperspectral Remote Sensing of Ocean Color from Space**

Gao, Bo-Cai; Montes, Marcos J; Ahmad, Ziauddin; Davis, Curtiss O; Applied Optics; Feb 20, 2000; Volume 39, No. 6, pp. 867-896; In English; Original contains color and black and white illustrations

Report No.(s): AD-A464318; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/100.2/ADA464318

Existing atmospheric correction algorithms for multichannel remote sensing of ocean color from space were designed for retrieving water-leaving radiances in the visible over clear deep ocean areas and cannot easily be modified for retrievals over turbid coastal waters. We have developed an atmospheric correction algorithm for hyperspectral remote sensing of ocean color with the near-future Coastal Ocean Imaging Spectrometer. The algorithm uses lookup tables generated with a vector radiative transfer code. Aerosol parameters are determined by a spectrum-matching technique that uses channels located at wavelengths longer than 0.86 mm. The aerosol information is extracted back to the visible based on aerosol models during the retrieval of water-leaving radiances. Quite reasonable water-leaving radiances have been obtained when our algorithm was applied to process hyperspectral imaging data acquired with an airborne imaging spectrometer.

Author

*Algorithms; Atmospheric Attenuation; Atmospheric Correction; Atmospheric Scattering; Coasts; Imagery; Radiative Transfer; Remote Sensing; Remote Sensors; Water Color*

**20080018832** Gemini Observatory, Hilo, HI, USA
**Gemini Focus: Newsletter of the Gemini Observatory**
Michaud, Peter, Editor; December 2007; 76 pp.; In English; See also 20080018833 - 20080018851; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Possible Evidence for Surface Renewal on Charon; The Missing Link Between Dwarf Galaxies and Globular Clusters; Unusual Magnetic Activity in the M8.5 Dwarf Star TVLM513-46546; Quasars and Supermassive Black Holes in the Early Universe; Mapping the Galactic Outflow Roots in NGC 1569; Chemical Evolution at the Milky Way's Center; The Gemini Deep Deep Survey: A Tenth Paper Redux; Ancient Supernova Light Echoes; Gemini Science Highlights; A Tale of the Starry Dandelion and the Cosmic Gecko; MCAO System Status; GNIRS Recovery Update; Astronomy's New Renaissance Scholar: Nathan Smith; Into the Deep: Isobel Hook; On the Path to First Light: Roberto Abraham; Looking for the Next Page-Turning Surprise: Joss Hawthorn; Solving Mysteries at the Heart of a Galaxy: Thaisa Storchi-Bergmann; Reaching for the Stars: Simon Casassus; and Exploring at the Limit: Michael Liu.
Derived from text
*Black Holes (Astronomy); Dwarf Galaxies; Galactic Clusters; Quasars; Supernovae; Observatories; Globular Clusters; Dwarf Stars; Charon*

**20080018833** Gemini Observatory, Hilo, HI, USA
**A Tale of the Starry Dandelion and the Cosmic Gecko**
Petersen, Carolyn Collins; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 36-39; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

About 190 million years ago, a dust cloud some 5,200 light-years from the Sun coalesced to begin the process of star birth. Today, NGC 6520 (shown on the center pages) is ablaze with hot, massive young stars arrayed in a dandelion seed-shaped cluster. Not far away lies the gecko-shaped remains of what may be their birth cloud, Barnard 86. Both are set against a glittering gold-toned backdrop of stars that are far more distant and populate parts of the inner regions and bulge of our galaxy. This image, taken using the Gemini Multi-Object Spectrograph on Gemini South, shows details in a 9.7 x 5.4-arcminute section of a larger, highly populated region in the Sagittarius star cloud. It provides the striking optical view of the cluster and its nearby dark-cloud companion. The total mass of the stars in NGC 6520 is roughly equivalent to 300-400 times the mass of the Sun, while the nearby cloud contains enough material to make about 3,000 more stars like the Sun. The close proximity between the star cluster and its nearby dark-cloud companion suggests that two are related. A robotic wide-angle survey of the southern sky (conducted by a team of astronomers led by John Gaustad of Swarthmore College and described in a 2001 paper) that singled out hydrogen-alpha emissions from warm, ionized interstellar gas shows a nebula extending from the dark globule to embrace the star cluster. The tale of the birth of NGC 6520 begins with Barnard 86, which is likely a remnant of a once-larger cloud of gas and dust. This mysterious dark spot is a Bok globule, a cold and dense cloud of dust and molecular gas from which stars form. Such clouds are often often associated with larger complexes of glowing gas and dust called H II regions (so-named because they glow in the light of ionized hydrogen). The globules are often backlit by the glow of the H II emission, but these dense clouds themselves appear dark because they absorb most visible light
Derived from text
*Stellar Mass; Star Clusters; Sagittarius Constellation; Galaxies; Ionized Gases; H II Regions; Hot Stars; Massive Stars*

**20080018834** Arizona Univ., AZ, USA
**Quasars and Supermassive Black Holes in the Early Universe**
Jiang, Linjua; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 16-18; In English; See also 20080018832; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Quasars or Quasi-Stellar Objects (QSOs) were at their discovery, believed to be star-like objects in the sky. It was soon discovered that they were extragalactic sources with extremely high luminosities that radiate across the electromagnetic spectrum from very far. This article reviews the work being done at Gemini to understand these phenomena.
CASI
*Electromagnetic Spectra; Quasars; Gravitational Collapse*

**20080018835** Gemini Observatory, Hilo, HI, USA
**Exploring at the Limit: Michael Liu**
O'Meara, Stephen James; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 70-73; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

This article reviews the research of Michael Liu. He is currently an Associate Astronomer at the University of Hawaii5

Institute for Astronomy. He has been a highly effective Gemini user, pushing the performance of the 8-meter Gemini North telescope to its limits while pushing himself to excel in new areas of astronomy research. His areas of interest are the study of substellar objects, such as brown dwarfs, particularly those in close proximity to a sun-like star.
CASI
*Astronomy; Biography; Extrasolar Planets*

**20080018836** Gemini Observatory, Hilo, HI, USA
**On the Path to First Light: Roberto Abraham**
Petersen, Carolyn Collins; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 54-57; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

Ask astronomers what first put them on the path to studying planets, stars and galaxies and they often point to such defining moments as planetarium visits, childhood telescope adventures, and watching space missions on TV. University of Toronto astronomer Roberto (Bob) Abraham counts all three experiences as guideposts on his lifelong path to the stars. 'A mp to Vancouver's H.R.Macmillan Planetarium was what got me interested in astronomy in the first place,' he said. 'There was some tour of Soviet space memorabilia and then simultaneous with that there was a Viking landing on Mars. When I was 11 all this space stuff h t the headlines and that got me kind of curious.' Then, there is his lifelong love of telescopes that began when he was a child. 'We had a summer place in Washington State where we'd go,' Roberto recalled. 'My dad had this telescope for spying on the neighbors. One night we turned it on the Moon and that was pretty much it. Just one look at the moon through that little telescope and that set me on the course for the rest of my life.' Somewhere along the line, Roberto vividly recalls watching Apollo astronauts walking on the moon on a black-and-white TV while on holiday with his parents in Spain. Connecting that to the Moon he'd seen through the telescope was a powerful call to study the stars. By his own account Roberto's life has always been on a vector to the deeps of space. 'I actually decided at age u that I wanted to be an astronomer,' he said. 'I even decided at age 18 that I wanted to be an astronomer at the University of Toronto. I have zero imagination. At no point in my life have I deviated from the plan that I devised at age u and refined at age 18. Things couldn't be better.' Bob's life plan first led him to study BL Lac host galaxies, a type of active galactic nuclei. This took him to galaxy morphology studies and what he described as a certain amount of notoriety for theorizing how galaxies got to be the shapes we see.
Derived from text
*Active Galactic Nuclei; Space Missions; Viking Mars Program; Planetariums; Morphology*

**20080018837** McMaster Univ., Hamilton, Ontario, Canada
**Ancient Supernova Light Echoes**
Welch, Doug; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 29-31; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

They have been out there for hundreds of years. We have probably recorded any number of them on images in the past. However, until now, no one recognized them for what they are-the reflected and delayed light from the most spectacular events in the heavens: supernovae. Now we are using the Gemini telescopes and the Gemini Multi-Object Spectrographs (GMOS, north and south) to learn about ancient outbursts that were either missed entirely or occurred prior to the development of the spectrograph and other sensitive detectors. The story of the discovery of ancient supernova light echoes by the SuperMACHO Project began with the allocation of a five-year survey program to detect microlensing using the Blanco 4-meter telescope at the Cerro Tololo Inter-American Observatory. Unlike the MACHO Project, which sought the presence of unluminous (or underluminous) mass by looking for the brightening8 of background stars already identified in a list, SuperMACHO dade use of 'd&rence imaging.' This technique allowed many images to be compared in a way that reduced the effects of crowding and could detect any brightening objects within the images, not just those originally on a star list. This technique also proved to be sensitive to motion. No interesting moving objects were anticipated--even high proper motion stars don't move much on images taken over the course of five years. Indeed, for the first two years, the sky did not move.
Derived from text
*Supernovae; Echoes; Stellar Luminosity; Gravitational Lenses; Spectrographs; Stellar Motions*

**20080018838** Princeton Univ., Princeton, NJ, USA
**Unusual Magnetic Activity in the M8.5 Dwarf Star TVLM513-46546**
Berger, Edo; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 13-15; In English; See also 20080018832; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

I n recent years, the stellar mass function has been extended at the bottom of the main sequence and beyond with the

discovery of numerous ultracool dwarfs (very low-mass stars and brown dwarfs of spectral types late-M, L, and T). Significant observational and theoretical progress in our understanding of these objects has been made since their discovery but many questions regarding their structure and formation remain unanswered. Of particular interest is whether ultra-cool dwarfs, which have h11y convective interiors, can generate and dissipate magnetic fields, and support chromospheres and coronae. The answer has important ramifications for our view of the internal structure of ultra-cool dwarfs, and the physical conditions in their atmospheres. Past observations of the traditional stellar magnetic activity indicators (chromospheric H-alpha and coronal x-ray emission) revealed peak activity in the mid-M dwarfs, followed by a dramatic decline in the fraction and level of activity in the ultra-cool regime. However, in recent years it has become evident that at least some ultra-cool dwarfs are capable of producing unanticipated levels of magnetic activity, manifested primarily in their strong quiescent and flaring radio emission. This emission is produced by relativistic electrons propagating in the stellar magnetic field, and therefore it traces the strength and geometry of the field. Indeed, the radio luminosity as a function of the total bolometric luminosity appears to increase relative to early- and mid-M dwarfs.
Author
*Magnetic Fields; Stellar Activity; Stellar Magnetic Fields; Brown Dwarf Stars; H Alpha Line; High Energy Electrons; Main Sequence Stars; Magnetic Variations*

**20080018839** Gemini Observatory, Hilo, HI, USA
**GNIRS Recovery Update**
Jensen, Joseph; Arriagada, Gustavo; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 43-45; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

At the end of April, just as the June 2007 issue of Gemini was being published, the Gemini Near-Infrared Spectrograph (GNIRS) suffered a temperature controller failure that caused it to overheat. Many details and photographs of GNIRS can be found on the Gemini web pages at: http://www.gemini.edu/ index.php?option=content&task=view&id=231 where the problem was first reported to the Gemini community. Although some significant parts were damaged, most of the GNIRS instrument is undamaged. Gemini has started the process of restoring GNIRS to fd functionality by bringing it to Hilo, where it will be repaired and returned to service on Gemini North, following the recommendation of the Gemini Science Committee. In this article I provide an up-to-date status report on GNIRS and plans for its future. GNIRS was warmed up in April for routine cold head service. The fast warm-up system and vacuum pumps were used following normal operating procedures that had been successfully followed a dozen times before. The fast warm-up system has a completely independent hardware controller that shuts off power to the heater resistors when the temperature set point is reached. For some unknown reason, the controller failed and GNIRS was continuously heated until it reached temperatures of nearly 200 C. When Gemini staff members recognized the problem, they shut the heaters off and allowed GNIRS to cool passively with the pumps running for several days. After
Derived from text
*Controllers; Vacuum Pumps; Spectrographs; Heaters; Failure*

**20080018840** Utrecht Univ., Utrecht, Netherlands
**The Missing Link Between Dwarf Galaxies and Globular Clusters**
Wehner, Elizabeth; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 10-12; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

A new category of galaxy-like objects has iecently been identified. These new galaxies (or stellar systems) are extremely compact, more closely resembling tightly-bound globular clusters than the more extended dwarf galaxies But strangely, they're orders of magnitude more luminous than typical globular clusters. Because of these qualities, they're called 'ultra compact dwaifs' (UCDs), and their exact nature 1s not yet known In fact, they may make up a hybrid class of object that contains multiple compact stellar systems that formed by completely different mechanisms
Derived from text
*Globular Clusters; Galactic Structure; Stellar Systems; Compact Galaxies*

**20080018841** Gemini Observatory, Hilo, HI, USA
**Into the Deep: Isobel Hook**
Ratcliffe, Martin; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 50-53; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

There are a few scientists in the world for whom the concept of 'exploration' literally includes everywhere from the

mountaintops to the bottom of the sea. Oxford University astronomer and scuba diver, Isobel Hook is one of those few. She has regularly explored the outer universe from the dizzying heights of Mauna Kea and gone to the depths of the blue ocean waters around Hawai'i, enjoying the most fascinating sights humans can experience. Yet, if it wasn't for an astronomer and baby-sitter named Mary Lou West, Isobel Hook might never have made her way to the top of Mauna Kea to work with the Gemini Observatory or found herself exploring the underwater universe. Mary Lou (now at Mont Clair State University, NJ) nurtured young Isobel's innate curiosity by showing Isobel an astronomy book. 'She got me interested in it,' Isobel recalls, recalling the dramatic images, amazing distances and the 'speed that things go' as the most fascinating Part.
Derived from text
*Oceans; Seas; Observatories; Diving (Underwater); Distance*

**20080018842** Gemini Observatory, La Serena, Chile
**Reaching for the Stars: Simon Casassus**
Garcia, Maria Antonieta; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 66-69; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

This article concerns the life of the astronomer Simon Casassus. He is currently teaching, and researching at the Gemini Observatory. His research interests include the study of planetary nebulae, sun-like stars that are in the last throes of their lives.
CASI
*Astronomy; Biography*

**20080018843** University Coll., London, UK
**Mapping the Galactic Outflow Roots in NGC 1569**
Westmoquette, Mark; Smith, Linda J.; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 19-21; In English; See also 20080018832; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

In pursuit of an understanding of galaxy evolution, it is of critical importance to study how successive generations of stars interact with their environment. This mechanism, called 'feedback,' controls the amount of enriched material returned by stars to the interstellar medium (ISM) and regulates the overall star formation rate. However, feedback can be very hard to observe and quantify due to the complexity of the interactions and the many forms they can take. Although massive stars (larger than eight solar masses) are rare, they completely dominate feedback processes due to their powerful radiation fields, large mass outflow rates, and subsequent supernova explosions. In periods of enhanced star-formation activity (such as a starburst), many massive stars can be formed in large concentrations, particularly within 'super' star clusters, and the results of feedback can have quite spectacular consequences. In a young star cluster, stellar winds from the massive stars, and later supernovae explosions, will combine to form a cluster wind. The expansion of this hot wind will carve out a shell in the surrounding ISM. The resulting bubbles can become so large that they overlap and begin to coalesce with neighboring bubbles. If a coalesced bubble inflates to a size on the order of a galactic scale-height (that is, of the same height as the galaxy) it is termed a 'super-bubble.' When the density of the ISM that acts to contain the bubble decreases at the edge of the galaxy, the bubble can 'blow out' pop), allowing the hot gas contained within it to vent out into the galactic halo. If this flow can be sustained and collimated, then a quasi-steady-state can be reached. This is termed a 'galactic wind.' True galactic winds have the potential to eject large amounts of matter from the host galaxy. The consequences of this ejection include the quenching of subsequent star formation by stripping out the gas-rich ISM and enriching the inter-galactic medium with metals. Thus, understanding exactly how galactic outflows are powered and evolve is important.
Derived from text
*Starburst Galaxies; Star Formation; Galactic Winds; Stellar Mass; Massive Stars; Interstellar Matter*

**20080018844** Toronto Univ., Ontario, Canada
**The Gemini Deep Deep Survey: A Tenth Paper Redux**
Abraham, Roberto; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 25-28; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

By the time you read this, the tenth paper in the Gemini Deep Deep Survey (GDDS) series will have been submitted for publication. This artificial milestone provides a nice opportunity to recapitulate a few highfights from the survey. The primary science driver of the GDDS is to use a stellar-mass-selected sample to probe galaxy evolution at $1 < z$ 2. Something like half the stellar mass in galaxies forms over this redshift range, and it spans the epoch at which star-formation in the universe is at its peak. At the time the survey was proposed the main challenge was to get any redshifts at all at $1.2 < z < 2$, which had come to be known as the 'redshift desert,' in reference to the paucity of optical redshifts known over this interval. However,

by the time the GDDS had actually begun, some progress had already been made in obtaining redshifts for ultraviolet (0sele cted samples in the redshift desert by Charles Steidel and collaborators, using the blue-sensitive LRIS-B spectrograph at the W.M. Keck Observatory. So, even from the outset, the 'redshift desert' was somethmg of a misnomer, albeit a rather catchy one. However, wseIected surveys are biased in favor of high starformation- rate &a, and it was clear that passive red galaxies with high mass-to-light ratios that are missed by W selection could well dominate the high-z galaxy stellar mass budget. Our ambition was to probe the sorts of galaxies being missed by other surveys.
Author
*Astronomical Observatories; Stellar Mass; Star Formation; Mass to Light Ratios; Bias*

**20080018845** Anglo-Australian Observatory, Sydney, Australia
**Looking for the Next Page-Turning Surprise: Joss Hawthorn**
Sim, Helen; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 58-61; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

Nestled inside the smd brass box is a paper-thin device the first prototype of an integrated photonic spectrograph for astronomy, the ~roducto f three years' work. 'Careful,' says Joss Hawthorn to the photographer. 'Don't drop it.' Joss is the head of instrument science at the Anglo- Australian Observatory in Sydney, Australia, and the photonic spectrograph is his brainchild. An object you can slip into your shirt pocket, it could potentially replace the room-size spectrographs of today's large telescopes. Light is fed into the 7-centimeter-long device by an optical fier, dispersed by a phased array (at R-approx. 4000), and emerges as a continuous spectrum. This and related devices could rein in the spiralling costs of instrument construction for large telescopes, Joss says. 'Instruments based on integrated circuits will be more easily scaled to larger sizes, cheaper to mass produce, and easier to control.' Although significant investment will be required to produce devices spec&cally for astronomy, photonics and telecommunications research groups have already laid the groundwork. The 'spectrograph on a chip' could realize the long-term vision of a million-element integral field unit (IFU): a million fibers feeding a thousand circuit boards, each with a thousand photonic spectrographs, the whole shebang packed into a cabinet the size of a refrigerator. Yet, Joss is not interested in ground-breaking instrumentation for its own sake. Rather, he is intrgued by the research that it makes possible. And the link is physics: of the instrument, and of the cosmos. 'My real pleasure is in understanding the physics of the instruments I'm using-how far can I push them--and when I obtain my observations, what can I really learn in terms of new physical models,' he said. 'If a hew technology comes along, one should be a s h new questions, solving new problems that you couldn't before.'
Derived from text
*Continuous Spectra; Spectrographs; Photonics; Phased Arrays; Integrated Circuits*

**20080018846** Gemini Observatory, Hilo, HI, USA
**Solving Mysteries at the Heart of a Galaxy: Thaisa Storchi-Bergmann**
Petersen, Carolyn Collins; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 62-65; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

Active galactic nuclei are some of the hottest research topics in astronomy today. These bright, shiny galactic cares radiate across the electromagnetic spectrum, their emissions belying the existence of something very interesting inside. Those brilliant signposts immediately attracted the attention of Thaisa Storchi-Bergmann, a professor of physics and astronomy at the Physics Institute of the Federal University do Rio Grande do Sul in Porto Alegre, Brazil. For her, these objects (usually referred to as AGNs), remain as mysterious as the day she first began to study them. Thaisa's is a career that has combined searching out the deepest secrets at the hearts of with the challenges of raising a family that she started at a very young age. This 'double career' found her, at last once, racing up and down a mountain to nurse her child while doing an important observing run at Cerro Tololo. Having a research career while raising children was not always easy for Thaisa and her My, but the draw of studying AGNs made it all worthwhile. 'When I began to look at AGNs, I was drawn by the mysteries surrounding these objects, including the fact that they were harboring supermassive black holes in their nuclei,' she said. 'Nowadays we know that most galaxies have a supermassive black hole at the nucleus, but I continued to be interested in the study of AGNs because some mysteries, some questions remain, such as how does material get to the center of the galaxy to feed the supermassive black hole?' Lately, Thaisa has been using the integral field unit (IFU) on &e Gemini Multi-Object Spectrograph (GMOS) to study the gas kinematics (the motions of gas) in nearby galaxies with active nuclei. Her work has allowed her to measure for the first time the motions of gas as it streams toward the nucleus. In the current paradigm for active galactic nuclei, the central supermassive black hole (present in d galaxies which have a stellar bulge) is being fed by mass accretion
Derived from text
*Black Holes (Astronomy); Active Galactic Nuclei; Stars; Cosmic Gases; Electromagnetic Spectra*

**20080018847** Gemini Observatory, Hilo, HI, USA
**Astronomy's New Renaissance Scholar: Nathan Smith**
Tytell, David; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 46-49; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

This article reviews the many interest of Astronomer Nathan Smith. Among his many interest are music, and in the area of astronomy his main interest is Eta Carinae, and putting together a three-dimensional structure of the nebula.
CASI
*Nebulae; Biography; Astronomy*

**20080018848** Gemini Observatory, Hilo, HI, USA
**Gemini Science Highlights**
Roy, Jean-Rene; Fisher, Scott; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 32-35; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

Observations that combine data from Gemini North and the Chandra X-ray observatory have led to the discovery of the most massive known stellar black hole. Intriguingly, the black hole is associated with an exceptionally large companion star which, by a fortunate coincidence, orbits the black hole from our perspective on Earth. The edge-on nature of the orbit also allows for a high-precision determination of the orbit also allows for a high-precision determination of the masses and other fundamental parameters of the system (Table 1). The ramifications of this pairing could have a profound effect on our understanding of how the largest stars evolve. The black hole/star pair is located about 3 million light years from Earth in the galaxy MB, in the constellation Triangulum. The combination of x-ray data with Gemini North's optical images and spectroscopy (see Figure 2) let the international team conclude that the black hole has a mass of 15.7 solar masses, which makes it the most massive stellar black hole known. Known as M33 Xy, the black hole orbits its 70-solar-mass companion in an orientation that creates an eclipse every 3.5 days. To have such a large black hole partnered with such a partly 'normal' star is an exceptional situation that will eventually result in a pair of black holes orbiting each other when the massive star eventually goes Supernova. However, there is a challenge to understanding how a system like this could have formed Since higher-mass stars evolve more rapidly than less-massive ones, the star that created the existing black hole in the pair must have already gone supernova. This implies that it was even heavier than the 70 solar-mass behemoth that remains in the system. This is puzzling since at that size, the progenitor star of the black hole would have been large enough that it would have shared its atmosphere with its companion. Current theories of mass exchange between binary pairs lead to scenarios very different from what is seen in this system. How such an unusual binary formed will, for now, remain an enigma.
Author
*Black Holes (Astronomy); X Ray Astrophysics Facility; Stellar Mass; Supernovae; Massive Stars; Eclipses; Constellations*

**20080018849** Gemini Observatory, Hilo, HI, USA
**MCAO System Status**
Rigaut, Francois; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 41-42; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

The Gemini South Multi-Conjugate Adaptive Optics (MCAO) system passed several important milestones during the last six months. First and foremost, we received the remaining subsystems of the AO module, CANOPUS, in July 2007. The natural guide star wavefront sensor (NGS WFS, from EOS Technologies), the laser guide star (LGS) WFS (from the Optical Sciences Company (tOSC)) and the real-time computer (also from tOSC) went through a three-week integration process in July/August which culminated with the first successful laboratory closed-loop tests of the entire system. This is a world's record-with three operating deformable mirrors and signals from five LGSs and three tip-tilt guide NGSs. Second, an important progress review occurred in early September. This review, mandated by the Gemini Board of Directors, coordinated by the National Science Foundation (NSF), and chaired by Norbert Hubin (European Southern Observatory) was meant to assess the project management and technical risks, and the impact of the GNIRS recovery effort on the MCAO schedule. Excerpts from the executive summary of the committee report include the following: 'The review committee believes that the Gemini MCAO team has the necessary past experience to develop this challenging and unique MCAO facility. The committee acknowledges the motivation and dedication of the MCAO team to complete the development of this facility [...]. The committee is concerned by the lack of dedicated systems engineering for this project and the lack of global error budget monitoring, which might lead to the MCAO facility not meeting the top level requirements [. . .] There are a number of

technical risk areas which have been highlighted by the project team, and acknowledged by the review committee, but no single major technical show stopper [...]'
Derived from text
*Adaptive Optics; European Southern Observatory; Systems Engineering; Deformable Mirrors; Feedback Control; Attitude (Inclination); Laser Guide Stars*

**20080018850** National Optical Astronomy Observatories, Tucson, AZ, USA
**Chemical Evolution at the Milky Way's Center**
Cunha, Katia; Sellgren, Kris; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 22-24; In English; See also 20080018832; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The inner 200 parsecs (650 light-years) region of the Milky Way Galaxy is an energetic and active environment. At its heart lurks a supermassive black hole, surrounded by a swarm of stars called the Central Cluster, This region is densely populated with a mix of old (more than 1 billion and young (less than lo million stars. In fact, two massive clusters of young stars, the Quintuplet Cluster and the Arches Cluster, lie within 30 parsecs of the galactic center, demonstrating recent and extensive star formation. These young clusters sparkle within an older stellar population spread throughout the central 200 parsecs, indicating that star formation has occurred fairly steadily over the lifetime of the galaxy. Our galaxy's center is dimmed by about 30 visual magnitudes of interstellar extinction (caused by the absorption of light by intervening dust clouds), and thus is undetectable with optical techniques. However, the extinction is only a few magnitudes in the near-infrared (at 1-2 microns). Continuing advancements in infixed astronomy, using both imaging and spectroscopy on large telescopes, makes it possible to study stars at the very center of the Milky Way in ever-increasing detail. The sources of the gas that fuel the star formation at the galaxy's center are uncertain. How much gas has fallen in from the Milky Way's bulge or halo? Is gas driven in fiom the disk, and if so, how does this change if our galaxy's bar evolves with time? What fraction is simply recycled gas from previous generations of galactic center stars themselves? These are the types of questions that can be answered by studying the current and historical episodes of star formation in the center of the Mdky Way. Insight into the star-formation history and chemical evolution of galaxies comes &om studies of their elemental abundance. Ratios of the abundances of the alpha-elements to the abundance of iron (Fe) can be used to probe the relative amounts of material that have been cycled through short-lived massive stars, which end their evolution by exploding as a core collapse supernova (SN 11), or through longer-lived intermediate-mass binary systems, which end in the nuclear detonation of a white dwarf (SN Ia).
Derived from text
*Black Holes (Astronomy); Chemical Evolution; Galactic Evolution; Interstellar Extinction; Star Formation; Star Clusters; Supernovae*

**20080018851** Southwest Research Inst., Boulder, CO, USA
**Possible Evidence for Surface Renewal on Charon**
Cook, Jason; Gemini Focus: Newsletter of the Gemini Observatory; December 2007, pp. 6-9; In English; See also 20080018832; Original contains color illustrations; Copyright; Avail.: Other Sources

Charon, the largest of Pluto's three satellites, likely has a surface composition that is similar to many Kuiper Belt Objects (KBOs). Increasing our understanding of this icy world gives us a true ghpse into the realm of the Kuiper Belt. Because Pluto is about two magnitudes brighter than Charon, and the separation between these two worlds is always less than 0.9 arcseconds, observations of Charon are typically contaminated by scattered lght &om Pluto. However, during the late 1980s, Pluto and Chmn were aligned in such a way that &om our point of view on Farth they eclipsed each other every 3.2 days. These 'mutual events' allowed observers to obtain the hrst spectrum of Chamn &ee &om the contamination of Pluto's scattered light. The data showed that Chmn's spectrum lacks any of the deep methane (CW) absorption features seen on Pluto. Instead, its spectrum showed wide absorption features at 1.5 and 2.0 microns, characteristic of water ice, but not much else (including whether the ice was in the crystalline or amorphous state). Little else was determined about Charon's swrface until early this decade. Observations &om the Hubble Space Telescope, which clearly resolved the two bodies, and observations from the W.M. Keck Observatory, which relied on moments of better-than-average seeing, showed an additional absorption feature at 1.65 microns, indicating that the water ice was in the crystalline state. This was somewhat surprising since crystalline water ice form when amorphous water ice is warmed to over loo K. The relationship between crystallization temperature and time increases exponentially as temperature decreases, such that at around 80 K it would take about the age of the solar system for amorphous water ice to crystallize. The temperature of Charon, as determined by the ~65-micronf eature may reach 60 K, but would new exceed 80 K. Therefore, some other mechanism must be responsible for heating the surface. Crystalline water ice was not all that was detected in these observations. A second feature was seen around 2.21 microns. However, this feature was only a few pi& wide at best and was seen at just above the level of the noise in these data sets. Nonetheless, the observations

suggested the feature could be due to ammonia (NH3), ammonia hydrate (NH3 . H2O), and hydrogen cyanide (HCN). It was clear that observations at higher spatial and spectral resolution would be needed to understand this fature.
Derived from text
*Charon; Surface Layers; Crystal Structure; Spectral Resolution; Kuiper Belt; Hydrogen; Crystallization*

**20080018898** Chicago State Univ., Chicago, IL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA
**Radio Sources toward Galaxy Clusters at 30 GHz**
Coble, K.; Bonamente, M.; Carlstrom, J. E.; Dawson, K.; Hasler, N.; Holzapfel, W.; Joy, M.; LaRoque, S.; Marrone, D. P.; Reese, E. D.; Astronomical Journal; September 2007; Volume 134, pp. 897-905; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-7985; PHY-0114422; AST 00-96913; AST 99-81546; AST 02-28963; AST 01-04465; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1086/519973

Extragalactic radio sources are a significant contaminant in cosmic microwave background and Sunyaev-Zel'dovich effect experiments. Deep interferometric observations with the BIMA and OVRO arrays are used to characterize the spatial, spectral, and flux distributions of radio sources toward massive galaxy clusters at 28.5 GHz. We compute counts of millijansky source fluxes from 89 fields centered on known massive galaxy clusters and 8 noncluster fields. We find that source counts in the inner regions of the cluster fields (within 0.5' of the cluster center) are a factor of 8.9 (sup +4.3)(sub -2.8) times higher than counts in the outer regions of the cluster fields (radius greater than 0.5'). Counts in the outer regions of the cluster fields are, in turn, a factor of 3.3 (sup +4.1) (sub -1.8) greater than those in the noncluster fields. Counts in the noncluster fields are consistent with extrapolations from the results of other surveys. We compute the spectral indices of millijansky sources in the cluster fields between 1.4 and 28.5 GHz and find a mean spectral index of alpha = 0.66 with an rms dispersion of 0.36, where flux S proportional to nu(sup -alpha). The distribution is skewed, with a median spectral index of 0.72 and 25th and 75th percentiles of 0.51 and 0.92, respectively. This is steeper than the spectral indices of stronger field sources measured by other surveys. Author
*Cosmic Microwave Background Radiation; Extragalactic Radio Sources; Galactic Clusters; Astronomy*

**20080018900** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Hinode Observations of the Onset Stage of a Solar Filament Eruption**
Sterling, Alphonse C.; Moore, Ronald L.; Berger, Thomas E.; Bobra, Monica; Davis, John M.; Jibben, Patricia; Kano, Ryohei; Lundquist, Loraine L.; Myers, D.; Narukage, Noriyuki; Sakao, Taro; Shibasaki, Kiyoto; Shine, Richard A.; Tarbell, Theodore D.; Weber, Mark; Publications of the Astronomical Society of Japan; November 30, 2007; Volume 59, pp. S823-S829; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://pasj.asj.or.jp/v59/v59sp3.html

We used Hinode X-Ray Telescope (XRT) and Solar Optical Telescope (SOT) filtergraph (FG) Stokes-V magnetogram observations, to study the early onset of a solar eruption that includes an erupting filament that we observe in TRACE EUV images. The filament undergoes a slow rise for at least 20min prior to its fast eruption and strong soft X-ray (SXR) flaring; such slow rises have been previously reported, and the new Hinode data elucidate the physical processes occurring during this period. XRT images show that during the slow-rise phase, an SXR sigmoid forms from apparent reconnection low in the sheared core field traced by the filament, and there is a low-level intensity peak in both EUV and SXRs during the slow rise. MDI and SOT FG Stokes-V magnetograms show that the pre-emption filament is along a neutral line between opposing-polarity enhanced network cells, and the SOT magnetograms show that these opposing fields are flowing together and canceling for at least six hours prior to eruption. From the MDI data we measured the canceling network fields to be approx. 40 G, and we estimated that approx. 10(exp 19)Mx of flux canceled during the five hours prior to eruption; this is only approx.5% of the total flux spanned by the eruption and flare, but apparently its tether-cutting cancellation was enough to destabilize the sigmoid field holding the filament and resulted in that field's eruption.
Author
*Solar Optical Telescope; Filaments; Extreme Ultraviolet Radiation; X Ray Telescopes; X Rays; Magnetic Signatures*

**20080018901** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Hinode Observations of the Onset Stage of a Solar Filament Eruption**
Sterling, Alphonse C.; Moore, Ronald L.; Berger, Thomas E.; Bobra, Monica; Davis, John M.; Jibben, Patricia; Kano, R.; Lundquist, Loraine; Myers, D.; Narukage, N.; Sakao, T.; Shibasaki, K.; Shine, R.; Tarbell, T.; Weber, Mark; October 16, 2007; 14 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

We use Hinode X-Ray Telescope (XRT) and Solar Optical Telescope (SOT) filtergraph (FG) Stokes-V magnetogram

observations, to study the early onset of a solar eruption that includes an erupting filament that we observe in TRACE EUV images. The filament undergoes a slow rise for at least 20 min prior to its fast eruption and strong soft X-ray flaring; such slow rises have been previously reported, and the new Hinode data elucidate the physical processes occurring during this period. XRT images show that during the slow-rise phase, a soft X-ray (SXR) sigmoid forms from apparent reconnection low in the sheared core field traced by the filament, and there is a low-level intensity peak in both EUV and SXRs during the slow rise. MDI and SOT FG/V magnetograms show that the pre-eruption filament is along a neutral line between opposing-polarity enhanced network cells, and the SOT magnetograms show that these opposing fields are flowing together and canceling for at least six hours prior to eruption. From the MDI data we measure the canceling network fields to be approx. 40 G, and we estimate that approx. 10(exp 19) Mx of flux canceled during the five hours prior to eruption; this is only approx. 5% of the total flux spanned by the eruption and flare, but apparently its tether-cutting cancellation was enough to destabilize the sigmoid field holding the filament and resulted in that field's eruption.
Author
*X Ray Telescopes; Solar Optical Telescope; Extreme Ultraviolet Radiation; Destabilization; Magnetic Signatures; Magnetic Fields; X Rays*

**20080018924** NASA Marshall Space Flight Center, Huntsville, AL, USA
**Outbursts Large and Small from EXO 2030+375**
Wilson, Colleen A.; Arranz, Ascension Camero; Finger, Mark H.; March 31, 2008; 1 pp.; In English; HEAD 2008: High Energy Astrophysics Division, 31 Mar.-3 Apr. 2008, Los Angeles, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Be/X-ray pulsar EXO 2030+375 has now been observed for more than 22 years. In this time, it underwent two giant outbursts, in 1985 and 2006, and numerous normal outbursts at its 46-day orbital period. Our observations include daily monitoring of EXO 2030+375 with RXTE from 2006 June through 2007 May and several snapshots of normal outbursts before and after the giant outburst. During this giant outburst, we discovered evidence for a cyclotron feature at about 11 keV. This feature was confidently detected for about 90 days during the brighter portion of the outburst. Daily observations after the giant outburst detected pulsations throughout EXO 2030+375's orbit and included five normal outbursts shifted later in orbital phase relative to those before the giant outburst. Here we will present results from our detailed RXTE observations of the giant outburst and the normal outbursts that surrounded it and examine how they fit into the long-term picture we have of EXO 2030+375 and Be/X-ray binaries.
Author
*Pulsars; X Ray Binaries; X Ray Timing Explorer*

## 90
## ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

**20080018267** European Southern Observatory, Munich, Germany
**The Mira Variable S Orionis: Relationships Between the Photosphere, Molecular Layer, Dust Shell, and SiO Maser Shell at 4 Epochs**
Wittkowski, M; Boboltz, D A; Ohnaka, K; Driebe, T; Scholz, M; Jan 2007; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476725; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476725

We present the first multi-epoch study that includes concurrent mid-infrared and radio interferometry of an oxygen-rich Mira star. We obtained mid-infrared interferometry of S Ori with VLTI/MIDI at four epochs. We concurrently observed v = 1, J = 1-0 (43.1GHz), and v = 2, J = 1-0 (42.8GHz) SiO maser emission toward S Ori with the VLBA in January, February, and November 2005. The MIDI data are analyzed using self-excited dynamic model atmospheres including molecular layers, complemented by a radiative transfer model of the circumstellar dust shell. The VLBA data are reduced to the spatial structure and kinematics of the maser spots. The modeling of our MIDI data results in phase-dependent continuum photospheric angular diameters. The dust shell can best be modeled with Al2O3 grains using phase-dependent inner boundary radii between 1.8 and 2.4 photospheric radii. The dust shell appears to be more compact with greater optical depth near visual minimum, and more extended with lower optical depth after visual maximum. The maser spots mark the region of the molecular atmospheric layers just beyond the steepest decrease in the mid-infrared model intensity profile. Their velocity structure indicates a radial gas

expansion. S Ori shows significant phase-dependences of photospheric radii and dust shell parameters. Al2O3 dust grains and SiO maser spots form at relatively small radii of <1.8 2.4 photospheric radii. Our results suggest increased mass loss and dust formation close to the surface near the minimum visual phase, when Al2O3 dust grains are co-located with the molecular gas and the SiO maser shells, and a more expanded dust shell after visual maximum. Silicon does not appear to be bound in dust, as our data show no sign of silicate grains.
DTIC
*Atmospheric Models; Dust; Masers; Mira Variables; Photosphere; Time Measurement*

**20080018352** Greifswald Univ., Germany
**European Space Weather Activities**
Jansen, Frank; Jun 1, 2006; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476964; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476964
No abstract available
*Aerospace Environments; Europe; Space Weather; Weather*

**20080018357** Alaska Univ., Fairbanks, AK USA
**Space Weather Applications of the UAF Eulerian Parallel Polar Ionosphere Model (EPPIM)**
Maurits, Sergei; Kulchitsky, Anton; Watkins, Brenton; Jun 1, 2006; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A476972; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA476972
No abstract available
*Aerospace Environments; Atmospheric Models; Earth Ionosphere; Forecasting; Space Weather; Supercomputers*

**20080018549** Naval Research Lab., Washington, DC USA
**The Promise of First Spectroscopy of Normal and Dwarf Galaxies**
Fischer, J; Jul 2001; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A462255; Copyright; Avail.: Other Sources
ISO spectroscopic studies of galaxies gave us a taste of the diversity of IR spectroscopic signatures of galaxies and their potential to characterize stellar populations and their effects on the local interstellar medium, but also led to ambiguities in interpretation because only the brightest lines were detected in many galaxies. First studies will provide a rich and high signal-to-noise database for understanding the emission line deficit and absorption features in warm, heavily obscured moderate luminosity galaxies like NGC 4418 and in the ultraluminous galaxies. Combined with ground-based, SOFIA and SIRTF studies, First will be able to study starburst evolution in galactic disks, gaseous abundance variations and gradients among Hubble types and the affects of active galactic nuclei on the central regions of these galaxies. Even spectroscopic studies of dusty ellipticals will be possible and will allow us to probe the signatures of heating by old populations and possibly to discover the starburst phenomenon within some of these early-type galaxies. First spectroscopic and broadband studies of low metallicity blue compact dwarf galaxies will provide important templates for interpreting the spectra of luminous galaxies at high redshift. First broadband studies of galaxies with L(sub IR)~L* will probe out to z~1 while FIR spectroscopy will for the first time be able to fully probe the Hubble sequence of galaxies in the local universe.
Author
*Dwarf Galaxies; Emission Spectra; Far Infrared Radiation; Luminosity; Spectroscopy; Stellar Atmospheres*

**20080018550** National Optical Astronomy Observatories, Tucson, AZ USA
**From Stars to Superplanets: The Low-Mass Initial Mass Function in the Young Cluster IC 348**
Najita, Joan R; Tiede, Glenn P; Carr, John S; Oct 1, 2000; 28 pp.; In English
Contract(s)/Grant(s): GO-07322.02-96A; NAS5-26555
Report No.(s): AD-A464634; Copyright; Avail.: Other Sources
We investigate the low-mass population of the young cluster IC 348 down to the deuterium-burning limit, a fiducial boundary between brown dwarf and planetary mass objects, using a new and innovative method for the spectral classification of late-type objects. Using photometric indices, constructed from HST/NICMOS narrowband imaging, that measure the strength of the 1.9 micron water band, we determine the spectral type and reddening for every M-type star in the field, thereby separating cluster members from the interloper population. Due to the efficiency of our spectral classification technique, our

study is complete from approximately 0.7 to 0.015 solar mass. The mass function derived for the cluster in this interval, dN/d log M varies as M(exp 0.5), is similar to that obtained for the Pleiades, but appears significantly more abundant in brown dwarfs than the mass function for companions to nearby Sunlike stars. This provides compelling observational evidence for different formation and evolutionary histories for substellar objects formed in isolation versus as companions. Because our determination of the IMF is complete to very low masses, we can place interesting constraints on the role of physical processes such as fragmentation in the star and planet formation process and the fraction of dark matter in the Galactic halo that resides in substellar objects.
Author
*Dwarf Stars; Mass; Star Clusters*

**20080018565** Alcala Univ., Madrid, Spain
**The Far-Infrared Spectrum of ARP 220**
Gonzalez-Alfonso, Eduardo; Smith, Howard A; Fischer, Jacqueline; Cernicharo, Jose; The Astronomical Journal; May 27, 2004; 613, pp. 247-261; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-10659; Proj-PR2003-0057
Report No.(s): AD-A464638; Copyright; Avail.: Other Sources

Infrared Space Observatory Long Wavelength Spectrometer grating observations of the ultraluminous infrared galaxy Arp 220 shows absorption in molecular lines of OH, H2O, CH, NH, and NH3, as well as in the [O I] 63 micron line and emission in the [C II] 158 micron line. We have modeled the continuum and the emission/absorption of all observed features by means of a nonlocal radiative transfer code. The continuum from 25 to 1300 micron is modeled as a warm (106 K) nuclear region that is optically thick in the far-infrared, attenuated by an extended region (2') that is heated mainly through absorption of nuclear infrared radiation. The molecular absorption in the nuclear region is characterized by high excitation due to the high-infrared radiation density. The OH column densities are high toward the nucleus and the extended region. The H2O column density is also high toward the nucleus and lower in the extended region. The column densities in a halo that accounts for the absorption in the lowest lying lines are similar to what are found in the diffuse clouds toward the star-forming regions in the Sgr B2 molecular cloud complex near the Galactic center. Most notable are the high column densities found for NH and NH3 toward the nucleus, whereas the NH2 column density is lower. A combination of photodissociation regions (PDRs) in the extended region and hot cores with enhanced H2O photodissociation and a possible shock contribution in the nuclei may explain the relative column densities of OH and H2O, whereas the nitrogen chemistry may be strongly affected by cosmic-ray ionization. The [C II] 158 m line is well reproduced by our models and its deficit relative to the C ii/far-IR ratio in normal and starburst galaxies is suggested to be mainly a consequence of the dominant non-PDR component of far-infrared radiation, although our models alone cannot rule out extinction effects in the nuclei.
Author
*Infrared Spectroscopy; Starburst Galaxies*

**20080018676**
**New Kinematical Constraints on Cosmic Acceleration**
Rapetti, D.; Allen, S. W.; Amin, M. A.; Blandford, R. D.; May 01, 2007; 3 pp.; In English
Report No.(s): DE2007-907953; SLAC-PUB-12529; No Copyright; Avail.: National Technical Information Service (NTIS)

We present and employ a new kinematical approach to 'dark energy' studies. We construct models in terms of the dimensionless second and third derivatives of the scale factor a(t) with respect to cosmic time t, namely the present-day value of the deceleration parameter and the cosmic jerk parameter, j(t). An elegant feature of this parameterization is that all CDM models have j(t) = 1 (constant), which facilitates simple tests for departures from the CDM paradigm. Applying our model to redshift-independent distance measurements, from type Ia supernovae and X-ray cluster gas mass fraction measurements, we obtain clear statistical evidence for a late time transition from a decelerating to an accelerating phase.
NTIS
*Astrophysics; Cosmology; Deceleration*

**20080018893** Leicester Univ., UK; NASA Marshall Space Flight Center, Huntsville, AL, USA

**Gamma-Ray Burst Afterglows as Probes of Environment and Blast Wave Physics. II. The Distribution of rho and Structure of the Circumburst Medium**

Starling, R. L. C.; vanderHorst, A. J.; Rol, E.; Wijers, R. A. M. J.; Kouveliotou, C.; Wiersema, K.; Curran, P. A.; Weltervrede, P.; Astrophysical Journal; January 2008; Volume 672, pp. 433-442; In English; Original contains black and white illustrations
Contract(s)/Grant(s): HPRN-CT-2002-00294; 639.043.302; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1086/521975

We constrain blast wave parameters and the circumburst media ofa subsample of 10 BeppoSAX gamma-ray bursts (GRBs). For this sample we derive the values of the injected electron energy distribution index, p, and the density structure index of the circumburst medium, k, from simultaneous spectral fits to their X-ray, optical, and NIR afterglow data. The spectral fits have been done in count space and include the effects ofmetallicity, and are compared with the previously reported optical and X-ray temporal behavior. Using the blast wave model and some assumptions which include on-axis viewing and standard jet structure, constant blast wave energy, and no evolution of the microphysical parameters, we find a mean value ofp for the sample as a whole of 9.... oa -0.003.0' 2 a_ statistical analysis of the distribution demonstrates that the p-values in this sample are inconsistent with a single universal value forp at the 3 _ level or greater, which has significant implications for particle acceleration models. This approach provides us with a measured distribution ofcircumburst density structures rather than considering only the cases of k ----0 (homogeneous) and k - 2 (windlike). We find five GRBs for which k can be well constrained, and in four of these cases the circumburst medium is clearly windlike. The fifth source has a value of 0 < k < 1, consistent with a homogeneous circumburst medium.
Author

*Afterglows; Gamma Ray Bursts; Shock Waves; Statistical Analysis; X Ray Optics; Particle Acceleration; Electron Energy*

**20080018894** Indian Space Research Organization, Trivandrum, India; NASA Marshall Space Flight Center, Huntsville, AL, USA

**First Terrestrial Soft X-Ray Auroral Observation by the Chandra X-Ray Observatory**

Bhardwaj, Anil; Gladstone, G. Randall; Elsner, Ronald F.; Oestgaard, Nikolai; Waite, J. Hunter, Jr.; Cravens, Thomas E.; Chang, Shen-Wu; Majeed, Tariq; Metzger, Albert E.; Journal of Atmospheric and Solar-Terrestrial Physics; January 2007; Volume 69, Issues 1-2, pp. 179-187; In English; Hunstville 2004 Workshop on Challenges to Modeling the Sun-Earth System, 18-22 October 2004, Hunstville, AL, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1016/j.jastp.2006.07.011

Northern auroral regions of Earth were imaged with energetic photons in the 0.1-10keV range using the High-Resolution Camera (HRC-I) aboard the Chandra X-ray Observatory at 10 epochs (each approx.20 min duration) between mid- December 2003 and mid-April 2004. These observations aimed at searching for Earth's soft (< 2 keV) X-ray aurora in a comparative study with Jupiter's X-ray aurora, where a pulsating X-ray 'hot-spot' has been previously observed by Chandra. The first Chandra soft X-ray observations of Earth's aurora show that it is highly variable 0ntense arcs, multiple arcs, diffuse patches, at times absent). In at least one of the observations an isolated blob of emission is observed near the expected cusp location. A fortuitous overflight of DMSP satellite F13 provided SSJ/4 energetic particle measurements above a bright arc seen by Chandra on 24 January 2004, 20:01-20:22 UT. A model of the emissions expected strongly suggests that the observed soft X-ray signal is bremsstrahlung and characteristic K-shell line emissions of nitrogen and oxygen in the atmosphere produced by electrons.
Author

*Auroral Zones; Energetic Particles; X Ray Astrophysics Facility; Electrons; K Lines; Bremsstrahlung*

**20080018902** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Scaling Relations from Sunyaev-Zel'dovich Effect and Chandra X-ray Measurements of High-Redshift Galaxy Clusters**

Bonamente, Massimiliano; Joy, Marshall; LaRoque, Samuel J.; Carlstrom, John E.; Nagai, Daisuke; Marrone, Dan; [2007]; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): AST-0096913; AST-0604982; PHY-0114422; AST 99-81546; AST 02-28963; Copyright; Avail.: CASI: A03, Hardcopy

We present Sunyaev-Zel'dovich Effect (SZE) scaling relations for 38 massive galaxy clusters at redshifts 0.14 less than or equal to z less than or equal to 0.89, observed with both the Chandra X-ray Observatory and the centimeter-wave SZE imaging system at the BIMA and OVRO interferometric arrays. An isothermal ,Beta-model with central 100 kpc excluded

from the X-ray data is used to model the intracluster medium and to measure global cluster properties. For each Cluster, we measure the X-ray spectroscopic temperature, SZE gas mass, total mass. and integrated Compton-gamma parameters within r(sub 2500). Our measurements are in agreement with the expectations based on a simple self-similar model of cluster formation and evolution. We compare the cluster properties derived from our SZE observations with and without Chandra spatial and spectral information and find them to be in good agreement: We compare our results with cosmological numerical simulations, and find that simulations that include radiative cooling, star formation and feedback match well both the slope and normalization of our SZE scaling relations.
Author
*X Ray Astrophysics Facility; Red Shift; Galactic Clusters; X Rays; Star Formation; Intergalactic Media*

**20080018921** Alabama Univ., Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA
**Scaling Relations from Sunyaev-Zel'dovich Effect and Chandra X-Ray Measurements of High-Redshift Galaxy Clusters**
Bonamente, Massimiliano; Joy, Marshall; LaRoque, Samuel J.; Carlstrom, John E.; Nagai, Daisuke; Marrone, Daniel P.; Astrophysical Journal; March 2008; Volume 675, pp. 106-114; In English; Original contains black and white illustrations
Contract(s)/Grant(s): AST 00-96913; AST 06-04982; PHY 01-14422; AST 99-81546; AST 02-28963; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1086/525517

We present Sunyaev-Zel'dovich Effect (SZE) scaling relations for 38 massive galaxy clusters at redshifts 0.14 less than or equal to z less than or equal to 0.89, observed with both the Chandra X-ray Observatory and the centimeter-wave SZE imaging system at the BIMA and OVRO interferometric arrays. An isothermal Beta-model with the central 100 kpc excluded from the X-ray data is used to model the intracluster medium and to measure global cluster properties. For each cluster, we measure the X-ray spectroscopic temperature, SZE gas mass, total mass, and integrated Compton gamma-parameters within r(sub 2500). Our measurements are in agreement with the expectations based on a simple self-similar model of cluster formation and evolution. We compare the cluster properties derived from our SZE observations with and without Chandra spatial and spectral information and find them to be in good agreement. We compare our results with cosmological numerical simulations and find that simulations that include radiative cooling, star formation, and feedback match well both the slope and normalization of our SZE scaling relations.
Author
*Red Shift; X Ray Astrophysics Facility; Star Formation; Galactic Clusters; Intergalactic Media*

**20080018928** NASA Marshall Space Flight Center, Huntsville, AL, USA
**An Imaging X-Ray Polarimetry Mission**
Weisskopf, Martin C.; Bellazini, Ronaldo; Costa, Enrico; Ramsey, Brian; O'Dell, Steve; Tennant, Allyn; Elsner, Ronald; Pavlov, George; Matt, Girogio; Kaspi, Vicky; Coppi, Paolo; Wu, Kinwah; Siegmund, Oswald; March 30, 2008; 1 pp.; In English; HEAD 2008: High Energy Astrophysics Division, 31 Mar.-3 Apr. 2008, Los Angeles, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Technical progress both in x-ray optics and in polarization-sensitive x-ray detectors, which our groups have pioneered, enables a scientifically powerful - yet inexpensive - dedicated mission for imaging x-ray polarimetry. Such a mission is sufficiently sensitive to measure x-ray (linear) polarization for a broad range of cosmic sources --- particularly those involving neutron stars, stellar black holes, and supermassive black holes (active galactic nuclei). We describe the technical elements, discuss a mission concept, and synopsiz:e the important physical and astrophysical questions such as mission would address.
Author
*Polarimetry; X Ray Optics; Imaging Techniques; Space Missions; Astrophysics*

## 91
## 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*.

**20080018474** NASA Glenn Research Center, Cleveland, OH, USA
**Characterization of Lunar Polar Illumination from a Power System Perspective**
Fincannon, James; May 2008; 59 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 986249.01.13.03.20
Report No.(s): NASA/TM-2008-215186; AIAA Paper 2008-0447; E-16431; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080018474

This paper presents the results of illumination analyses for the lunar south and north pole regions obtained using an independently developed analytical tool and two types of digital elevation models (DEM). One DEM was based on radar height data from Earth observations of the lunar surface and the other was a combination of the radar data with a separate dataset generated using Clementine spacecraft stereo imagery. The analysis tool enables the assessment of illumination at most locations in the lunar polar regions for any time and any year. Maps are presented for both lunar poles for the worst case winter period (the critical power system design and planning bottleneck) and for the more favorable best case summer period. Average illumination maps are presented to help understand general topographic trends over the regions. Energy storage duration maps are presented to assist in power system design. Average illumination fraction, energy storage duration, solar/horizon terrain elevation profiles and illumination fraction profiles are presented for favorable lunar north and south pole sites which have the potential for manned or unmanned spacecraft operations. The format of the data is oriented for use by power system designers to develop mass optimized solar and energy storage systems.
Author
*Lunar Surface; Energy Storage; Solar Energy; Radar Data; Digital Elevation Models; Clementine Spacecraft*

**20080018569** NASA, Washington, DC, USA
**Science Opportunities Enabled by NASA's Constellation System: Interim Report**
[2008]; 19 pp.; In English
Contract(s)/Grant(s): NASW-01001; Copyright; Avail.: Other Sources

In 2004 NASA initiated studies of advanced science mission concepts known as the Vision Missions and inspired by a series of NASA roadmap activities conducted in 2003. Also in 2004 NASA began implementation of the first phases of a new space exploration policy, the Vision for Space Exploration. This implementation effort included development of a new human-carrying spacecraft, known as Orion, and two new launch vehicles, the Ares I and Ares V rockets.collectively called the Constellation System. NASA asked the National Research Council (NRC) to evaluate the science opportunities enabled by the Constellation System (see Preface) and to produce an interim report on a short time schedule and a final report by November 2008. The committee notes, however, that the Constellation System and its Orion and Ares vehicles have been justified by NASA and selected in order to enable human exploration beyond low Earth orbit, and not to enable science missions. This interim report of the Committee on Science Opportunities Enabled by NASA s Constellation System evaluates the 11 Vision Mission studies presented to it and groups them into two categories: those more deserving of future study, and those less deserving of future study. Although its statement of task also refers to Earth science missions, the committee points out that the Vision Missions effort was focused on future astronomy, heliophysics, and planetary exploration and did not include any Earth science studies because, at the time, the NRC was conducting the first Earth science decadal survey, and funding Earth science studies as part of the Vision Missions effort would have interfered with that process. Consequently, no Earth science missions are evaluated in this interim report. However, the committee will evaluate any Earth science mission proposal submitted in response to its request for information issued in March 2008 (see Appendix A). The committee based its evaluation of the preexisting Vision Missions studies on two criteria: whether the concepts offered the potential for a significant scientific advance, and whether or not the concepts would benefit from the Constellation System. The committee determined that all of the concepts offered the possibility of a significant scientific advance, but it cautions that such an evaluation ultimately must be made by the decadal survey process, and it emphasizes that this interim report s evaluation should not be considered to be an endorsement of the scientific merit of these proposals, which must of course be evaluated relative to other proposals. The committee determined that seven of these concepts would benefit from the Constellation System, whereas four would not, but it stresses that this conclusion does not reflect an evaluation of the scientific merit of the projects, but rather an assessment of whether or not new capabilities provided by the Constellation System could significantly

affect them. Some of the mission concepts, such as the Advanced Compton Telescope, already offer a significant scientific advance and fit easily within the mass and volume constraints of existing launch vehicles. Other mission concepts, such as the Palmer Quest proposal to drill through the Mars polar cap, are not constrained by the launch vehicle, but rather by other technology limitations. The committee evaluated the mission concepts as presented to it, aware nevertheless that proposing a far larger and more ambitious mission with the same science goals might be possible given the capabilities of the Ares V launch vehicle. (Such proposals can be submitted in response to the committee s request for information to be evaluated in its final report.) See Table S.1 for a summary of the Vision Missions, including their cost estimates, technical maturity, and reasons that they might benefit from the Constellation System. The committee developed several findings and recommendations.
Author
*Ares 5 Cargo Launch Vehicle; Space Exploration; Mission Planning; Earth Sciences; Low Earth Orbits; Cost Estimates; Mars Surface*

**20080018923** NASA Marshall Space Flight Center, Huntsville, AL, USA
**From Lunar Regolith to Fabricated Parts: Technology Developments and the Utilization of Moon Dirt**
McLemore, C. A.; Fikes, J. C.; McCarley, K. S.; Good, J. E.; Gilley, S. D.; Kennedy, J. P.; March 03, 2008; 11 pp.; In English; Earth and Space Conference 2008: 11th International Conference on Engineering, Science, Construction, and Operations in Challenging Environments, 3-5 Mar. 2008, Long Beach, CA, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The U.S. Space Exploration Policy has as a cornerstone the establishment of an outpost on the moon. This lunar outpost wil1 eventually provide the necessary planning, technology development, testbed, and training for manned missions in the future beyond the Moon. As part of the overall activity, the National Aeronautics and Space Administration (NASA) is investigating how the in situ resources can be utilized to improve mission success by reducing up-mass, improving safety, reducing risk, and bringing down costs for the overall mission. Marshall Space Flight Center (MSFC), along with other NASA centers, is supporting this endeavor by exploring how lunar regolith can be mined for uses such as construction, life support, propulsion, power, and fabrication. An infrastructure capable of fabrication and nondestructive evaluation will be needed to support habitat structure development and maintenance, tools and mechanical parts fabrication, as well as repair and replacement of space-mission hardware such as life-support items, vehicle components, and crew systems, This infrastructure will utilize the technologies being developed under the In Situ Fabrication and Repair (ISFR) element, which is working in conjunction with the technologies being developed under the In Situ Resources Utilization (ISRU) element, to live off the land. The ISFR Element supports the Space Exploration Initiative by reducing downtime due to failed components; decreasing risk to crew by recovering quickly from degraded operation of equipment; improving system functionality with advanced geometry capabilities; and enhancing mission safety by reducing assembly part counts of original designs where possible. This paper addresses the need and plan for understanding the properties of the lunar regolith to determine the applicability of using this material in a fabrication process. This effort includes the development of high fidelity simulants that will be used in fabrication processes on the ground to drive down risk and increase the Technology Readiness Level (TRL) prior to implementing this capability on the moon. Also discussed in this paper is the on-going research using Electron Beam Melting (EBM) technology as a possible solution to manufacturing parts and spares on the Moon's surface.
Author
*Moon; Regolith; Technology Utilization; In Situ Resource Utilization; Lunar Bases; Fabrication; NASA Space Programs; Lunar Rocks*

## 92
## SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

**20080018867** California Univ., Los Angeles, CA, USA
**Response of the Earth's Magnetosphere to Changes in the Solar Wind**
McPherron, Robert L.; Weygand, James M.; Hsu, Tung-Shin; Journal of Atmospheric and Solar-Terrestrial Physics; October 04, 2007; Volume 70, Issues 2-4, pp. 303-315; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNG04GA93G; ATM 02-1798; ATM 02-08501; ATM-0120950; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1016/j.jastp.2007.08.040

The solar wind couples to the magnetosphere via dynamic pressure and electric field. Pressure establishes the size and

shape of the system, while the electric field transfers energy, mass, and momentum to the magnetosphere. When the interplanetary magnetic field (IMF) is antiparallel to the dayside magnetic field, magnetic reconnection connects the IMF to the dipole field. Solar wind transport of the newly opened field lines to the nightside creates an internal convection system. These open field lines must ultimately be closed by reconnection on the nightside. For many decades, it was thought that a magnetospheric substorm was the process for accomplishing this and that all magnetic activity was a consequence of substorms. It is now recognized that there are a variety of modes of response of the magnetosphere to the solar wind. In this paper, we briefly describe these modes and the conditions under which they occur. They include substorms, pseudo-breakups, poleward boundary intensifications (PBI), steady magnetospheric convection (SMC), sawtooth injection events, magnetic storms, high-intensity long-duration continuous AE activities (HILDCAAs), and storm-time activations. There are numerous explanations for these different phenomena, some of which do not involve magnetic reconnection. However, we speculate that it is possible to interpret each mode in terms of differences in the way magnetic reconnection occurs on the nightside.
Author
*Solar Wind; Earth Magnetosphere; Interplanetary Magnetic Fields; Magnetospheric Instability; Dynamic Pressure; Electric Fields; Magnetic Field Reconnection*

**20080018895** NASA Marshall Space Flight Center, Huntsville, AL, USA
**The Width of a Solar Coronal Mass Ejection and the Source of the Driving Magnetic Explosion: A Test of the Standard Scenario for CME Production**
Moore, Ronald L.; Sterling, Alphonse C.; Suess, Steven T.; Astrophysical Journal; October 20, 2007; Volume 668, pp. 1221-1231; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1086/521215

We show that the strength (B(sub F1are)) of the magnetic field in the area covered by the flare arcade following a CME-producing ejective solar eruption can be estimated from the final angular width (Final Theta(sub CME)) of the CME in the outer corona and the final angular width (Theta(sub Flare)) of the flare arcade: B(sub Flare) approx. equals 1.4[(Final Theta(sub CME)/Theta(sub Flare)] (exp 2)G. We assume (1) the flux-rope plasmoid ejected from the flare site becomes the interior of the CME plasmoid; (2) in the outer corona (R > 2 (solar radius)) the CME is roughly a ‘spherical plasmoid with legs’ shaped like a lightbulb; and (3) beyond some height in or below the outer corona the CME plasmoid is in lateral pressure balance with the surrounding magnetic field. The strength of the nearly radial magnetic field in the outer corona is estimated from the radial component of the interplanetary magnetic field measured by Ulysses. We apply this model to three well-observed CMEs that exploded from flare regions of extremely different size and magnetic setting. One of these CMEs was an over-and-out CME, that is, in the outer corona the CME was laterally far offset from the flare-marked source of the driving magnetic explosion. In each event, the estimated source-region field strength is appropriate for the magnetic setting of the flare. This agreement (1) indicates that CMEs are propelled by the magnetic field of the CME plasmoid pushing against the surrounding magnetic field; (2) supports the magnetic-arch-blowout scenario for over-and-out CMEs; and (3) shows that a CME’s final angular width in the outer corona can be estimated from the amount of magnetic flux covered by the source-region flare arcade.
Author
*Coronal Mass Ejection; Solar Corona; Solar Flares; Magnetic Flux; Interplanetary Magnetic Fields; Solar Diameter*

# Subject Term Index

# Personal Author Index