



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

**Scientific and Technical  
Information Program Office**

# **Scientific and Technical Aerospace Reports**

# STAIR

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## NASA STI Program ... in Profile

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

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

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

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

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

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

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

# Introduction

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

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

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

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

## The NASA STI Program

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

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

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

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

# NASA STI Availability Information

## NASA Center for AeroSpace Information (CASI)

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

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

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

## National Technical Information Service (NTIS)

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

## The Federal Depository Library Program (FDLP)

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

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

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

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[\*\*Subject Term Index\*\*](#)

[\*\*Personal Author Index\*\*](#)

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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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

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VOLUME 45, NUMBER 1

JANUARY 22, 2007

## 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.

**20070001520** Army Communications-Electronics Command, Fort Belvoir, VA USA  
**Humanitarian Demining Flare Against Cluster Munitions and Hard Cased Land Mines**

Jan 2006; 9 pp.; In English

Report No.(s): AD-A458417; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Mines (Ordnance); Land*

**20070001586** Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China  
**Transactions of Nanjing University of Aeronautics and Astronautics, Vol. 23, No. 2, June 2006**

Dewang, L.; Jun. 2006; 86 pp.; In English

Report No.(s): PB2007-100118; Copyright; Avail.: National Technical Information Service (NTIS)

Contents: Pareto Front Capture Using Deterministic Optimization Methods in Multi-criterion Aerodynamic Design; Conservative Difference Scheme Based on Numerical Analysis for Nonlinear Schrodinger Equation with Wave Operator; Effect of Upstream Rotor on Aerodynamic Force of Downstream Stator Blades; Diagnosis of Damping Faults in Helicopter Rotor Hub Based on Fuselage Vibrations; Method for Suppressing Cutting Chatter in Numerical Control Machine Tools; Depth Prediction of Rain Water on Road Surface Based on Artificial Neural Network; Effect of Composite Mineral Admixtures on Restraining Alkali-Silica Reaction; Heat Transfer Characteristics of New Cooling Technique Based on Thermal Driving; Multi-phase Active Contour Model for Image Segmentation Based on Level Sets; Workpiece Locating and Post Processing Systems on 6-DOF CNC Milling Machine; Flexible Job-Shop Scheduling with Fuzzy Goal Through IOCDGA; Motion Analysis of Taper Machining Using Four-Axis WEDM Machine Tool; and Improved ACO Scheduling Algorithm Based on Flexible Process.

NTIS

*Astronautics; Aeronautics; Universities*

**20070001587** Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China  
**Transactions of Nanjing University of Aeronautics and Astronautics, Vol. 23, No. 3, September 2006**

Dewang, L.; Sep. 2006; 88 pp.; In English

Report No.(s): PB2007-100119; Copyright; Avail.: National Technical Information Service (NTIS)

Contents: Multi-body Aeroelastic Stability Analysis of Tiltrotor Aircraft in Helicopter Mode; Application of Velocity Gain Guidance to Far-Distance Rendezvous; Improvement of Aerodynamic Performance of Supersonic Aircraft Using Canard Surface with TVFC; Optimal Design of Dual Stator-Winding Induction Generator with PWM Converter; Free Vibration Analysis of Shear Walls with Short Piers; Performance of Simple-Encoding Irregular LDPC Codes Based on Sparse Generator Matrix; Allied Fuzzy c-Means Clustering Model; Representation Properties of Abstract Default Reasoning Frameworks; Note on Functions with Difference Uniformity; Efficient Computation of Heirarchical PrefixCube; and Regularization Approach for Fast Interger Ambiguity Resolution of Medium-Long Baseline GPS Network RTK.

NTIS

*Aeronautics; Astronautics; Universities*



## 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.

**2007000536** NASA Langley Research Center, Hampton, VA, USA

### **Thermodynamic Analysis of Dual-Mode Scramjet Engine Operation and Performance**

Riggins, David; Tacket, Regan; Taylor, Trent; Auslender, Aaron; [2006]; 28 pp.; In English; 14th AIAA/AHI International Space Planes and Hypersonics Systems and Technologies Conference, 6 - 9 Nov. 2006, Canberra, Australia; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 759.07.06

Report No.(s): AIAA Paper 2006-8059; Copyright; Avail.: CASI: [A03](#), Hardcopy

Recent analytical advances in understanding the performance continuum (the thermodynamic spectrum) for air-breathing engines based on fundamental second-law considerations have clarified scramjet and ramjet operation, performance, and characteristics. Second-law based analysis is extended specifically in this work to clarify and describe the performance characteristics for dual-mode scramjet operation in the mid-speed range of flight Mach 4 to 7. This is done by a fundamental investigation of the complex but predictable interplay between heat release and irreversibilities in such an engine; results demonstrate the flow and performance character of the dual mode regime and of dual mode transition behavior. Both analytical and computational (multi-dimensional CFD) studies of sample dual-mode flow-fields are performed in order to demonstrate the second-law capability and performance and operability issues. The impact of the dual-mode regime is found to be characterized by decreasing overall irreversibility with increasing heat release, within the operability limits of the system.

Author

*Computational Fluid Dynamics; Ramjet Engines; Supersonic Combustion Ramjet Engines; Thermodynamics*

**20070001000** NASA Dryden Flight Research Center, Edwards, CA, USA

### **Flight-Test-Determined Aerodynamic Force and Moment Characteristics of the X-43A at Mach 7.0**

Davis, Marl C.; White, J. Terry; January 2006; 48 pp.; In English; International Space Planes and Hypersonics Systems and Technologies Conference, 6-11 Nov. 2006, Canberra, Australia; Original contains color illustrations; Copyright; Avail.:

CASI: [A03](#), Hardcopy

The second flight of the Hyper-X program afforded a unique opportunity to determine the aerodynamic force and moment characteristics of an airframe-integrated scramjet-powered aircraft in hypersonic flight. These data were gathered via a repeated series of pitch, yaw, and roll doublets; frequency sweeps; and pushover-pullup maneuvers performed throughout the X-43A cowl-closed descent. Maneuvers were conducted at Mach numbers of 6.80 to 0.95 and altitudes from 92,000 ft msl to sea level. The dynamic pressure varied from 1300 psf to 400 psf with the angle of attack ranging from 0 deg to 14 deg. The flight-extracted aerodynamics were compared with preflight predictions based on wind-tunnel-test data. The X-43A flight-derived axial force was found to be 10 percent to 15 percent higher than prediction. Under-predictions of similar magnitude were observed for the normal force. For Mach numbers above 4.0, the flight-derived stability and control characteristics resulted in larger-than-predicted static margins, with the largest discrepancy approximately 5 in. forward along the x-axis center of gravity at Mach 6.0. This condition would result in less static margin in pitch. The predicted lateral-directional stability and control characteristics matched well with flight data when allowance was made for the high uncertainty in angle of sideslip.

Author

*Hypersonic Flight; Aerodynamic Forces; Wind Tunnel Tests; Flight Tests; Directional Stability; Dynamic Pressure; Angle of Attack; Aerodynamic Stability*

**20070001682** Micro Analysis and Design, Boulder, CO USA

### **Spatial Disorientation Analysis of AF Safety Center Mishap Data**

Keller, John; Small, Ron; Feb 2006; 83 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-04-C-6457; Proj-3005

Report No.(s): AD-A458602; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458602>; Avail.: CASI: [A05](#), Hardcopy

During the initial development of micro Analysis & Design's (MA&D's) Spatial Disorientation Analysis Toll (SDAT), we received seven mishap data sets from the Air Force Safety Center (AFSC). AFSC simply told us that five of the data sets were

definitely SD related, and two were probably SD related; we received no other details about the data. Our goal was to use SDAT to analyze the data sets, report our results to AFSC, and then compare our findings to the Safety Investigation Board's (SIB's) conclusions. SDAT does not account for other sensory inputs to orientation. Even though it is known that the human visual system is the primary source of orientation information, there is nothing in the research literature that quantifies the contribution of visual inputs. SADT results assume that the pilot is not attending to visual attitude information (which is often the case when SD mishaps occur) or that such information is not available.

DTIC

*Aircraft Safety; Disorientation; Flight Safety; Safety; Vision*

**20070001902** Air Force Research Lab., Hanscom AFB, MA USA

**Pattern Synthesis for a Conformal Wing Array**

Steyskal, Hans; Mar 2002; 7 pp.; In English

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

Report No.(s): AD-A458802; AFRL-SN-HS-TP-2001-1316; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Future aircraft may utilize the large aerodynamic areas of the wings for electrodynamic by structurally embedding conformal phased array antennas. We explore this concept with a computer model for a line array wrapped around a wing. The model uses a realistic wing profile and array element patterns which include the effects of mutual coupling and the local radius of curvature. The study has two objectives: 1) demonstrate a pattern synthesis method for this non-conventional array shape, and 2) determine whether low sidelobe patterns can be realized. We find pattern synthesis based on altering projections is a flexible and highly efficient synthesis method. High quality patterns with uniform low sidelobes achieved for most beam directions, except in a narrow sector about the difficult forward direction, where there appears to be a sidelobe floor of roughly -23dB.

DTIC

*Aerodynamics; Antennas; Electrodynamics; Phased Arrays; Sidelobes; Wings*

### 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.

**20070000528** Civil Aerospace Medical Inst., Oklahoma City, OK, USA

**Mining for Information in Accident Data**

Milburn, Nelda, J.; Dobbins, Lena; Pounds, Julia; Goldman, Scott; November 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DOT-AHRR522

Report No.(s): DOT/FAA/AM-06/26; No Copyright; Avail.: CASI: [A02](#), Hardcopy

**Purpose.** This project evaluated WinMine, an analytic tool developed by Chickering, Heckerman, Meek, Platt, and Thiesson to determine its usefulness for identifying higher-order relationships in research data from dynamic and high-consequence aviation events. Traditionally, researchers have relied on several types of analyses to better understand the relationships between factors related to an outcome. However, researchers need an analytic approach that can clearly illustrate the interactions among causal factors as probabilities associated with the chain of events. **Method.** A convenience sample of aviation accident data previously classified using the Human Factors Analysis and Classification System was used to evaluate WinMine in contrast to traditional methods, such as bar graphs, contingency tables, and odds ratios. **Results.** WinMine showed an advantage when compared with other methods because it graphs quantifiable interrelationships between factors and illuminates the underlying hierarchical structure of variables. **Discussion.** Each technique examined contributed toward understanding the causal factors; however, WinMine provided a better picture of the factor interrelationships than the other methods.

Author

*Data Mining; Identifying; Aircraft Accident Investigation; Flight Safety; Aircraft Safety; Aircraft Accidents*

**2007000806** RAND Corp., Santa Monica, CA USA

**The Closed-Loop Planning System for Weapon System Readiness**

Hillestad, Richard J; Kerchner, Robert; Miller, Louis W; Resnick, Adam; Shulman, Hyman L; Jan 2006; 116 pp.; In English  
Contract(s)/Grant(s): F49642-01-C-0003

Report No.(s): AD-A458218; RAND/MG-434; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The U.S. Air Force Spares Campaign and other analyses identified the need for a new, consistent approach for managing spares and repair requirements. The objective is to provide resources to achieve the levels of fully mission capable sorties and weapon system availability required in the Air Expeditionary Force (AEF) environment for both regional contingencies and major theater wars. The new approach is needed because the Air Force does not have a procedure to allocate limited funding for depot repair across weapon systems in a way that links the trade-offs to the projected readiness of each weapon system. In fact, no current system computes the readiness related to various levels of depot repair funding. The current planning system for depot-level repairs develops a requirement based on historical repair demands. The funding of the requirement depends on other priorities within the Air Force budget process, and frequently the requirement is not fully funded. With the current planning systems and process, the implications of this shortfall cannot be easily estimated in terms of reduced sortie capability or weapon availability. This is, in effect, an open-loop system that cannot easily show decisionmakers the consequences of their repair budgeting decisions. A closed-loop system would allow decisionmakers to choose budget levels and feed back the readiness implications. Alternatively, it would allow decisionmakers to iterate among levels of readiness and required budgets to see what the budget consequences of desired levels of readiness would be.

DTIC

*Feedback Control; Maintainability; Military Operations; Planning; System Effectiveness; Weapon Systems*

**20070001501** Civil Aerospace Medical Inst., Oklahoma City, OK, USA

**Validation for CFD Prediction of Mass Transport in an Aircraft Passenger Cabin**

Baker, A. J.; Ericson, S. C.; Orzechowski, J. A.; Wong, K. L.; Garner, R. P.; November 2006; 59 pp.; In English; Original contains black and white illustrations

Report No.(s): DOT/FAA/AM-06/27; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A joint project was established to validate computational fluid dynamics (CFD) as a quantitative methodology for prediction of the distribution of pathogens released into the environmental control system (ECS)-generated ventilation flowfield of an aircraft passenger cabin. Acquisition of the requisite experimental databases for three-dimensional velocity and contaminant distributions was accomplished in the FAA Civil Aerospace Medical Institute's (CAMI's) Aircraft Environmental Research Facility (AERF). The associated CFD simulations were conducted by the University of Tennessee CFD Laboratory staff on the resident Beowulf PC cluster and/or the University of Tennessee Innovative Computing Laboratory SiNRG cluster, using both commercial and proprietary CFD computer codes. The results of this CFD validation project are reported herein.

Author

*Computational Fluid Dynamics; Flow Distribution; Pressurized Cabins; Cabin Atmospheres; Mass Flow*

**20070001882** Air Force Academy, Colorado Springs, CO USA

**Failure Analysis and Prevention for the Air Logistics Center Engineer: CAStLE Course Development Summary**

Shoales, Gregory A; Avram, Jason; Greer, James M; Shah, Sandeep; Sep 2006; 367 pp.; In English

Contract(s)/Grant(s): F05611-03-D-0003

Report No.(s): AD-A458766; USAFA-TR-2006-08; No Copyright; Avail.: CASI: [A16](#), Hardcopy

USA Air Force (USAF) Air Logistics Center (ALC) engineers are assigned to support the maintenance of operational aircraft fleets. As a result, they need to be well trained in specialized engineering topics related to that mission. Not the least of these topics are those of structural failure analysis and designing structure to prevent failure. While many commercially available short courses may appear to address these topics by their title, none have been found that target the specific needs of the ALC engineer. Furthermore, few such courses have instructors with first-hand knowledge of the duty requirements of and challenges faced by ALC engineers. These shortcomings notwithstanding, sending ALC engineers to a vendor site for a week-long short course presents further challenges. Supporting the USAF aircraft fleet, while minimizing the impact to operations, requires quick response to all engineering issues. Having ALC engineers off-site and away from their duties, for even a week, adds an unnecessary schedule burden to that support process. While some commercial vendors will provide on-site training, this option is not without an additional cost burden over and above the already high short course cost.

DTIC

*Education; Failure; Failure Analysis; Logistics; Maintenance; Prevention*

**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.

**2007000664** Ascension Technology, Inc., Milton, VT USA

**Next Generation, High Accuracy Optical Tracker for Target Acquisition and Cueing**

Odell, Don S; Kogan, Vlad; Mar 2006; 12 pp.; In English

Contract(s)/Grant(s): Proj-3257

Report No.(s): AD-A457961; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A critical need exists for a fast, cost-effective, six-degrees-of-freedom (6DOF) tracker that is immune to cockpit and helmet scatterers of magnetic/electrical field energy, vehicle vibration, and harsh lighting conditions. Magnetic and inertial tracking technologies each have limitations that make them undesirable as next-generation solutions. Optical tracking technologies, while having occlusion problems, are increasingly seen as the more attractive next-generation solution. The optical tracker, developed at Ascension Technology Corp to meet these needs, measures the angle of incidence of point radiating emitters mounted on the helmet. The sensors measure angle of incidence in one dimension; two or three sensors are required to be mounted on the cockpit instrument panel to determine the position and orientation of the helmet. The sensor uses a transmissivity mask, which is located a known distance above a linear detector array surface. The mask consists of three transmissivity frequencies varying in one dimension. Each point radiating emitter illuminates the mask to cast an image onto the array. The array image is read at a high update rate and a remote processor identifies image phases to determine the image shift along the detector array axis. The three frequencies, being sufficiently separate in frequency to determine a coarse absolute image shift, as well as medium and fine image shifts, are used to determine a high-resolution absolute image shift. The image shift of each sensor is used to compute the plane angle of incidence of each emitter. The minimal system configuration includes two sensors and four emitters or three sensors and three emitters. More sensors and emitters may be used to increase tracker motion box. Flight tests were conducted in August and September of 2005. The phasorBiRD (trademark) prototype was flown in a test aircraft to evaluate the effect of direct sunlight and vibration on accuracy and noise.

DTIC

*Cockpits; Cues; Fighter Aircraft; Helmets; Jet Aircraft; Light Emitting Diodes; Optical Tracking; Target Acquisition; Ultraviolet Detectors*

**2007000677** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Determining In-Flight Tracker Accuracy**

Koepke, Corbin G; Parisi, Vincent; Mar 2006; 8 pp.; In English

Contract(s)/Grant(s): Proj-2830

Report No.(s): AD-A457979; AFRL-HE-WP-TP-2006-0064; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Evaluating a system in flight poses challenges that are not found in a laboratory environment. This paper discusses some of the issues involved in conducting an in-flight test to evaluate tracker accuracy, such as head movement, synchronization of time, changing coordinate systems, and interpolating data. The paper describes six types of accuracy: laboratory static, laboratory dynamic, installed static, installed dynamic, operational static, and operational dynamic. In general, as the realism of the accuracy increases, the difficulty in setting up a test to find the accuracy also increases. The authors present one possible method of finding installed static (ground testing) and operational static (flight testing) accuracies in a helmet-mounted tracker used in jet fighter aircraft. The calculations are straight forward, but data issues that cause measurement error, such as vibration and synchronization of time, must be dealt with. The paper's technical approach outlines one possible solution for dealing with in-flight challenges.

DTIC

*Accuracy; Flight Tests; Ground Tests; Helmet Mounted Displays; Measurement; Static Tests*

**2007000776** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Automated Fiber Placement of Advanced Materials (Preprint)**

Benson, Vernon M; Arnold, Jonahira; Apr 2006; 17 pp.; In English

Report No.(s): AD-A458167; No Copyright; Avail.: CASI: [A03](#), Hardcopy

As Composite Materials expand into higher temperature ranges they generally become increasingly more difficult to process with today's proven automated technologies. Automated Fiber Placement has become a standard process for

fabricating large complex epoxy skins and shells. Fiber Placement with higher temperature materials, BMIs, and higher service temperature materials, has proven more difficult. Placement of BMIs on the Joint Strike Fighter (JSF) Program and other applications has presented some new challenges for the equipment and process. ATK has been working with the Air Force Research Laboratory to foster improvements in the BMI materials and in the fiber placement processing techniques to achieve rates comparable to Epoxy placement rates. This paper will concentrate on the recent advancements in BMI Materials for Fiber Placement and advancements in fiber placement processing techniques.

DTIC

*Bismaleimide; Composite Materials*

**20070000829** Defence Science and Technology Organisation, Victoria, Australia

**Development of a Two-Component Strain-Gauge-Balance Load-Measurement System for the DSTO Water Tunnel**

Erm, Lincoln P; Mar 2006; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458259; DSTO-TR-1835; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report provides details of a two-component strain-gauge balance and ancillary equipment that has been developed to measure flow-induced loads on models in the DSTO water tunnel. The loads are very small and the balance was designed to measure normal forces and pitching moments within the ranges  $\pm 2.5$  N and  $\pm 0.02$  N.m respectively. Due to the small loads, it was necessary to use semi-conductor strain gauges on the balance. Balance was used to measure forces and moments on a delta wing in the water tunnel for a range of fixed angles of attack. The measured loads showed good agreement with wind- and water-tunnel data reported in the literature, showing that the new load-measurement system gives good results.

DTIC

*Aircraft Models; Loads (Forces); Strain Gage Balances; Strain Gages; Water Tunnel Tests; Wind Tunnel Tests*

**20070000844** Florida Agricultural and Mechanical Univ., Tallahassee, FL USA

**Active Control of Supersonic Impinging Jets Using Supersonic Microjets**

Alvi, Farrukh; Jan 2005; 71 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0017

Report No.(s): AD-A458295; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A comprehensive experimental investigation on the use of microjets for the control of supersonic impinging jets was conducted under this research program. Supersonic impinging jets occur in many applications including in STOV aircraft where they lead to a highly oscillatory flow with very high unsteady loads on the nearby aircraft structures and the landing surfaces. Prior research has shown that microjets, placed around the main jet periphery, are very effective in reducing the flow unsteadiness and the associated dynamic loads. In the present work, our goal was to better understand the physical properties of supersonic impinging jets through detailed experiments and to develop optimal open and closed-loop control strategies in order to produce efficient control over the range of conditions impinging jet-related problems are significant.

DTIC

*Active Control; Adaptive Control; Dynamic Loads; Gas Jets; Impingement; Jet Control; Supersonic Aircraft; Supersonic Jet Flow*

**20070000850** Stanford Univ., Stanford, CA USA

**Methodologies for Predicting and Testing the Combat Damage on Flight Envelopes**

Farhat, Charbel; Feb 2006; 7 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0038

Report No.(s): AD-A458307; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Survivability of an aircraft in combat is achieved by not getting hit, or withstanding the effects of suffered hits. To assess the latter aspect of survivability of a given military aircraft, live-fire tests are performed on its wings. However, these tests may fail to provide accurate and complete vulnerability assessments, because the static and quasi-static ground loading techniques they currently rely on do not replicate the loads encountered during flight. This effort focuses on developing a numerical simulation technology for predicting the consequences of battle damage on the flight and flutter envelopes of fighters, assessing the impact of several contributors to aircraft survivability using full-order as reduced-order computational models, and assisting in the development of new dynamic live-fire testing methodologies that may remedy the shortcomings of current static ground-testing techniques. The report itself focuses on the technical achievements made during the first nine months of the third year of funding.

DTIC

*Aerodynamic Loads; Combat; Damage; Dynamic Tests; Fighter Aircraft; Flight Envelopes; Predictions; Simulation*

**20070000856** North Carolina Agricultural and Technical State Univ., Greensboro, NC USA  
**Structural Health Monitoring of an Aircraft Panel Using Continuous AE Sensor (Preprint)**  
Sundaresan, Mannur J; Grandhi, Gangadhararao; Nkruman, Francis; Apr 2006; 32 pp.; In English  
Contract(s)/Grant(s): F33615-03-D-5204-0013; Proj-4349  
Report No.(s): AD-A458325; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Fatigue crack growth during the service of aging aircrafts has become an important issue and the monitoring of such cracks in hot spots is desirable. A structural health monitoring sensor system that uses acoustic emission technique for monitoring safety of such structures is described in this report. A 'continuous sensor' formed by connecting multiple sensor nodes in series arrangement to form a single channel sensor is proposed to monitor acoustic emission signals. This report describes the work performed for monitoring fatigue cracks in aluminum lap joints. The traditional AE sensors as well as bonded continuous sensors described above were used to monitor acoustic emission signals emanating from crack growth in aluminum 7075-T6 and 2024-T3 specimens. It was possible to differentiate the signals due to crack growth from noise signals arising from fretting and RF pickup. The sensitivity of the bonded continuous sensor was comparable to commercial high sensitivity resonant frequency AE sensors. The relationship between acoustic emission parameters and the crack growth rate in the aluminum specimens is examined.

DTIC

*Acoustic Emission; Crack Propagation; Health; Panels*

**20070000859** Defence Science and Technology Organisation, Victoria, Australia  
**Development and Use of a Dynamic-Testing Capability for the DSTO Water Tunnel**  
Erm, Lincoln P; Mar 2006; 42 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A458341; DSTO-TR-1836; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report gives details of the development and use of a water-tunnel dynamic-testing system, whereby models of aircraft are tested as they undergo a dynamic manoeuvre, with the roll, pitch and yaw angles changing in a specified way. Traditionally, most testing of aircraft in tunnels has been done with the aircraft stationary and set at a known orientation, but the acquired static data has limited applicability to manoeuvring aircraft. Dynamic data are needed to study unsteady aerodynamic effects associated with aircraft motion, to obtain data for use in flight-dynamic models of aircraft behaviour, and when validating CFD predictions of aircraft behaviour. Using the new testing system, flow-induced loads on an aircraft model can be measured and corresponding images of the flow over the aircraft can be captured for known instantaneous orientations of the aircraft, so that the loads can be correlated with the flow patterns. During a dynamic manoeuvre, including a coning manoeuvre, loads and images can also be acquired while simulating engine-intake flows. Loads were measured on a delta wing in the water tunnel when the wing was stationary and when it was in motion. The measured loads showed good agreement with wind- and water-tunnel data reported in the literature, showing that the new testing system gives credible results.

DTIC

*Dynamic Tests; Hydraulic Test Tunnels; Water Tunnel Tests*

**20070000867** California Univ., Los Angeles, CA USA  
**A Transcription Scheme for Languages Employing the Arabic Script Motivated by Speech Processing Application**  
Ganjavi, Shadi; Georgiou, Panayiotis G; Narayanan, Shrikanth; Jan 2004; 8 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): N66001-02-C-6023  
Report No.(s): AD-A458354; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Abstract This paper offers a transcription system for Persian, the target language in the Transonics project, a speech-to-speech translation system developed as a part of the DARPA Babylon program (The DARPA Babylon Program; Narayanan, 2003). In this paper, we discuss transcription systems needed for automated spoken language processing applications in Persian that uses the Arabic script for writing. This system can easily be modified for Arabic, Dari, Urdu and any other language that uses the Arabic script. The proposed system has two components. One is a phonemic based transcription of sounds for acoustic modelling in Automatic Speech Recognizers and for Text to Speech synthesizer, using ASCII based symbols, rather than International Phonetic Alphabet symbols. The other is a hybrid system that provides a minimally-ambiguous lexical representation that explicitly includes vocalic information; such a representation is needed for language modelling, text to speech synthesis and machine translation.

DTIC

*Languages; Machine Translation; Speech Recognition*

**20070001545** NASA Marshall Space Flight Center, Huntsville, AL, USA

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

Mach, D. M.; Koshak, W. J.; [2006]; 31 pp.; In English; Original contains black and white illustrations; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001545>; Avail.: CASI: A03, Hardcopy

We have developed a matrix calibration procedure that uniquely relates the electric fields measured at the aircraft with the external vector electric field and net aircraft charge. Our calibration method is being used with all of our aircraft/electric field sensing combinations and can be generalized to any reasonable combination of electric field measurements and aircraft. We determine a calibration matrix 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 de-emphasized (for example, due to a malfunction), it is a simple matter to reinvert the matrix without the malfunctioning FMs. To demonstrate our calibration technique, we present data from several of our aircraft programs (ER-2, DC-8, Altus, Citation).

Author

*Calibrating; Detection; Electric Fields; Inversions; Matrices (Mathematics); Flying Platforms*

**20070001628** Delaware Univ., Newark, DE USA

**Passive Synthetic Aperture Array Imaging at Millimeter Wave Frequencies using Novel Electro-optical Detection and Processing**

Prather, Dennis W; Mirotznik, Mark; Oct 31, 2006; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0835

Report No.(s): AD-A458511; DU-ELEG332174-103106; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458511>; Avail.: CASI: A03, Hardcopy

In this effort we have designed, fabricated, and demonstrated a one-dimensional synthetic aperture imaging system for the passive imaging of millimeter waves (MMWs) using optical upconversion and correlation techniques. The advantage of this approach over alternate techniques is that the proposed system does not require expensive high-speed electronic detection and read out circuits and it is light enough to be used on UAV platforms. This technique eliminates the need for a lens and can provide high resolution at mm wavelengths by extending the baseline of the antenna array. We developed a novel optical feedback technique that allows us to lock the phase of each optical carrier with a coherent reference beam. We have demonstrated the feasibility of the technology by building a linear, four element sparse aperture antenna array capable of imaging at mm wavelengths using commercial, off-the-shelf telecommunications components. The system was used to image a 35 GHz plane wave and demonstrated near diffraction limited resolution.

DTIC

*Drone Vehicles; Electro-Optics; Fabrication; Imaging Techniques; Millimeter Waves; Synthetic Apertures*

**20070001649** Massachusetts Inst. of Tech., Cambridge, MA USA

**Quantifying Hurricane Wind Speed with Undersea Sound**

Wilson, Joshua D; Jun 2006; 172 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0417

Report No.(s): AD-A458547; MIT/WHOI-2006-11; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458547>; Avail.: CASI: A08, Hardcopy

Hurricanes are one of the most destructive natural disasters known to man. While current satellite technology has made it possible to effectively detect and track hurricanes, expensive hurricane-hunting' aircraft are required to accurately classify their destructive power. Here we show that passive undersea acoustic techniques may provide a promising tool for accurately quantifying the destructive power of a hurricane. It is well known that the crashing of wind-driven waves generates underwater noise in the 10 Hz to 10kHz range. Theoretical and empirical evidence are combined to show that underwater acoustic sensing techniques may be valuable for measuring the wind speed in a hurricane. Acoustic measurements of the underwater noise generated by hurricane Gert are correlated with meteorological data from reconnaissance aircraft and satellites to show that underwater noise intensity between 10 and 50 Hz is approximately proportional to the cube of the local wind speed. It has also long been known that hurricanes generate microseisms in the 0.1 to 0.6 Hz frequency range through the non-linear interaction of ocean surface waves. Here we model the microseisms generated by the spatially inhomogeneous waves of a hurricane, using the non-linear wave equation, and compare these estimates with seismic measurements.

DTIC

*Acoustic Measurement; Hurricanes; Meteorological Parameters; Reconnaissance Aircraft; Underwater Acoustics; Wind Velocity*

**20070001688** Massachusetts Inst. of Tech., Cambridge, MA USA

**The Role of Range and Speed in the 21st Century: Transforming Air Power through Technology. A Systems Study**

Epstein, Alan H; Protz, Jonathan; Jul 2006; 22 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0247

Report No.(s): AD-A458618; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458618>; Avail.: CASI: **A03**,

Hardcopy

A top-down analysis of the cost structure of a U.S. air war was performed with the aim of elucidating the importance of aircraft range to campaign cost. Historically, operations and support costs dominated the cost of an air war due to the large number of sorties required to deliver the large volume of relatively inexpensive, low-precision munitions needed to destroy a specific target. The advent of precision munitions has dramatically reduced the number of sorties needed to such a degree that basing costs now dominate the current force's cost structure. These findings imply that long-range aircraft are currently more valuable than they have been historically, and they deserve more emphasis in the technical community than they have enjoyed in the past. A reassessment of science and technology investment may be warranted. A range of 12,000-13,000 nautical miles is required for world-wide coverage from domestic bases. This study has found that in the new world of precision munitions, the cost of maintaining foreign bases needed to support air operation of the current, relatively short-range USAF is the dominant cost element, consuming up to 50-60% of the total funds. This gives new impetus to the concept of global-range aircraft. In addition to providing flexibility and a reduction on foreign base dependence, such an aircraft could also significantly reduce the cost of fighting a modern air war. There are many technical solutions for realizing such aircraft. One particularly attractive approach is the oblique supersonic flying wing aircraft. The cost savings from relinquishing many of the foreign bases may provide several billion dollars per year in savings, suggesting that a cash stream to partially pay for such vehicles may be available. The recognition of the true costs of the current approach of a combination of foreign bases and air-refueling suggests that the DoD would be well-served to examine other aeronautical systems and approaches.

DTIC

*Bomber Aircraft; Cost Analysis; Costs; Fighter Aircraft; Terminal Facilities; Warfare*

**20070001861** Defence Science and Technology Organisation, Victoria, Australia

**Development of a Hard-Patch Approach for Scarf Repair of Composite Structure**

Baker, Alan; Jun 2006; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458447; DSTO-TR-1892; No Copyright; Avail.: CASI: **A03**, Hardcopy

The pre-moulded (hard) patch approach for scarf repair of composite structures has several advantages compared with the conventional prepreg lay-up (soft-patch) approach, which involves forming the patch directly in the repair cavity. These include the development of patch properties which match the parent structure, much improved patch geometry (no wrinkling or ply distortion) and, importantly for aircraft employing high temperature-composites designed to operate at 177C/350F (such as JSF), reduced application temperature-dependence on the repair adhesive chosen.

DTIC

*Airframes; Composite Structures; Maintenance; Scarf Joints*

**20070001889** Engineering Software Research and Development, Inc., Saint Louis, MO USA

**Software for the Design and Certification of Unitized Airframe Components**

Actis, Richardo; Feb 23, 2006; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-05-C-0128

Report No.(s): AD-A458781; No Copyright; Avail.: CASI: **A03**, Hardcopy

This report presents the results of the investigation of two important subjects associated with the design and certification in unitized airframe components. The first subject is related to the effects of residual stresses on the structural stability of thin unitized components machined from aluminum plates, in particular 7050-T74 and 7050-T7451 plates. The findings indicate that residual stresses introduced in a plate during the rolling operation (bulk stresses) and residual stresses introduced into a part machined from the plate during high speed machining should be included as a modeling consideration when designing thin unitized components. The second subject is related to the computation of strain energy release rate in damaged laminate composite materials. Typical failure in the presence of an initial defect, such as delamination, appears under a mixed mode loading, therefore it is essential to have an efficient algorithm for the computation of the strain energy release associated with each loading mode for the construction a mixed mode failure criterion for the determination of residual strength of unitized components made of composite materials. The Virtual Crack Closure Technique (VCCT) was considered during the Phase I project. It was found that typical numerical implementations of the VCCT utilizing the h-version of the finite element method (FEM) are unreliable because the results are meshdependent. A modification of the method was investigated, involving a



combination of numerical and analytical computations, which is well suited for its implementation with the p-version of the Finite Element Method.

DTIC

*Airframes; Certification; Composite Materials; Computer Programs; High Speed; Software Engineering; Structural Analysis*

**20070002008** NASA Langley Research Center, Hampton, VA, USA

**Development of Experimental and Computational Aeroacoustic Tools for Advanced Liner Evaluation**

Jones, Michael G.; Watson, Willie R.; Nark, Douglas N.; Parrott, Tony L.; Gerhold, Carl H.; Brown, Martha C.; [2006]; 10 pp.; In English; INTER-NOISE 2006: 35th International Congress and Exposition on Noise Control Engineering, 3-6 Dec. 2006, Honolulu, HI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 23-781-30-14; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070002008>; Avail.: CASI: A02, Hardcopy

Acoustic liners in aircraft engine nacelles suppress radiated noise. Therefore, as air travel increases, increasingly sophisticated tools are needed to maximize noise suppression. During the last 30 years, NASA has invested significant effort in development of experimental and computational acoustic liner evaluation tools. The Curved Duct Test Rig is a 152-mm by 381- mm curved duct that supports liner evaluation at Mach numbers up to 0.3 and source SPLs up to 140 dB, in the presence of user-selected modes. The Grazing Flow Impedance Tube is a 51- mm by 63-mm duct currently being fabricated to operate at Mach numbers up to 0.6 with source SPLs up to at least 140 dB, and will replace the existing 51-mm by 51-mm duct. Together, these test rigs allow evaluation of advanced acoustic liners over a range of conditions representative of those observed in aircraft engine nacelles. Data acquired with these test ducts are processed using three aeroacoustic propagation codes. Two are based on finite element solutions to convected Helmholtz and linearized Euler equations. The third is based on a parabolic approximation to the convected Helmholtz equation. The current status of these computational tools and their associated usage with the Langley test rigs is provided.

Author

*Aeroacoustics; Linings; Nacelles; Noise Reduction; Engine Noise; Grazing Flow*

## 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.

**20070001979** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Time Triggered Protocol (TTP) for Integrated Modular Avionics**

Motzet, Guenter; Gwaltney, David A.; Bauer, Guenther; Jakovljevic, Mirko; Gagea, Leonard; [2006]; 1 pp.; In English; 2006 MAPLD International Conference NASA GSFC, National Security Agency, NASA Electronics Parts Program, 26-28 Sep. 2006, Washington, DC, USA; Copyright; Avail.: Other Sources; Abstract Only

Traditional avionics computing systems are federated, with each system provided on a number of dedicated hardware units. Federated applications are physically separated from one another and analysis of the systems is undertaken individually. Integrated Modular Avionics (IMA) takes these federated functions and integrates them on a common computing platform in a tightly deterministic distributed real-time network of computing modules in which the different applications can run. IMA supports different levels of criticality in the same computing resource and provides a platform for implementation of fault tolerance through hardware and application redundancy. Modular implementation has distinct benefits in design, testing and system maintainability. This paper covers the requirements for fault tolerant bus systems used to provide reliable communication between IMA computing modules. An overview of the Time Triggered Protocol (TTP) specification and implementation as a reliable solution for IMA systems is presented. Application examples in aircraft avionics and a development system for future space application are covered. The commercially available TTP controller can be also be implemented in an FPGA and the results from implementation studies are covered. Finally future direction for the application of TTP and related development activities are presented.

Author

*Avionics; Controllers; Protocol (Computers); Modularity; Specifications*

## 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.

**20070001125** NASA Glenn Research Center, Cleveland, OH, USA

#### **A Theoretical Solid Oxide Fuel Cell Model for System Controls and Stability Design**

Kopasakis, George; Brinson, Thomas; Credle, Sydni; Xu, Ming; December 2006; 17 pp.; In English; Turbo Expo 2006, 8-11 May 2006, Barcelona, Spain; Original contains color illustrations

Contract(s)/Grant(s): WBS 489.02.07.03

Report No.(s): NASA/TM-2006-214104; GT2006-91247; E-15439; Copyright; Avail.: CASI: [A03](#), Hardcopy

As the aviation industry moves towards higher efficiency electrical power generation, all electric aircraft, or zero emissions and more quiet aircraft, fuel cells are sought as the technology that can deliver on these high expectations. The Hybrid Solid Oxide Fuel Cell system combines the fuel cell with a microturbine to obtain up to 70 percent cycle efficiency, and then distributes the electrical power to the loads via a power distribution system. The challenge is to understand the dynamics of this complex multi-discipline system, and design distributed controls that take the system through its operating conditions in a stable and safe manner while maintaining the system performance. This particular system is a power generation and distribution system and the fuel cell and microturbine model fidelity should be compatible with the dynamics of the power distribution system in order to allow proper stability and distributed controls design. A novel modeling approach is proposed for the fuel cell that will allow the fuel cell and the power system to be integrated and designed for stability, distributed controls, and other interface specifications. This investigation shows that for the fuel cell, the voltage characteristic should be modeled, but in addition, conservation equation dynamics, ion diffusion, charge transfer kinetics, and the electron flow inherent impedance should also be included.

Author

*Fuel Cells; Electrolytic Cells; Solid Oxide Fuel Cells; Stability; Complex Systems; Aircraft Industry*

## 08

### AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also 05 Aircraft Design, Testing and Performance; and 06 Avionics and Aircraft Instrumentation.

**20070001684** Air Force Research Lab., Wright-Patterson AFB, OH USA

#### **Passive Altimeter Study Using GPS Flight Data (Preprint)**

Liou, L L; Tsui, J B; Lin, D M; Schamus, J; van Graas, F; Morton, Y T; Aug 2003; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-7622

Report No.(s): AD-A458611; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458611>; Avail.: CASI: [A02](#), Hardcopy

Software GPS receiver results are presented for an over-land, passive altimeter application utilizing GPS signals. The flight data were collected using a DC-3 aircraft operated by Ohio University. The flight took place over southeast Ohio, where the terrain is hilly and forested. The GPS receiver on board the aircraft contains two channels. One channel has a right-hand-circular-polarized antenna facing upward, and the second has a left-hand-circular-polarized antenna facing downward. The upward antenna primarily receives the GPS direct signals, while the downward antenna primarily receives the ground-reflected GPS signals. Software radio GPS algorithms are used to process the data received from the upward channel. The information obtained after processing includes receiver position data, visible satellites, C/A code delay, Doppler frequency and navigation data bits as functions of time. This information is used to generate a reference signal to correlate the data received from the downward channel. Since the Doppler shift can be different between the reference and the reflected signals, the length of the coherent integration time is limited. Furthermore, the Doppler shift of the reflected signal can change rapidly as a function of the terrain. Therefore, a combination of coherent and noncoherent integration is used to enhance the signal-to-noise ratio of the reflected signals. The correlation result shows a C/A code delay corresponding to the path length difference between the direct and reflected signals. From the known locations of the receiver and the satellites, the height

above ground of the receiver can be calculated. The flight data cover heights ranging from 0 to 3000 meters above the terrain.  
DTIC

*Altimeters; Global Positioning System*

**20070001906** Northrop Grumman Corp., El Segundo, CA USA

**Air Vehicle Technology Integration Program (AVTIP) Delivery Order 0008: Open Control Platform (OCP) Software Enabled Control (SEC) Hardware in the Loop Simulation Program**

Portilla, Eric; Jul 2004; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-00-D-3054-0008; Proj-A0D1

Report No.(s): AD-A458807; NOR-04-801; No Copyright; Avail.: CASI: [A03](#), Hardcopy

These annotated Final Review charts summarize the work performed for the Open Control Platform (OCP) Software Enabled Control (SEC) Hardware in the Loop (HITL) Delivery Order #0008 under the Air Vehicles Technology Integration Program (AVTIP) contract awarded to Northrop Grumman Corporation (NGC). The OCP HITL program developed a Hardware-in-the Loop facility for demonstrating and evaluating High-Confidence Software and Systems (HCSS). Boeing, AFRL, and NGC created and implemented an architecture that provided AFRL/VAC with the baseline capability to test control algorithms (including collision avoidance and Fault Detection Isolation), run combined piloted and autonomous vehicle simulations, and created an interface to AFRL visualization software Virtual Battlefield Management System (VBMS) and SubrScene.

DTIC

*Control Simulation; Flight Simulation; Hardware-in-the-Loop Simulation*

## 09

### RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronomical facilities see *14 Ground Support Systems and Facilities (Space)*.

**20070000831** Defence Science and Technology Organisation, Victoria, Australia

**Review of RAAF Procedures for Qualifying Bonded Repair Technicians**

Rider, Andrew; Vodicka, Roger; Mathys, Gary; Stoyanovski, Ivan; Jun 2006; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458265; DSTO-TR-1876; No Copyright; Avail.: CASI: [A04](#), Hardcopy

DSTO has recently undertaken a review of procedures employed by the Royal Australian Air Force (RAAF) Bonded Structures and Testing Team (BSTT) during testing and requalification of technicians who undertake bonded repairs on ADF aircraft. Currently, technicians are required to produce a bonded wedge test under examination from BSTT staff and, based on adherence to the current RAAF Engineering Standard, will be considered competent to undertake bonded repairs. From December 2001 to January 2004 a notable deterioration in the quality of the bonded wedge tests produced through qualification testing was observed and an audit of processes was undertaken to determine if any areas in bonding and requalification testing may have been leading to the deterioration in quality. Based on an audit of the processes and subsequent experimental testing at DSTO, recommendations on improvements to bonding procedures have been made.

DTIC

*Adhesive Bonding; Maintenance*

## 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*.

**20070000506** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Experimental Design for Evaluation of Co Extruded Refractory Metal Nickel Base Superalloy Joints**

Petrichek, M. E.; Dec. 16, 2005; 12 pp.; In English

Report No.(s): DE2006-884672; No Copyright; Avail.: National Technical Information Service (NTIS)

Prior to the restructuring of the Prometheus Program, the NRPCT was tasked with delivering a nuclear space reactor. Potential NRPCT nuclear space reactor designs for the Prometheus Project required dissimilar materials to be in contact with each other while operating at extreme temperatures under irradiation. As a result of the high reactor core temperatures, refractory metals were the primary candidates for many of the reactor structural and cladding components. They included the tantalum-base alloys ASTAR-811C and Ta-10W, the niobium-base alloy FS-85, and the molybdenum base alloys Moly 41-47.5 Rhenium. The refractory metals were to be joined to candidate nickel base alloys such as Haynes 230, Alloy 617, or Nimonic PE 16 either within the core if the nickel-base alloys were ultimately selected to form the outer core barrel, or at a location exterior to the core if the nickel-base alloys were limited to components exterior to the core. To support the need for dissimilar metal joints in the Prometheus Project, a co-extrusion experiment was proposed. There are several potential methods for the formation of dissimilar metal joints, including explosive bonding, friction stir welding, plasma spray, inertia welding, HIP, and co-extrusion. Most of these joining methods are not viable options because they result in the immediate formation of brittle intermetallics. Upon cooling, intermetallics form in the weld fusion zone between the joined metals. Because brittle intermetallics do not form during the initial bonding process associated with HIP, co-extrusion, and explosive bonding, these three joining procedures are preferred for forming dissimilar metal joints. In reference to a Westinghouse Astronuclear Laboratory report done under a NASA sponsored program, joints that were fabricated between similar materials via explosive bonding had strengths that were directly affected by the width of the diffusion barrier.

NTIS

*Experiment Design; Extruding; Heat Resistant Alloys; Metal Joints; Nickel Alloys; Nuclear Reactors; Reactor Cores; Refractory Metals*

**20070000560** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Compatibility of Space Nuclear Power Plant Materials in an Inert He/Xe Working Gas Containing Reactive Impurities (U)**

Hall, M. M.; Jan. 2006; 32 pp.; In English

Report No.(s): DE2006-884663; No Copyright; Avail.: Department of Energy Information Bridge

A major materials selection and qualification issue identified in the Space Materials Plan is the potential for creating materials compatibility problems by combining dissimilar reactor core, Brayton Unit and other power conversion plant materials in a recirculating, inert He/Xe gas loop containing reactive impurity gases. Reported here are results of equilibrium thermochemical analyses that address the compatibility of space nuclear power plant (SNPP) materials in high temperature impure He gas environments. These studies provide early information regarding the constraints that exist for SNPP materials selection and provide guidance for establishing test objectives and environments for SNPP materials qualification testing.

NTIS

*Compatibility; Impurities; Nuclear Power Plants; Reactivity; Reactor Cores; Spacecraft Construction Materials*

**20070000561** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Review of Tribological Coatings for Control Drive Mechanisms for Space Reactors**

Larkin, C.; Edington, J.; Close, B.; Feb. 21, 2006; 16 pp.; In English

Report No.(s): DE2006-884665; No Copyright; Avail.: Department of Energy Information Bridge

Tribological coatings must provide lubrication for moving components of the control drive mechanism for a space reactor and prevent seizing due to friction or diffusion welding to provide highly reliable and precise control of reflector position over the mission lifetime. Several coatings were evaluated based on tribological performance at elevated temperatures and in ultrahigh vacuum environments. Candidates with proven performance in the anticipated environment are limited primarily to disulfide materials. Irradiation data for these coatings is nonexistent. Compatibility issues between coating materials and structural components may require the use of barrier layers between the solid lubricant and structural components to prevent deleterious interactions. It would be advisable to consider possible lubricant interactions prior to down-selection of structural materials. A battery of tests was proposed to provide the necessary data for eventual solid lubricant/coating selection.

NTIS

*Controllers; Mechanical Drives; Tribology*

**20070000696** Mitre Corp., Bedford, MA USA

**A Space Surveillance Ontology: Captured in an XML Schema**

Pulvermacher, Mary K; Brandsma, Daniel L; Wilson, John R; Oct 2000; 130 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-99-C-0001

Report No.(s): AD-A458009; MP-00B0000055; No Copyright; Avail.: CASI: [A07](#), Hardcopy

Achieving data interoperability is a necessary element of realizing the USA Government's vision of interoperability across all the services. This paper describes an Extensible Markup Language (XML) approach that was invented to capture data structure, content, and semantics in a targeted military domain of space surveillance. The resulting Space Surveillance Ontology could become a standard, shared space surveillance vocabulary as a step toward achieving data interoperability for military space data across domains. The ontology was created using the World Wide Web Consortium (W3C) emerging standard called XML Schema.

DTIC

*Data Management; Document Markup Languages; Interoperability*

**20070000723** Air Force Research Lab., Rome, NY USA

**C2 Through Space: The Key To Effects Based Aerospace Operations**

Phister, Paul; Fayette, Dan; McCrabb, Buster; Jan 2000; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458078; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A difficult task a Commander must accomplish relates to the types of information required to effectively engage the enemy in order to achieve the desired outcome with minimal expenditure of assets. In today's environment, the Commander is rapidly approaching, if not already achieved, information overload. The heart of the problem is to determine exactly what types of information the Commander really requires in order to reach a desired outcome. The types of information most useful to a Commander is based on the desired effects the Commander wishes to achieve and not just a fusion of the sensor data. This paper discusses a new Air Force Research Laboratory (AFRL) paradigm regarding information collection, fusion, exploitation and dissemination, namely Effects Based Aerospace Operations (EBO) and how it relates to another AFRL initiative, called the Joint Battlespace Infosphere. Additionally, this paper will discuss appropriate observable indicators of effects to collect, fuse and present to a Commander. Areas such as advanced sensor exploitation capabilities (e.g., hyperspectral and ultraspectral), on-board spacecraft fusion of effects information, and the ability to integrate many aspects of an on-going battle engagement to determine the best course of action to achieve the desired effect will be discussed. Using these examples, EBO, its potential, and its challenges will be examined. Furthermore, this paper will examine the difficulties and benefits of, and techniques for, integrating key observable indicators that a Commander needs to effectively engage the enemy and why the command and control through space is the key to effects based operations.

DTIC

*Aerospace Systems; Command and Control*

**20070000800** General Accounting Office, Washington, DC USA

**Space Acquisitions: DOD Needs to Take More Action to Address Unrealistic Initial Cost Estimates of Space Systems**

Chaplain, Cristina T; Bothwell, Brian; Campbell, Greg; Chan, Joanna; Echard, Jennifer; Gallegos, Art; Haynes, Barbara; Hobson, Anne; Lee, Jason; McGinty, Sigrid; Nov 2006; 57 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458208; GAO-07-96; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Estimated costs for the Department of Defense's (DoD) major space acquisition programs have increased by about \$12.2 billion from initial estimates for fiscal years 2006 through 2011. Cost growth for ongoing Air Force programs above initial estimates accounts for a substantial portion of this 44 percent increase. In light of the role that optimistic estimating is believed to have played in exacerbating space acquisition cost growth, the Congress requested that GAO examine the following: (1) in what areas space system acquisition cost estimates have been unrealistic, and (2) what incentives and pressures have contributed to the quality and usefulness of cost estimates for space system acquisitions. GAO recommends that DoD take a number of actions to increase the likelihood that independent, more realistic cost estimates will be developed and utilized. DoD concurred with the overall findings of this report, and it provided information on the specific actions it was already taking to improve the Air Force's cost-estimating capability.

DTIC

*Aerospace Systems; Cost Estimates; Costs; Defense Program; Procurement*

**20070001772** World Technology Evaluation Center, Baltimore, MD, USA

**WTEC Panel Report on International Assessment of Research and Development in Micromanufacturing**

Ehmann, K. F.; Bourell, D.; Culpepper, M. L.; Hodgson, T. J.; Kurfess, T. R.; Oct. 2005; 279 pp.; In English

Contract(s)/Grant(s): NSF-ENG-0423742

Report No.(s): PB2007-102143; Copyright; Avail.: National Technical Information Service (NTIS)

This international technology assessment study has focused on the emerging global trend toward the miniaturization of

manufacturing processes, equipment and systems for microscale components and products, i.e. 'Small Equipment for Small Parts.' It encompasses the creation of miniaturized units or hybrid processes integrated with metrology, material handling and assembly to create microfactories capable of producing microprecision products in a fully automated manner at low cost. The study has investigated both the state-of-the-art as well as emerging technologies from the scientific, technological, and commercialization perspectives across key industrial sectors in the U.S., Asia and Europe including medical, electronics, aerospace, and consumer products. This study does NOT include the lithographic-based processes common to the microelectromechanical systems (MEMS) community. While the U.S. gets high marks for nanotechnology R&D, emphasis in the U.S. on micromanufacturing R&D is lagging behind the rest of the world, particularly in technology transfer and ongoing development. This will undoubtedly have serious long-term implications, since it is well-recognized that micromanufacturing will be a critical enabling technology in bridging the gap between nanoscience and technology developments and their realization in useful products and processes. While examples do exist where U.S. government programs are focused squarely on industry-university-government collaboration, the scale of efforts both in Asia and Europe is significantly larger. On this latter point, Europe appears to be very strong, particularly as these partnerships work to refine and fine-tune developments for industry adaptation and commercialization.

NTIS

*Manufacturing; Miniaturization; Technology Assessment; Trends*

**20070001907** ITN Energy Systems, Inc., Littleton, CO USA

**Survey of Current and Next Generation Space Power Technologies**

Lanning, B; Martin, D; Jun 26, 2006; 17 pp.; In English

Contract(s)/Grant(s): FA9453-06-C-0023; Proj-3005

Report No.(s): AD-A458808; No Copyright; Avail.: CASI: [A03](#), Hardcopy

As part of an ongoing effort to improve responsiveness of power systems to meet future mission needs in space, an independent survey of conventional and emerging power technology options has been conducted. In this paper, all power technology options, both generation and storage, have been organized, using figures of merit relevant to space systems, to provide a basis for more effectively matching power technology options to future mission requirements. The goal was to initially organize technologies based on overall energy content normalized to mass and volume at the component level as a generic means for comparison, recognizing that if mission specific features, such as system level packaging and integration designs, were included in this initial survey, a certain level of bias would have been introduced into the results.

DTIC

*Aerospace Engineering; Requirements; Space Missions; Surveys*

## 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*.

**20070000681** Library of Congress, Washington, DC USA

**Liability Issues Associated With the Space Shuttle Columbia Disaster**

Murnane, Andrew W; Inkelas, Daniel; Feb 12, 2003; 6 pp.; In English

Report No.(s): AD-A457984; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The loss of the Space Shuttle Columbia resulted in the tragic deaths of seven astronauts and a hail of debris strewn over parts of at least two states. Investigators remain uncertain why Columbia was lost; there have been no definitive determinations of underlying causes or fault. But while the facts of the Columbia disaster are unclear, the legal principles and processes that govern possible compensation for the resultant losses of life and property can be identified. This report provides an overview of these issues and will be updated as circumstances warrant.

DTIC

*Astronauts; Disasters; Liabilities; Space Shuttles*

**20070000710** Naval Security Group Command Headquarters, Fort Meade, MD USA

**Software Design For a Fault-Tolerant Communications Satellite**

Hunter, G K; Rowe, Neil C; Jan 2000; 18 pp.; In English

Report No.(s): AD-A458050; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We describe a design of fault-tolerant features for the PANSAT communications satellite, a design which can address a wide variety of possible faults. We discuss system errors, program errors, and data errors, each subdivided into a variety of types. We discuss acceptance tests that can be used to detect faults, and the appropriate remediation methods for each type.

DTIC

*Communication Satellites; Fault Tolerance; Software Engineering*

**20070000786** Air Force Research Lab., Edwards AFB, CA USA

**Polyhedral Oligomeric Silsesquioxane (POSS) Polyimides as Space-Survivable Materials**

Tomczak, Sandra J; Viji, Vandana; Marchant, Darrell; Minton, Timothy K; Brunsvold, Amy L; Wright, Michael E; Petteys, Brian J; Guenther, Andrew J; Yandek, Gregory R; Mabry, Joe; Jan 2006; 13 pp.; In English

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

Report No.(s): AD-A458179; AFRL-PR-ED-TP-2006-239; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Polyimides (PIs) such as Kapton are used extensively in spacecraft thermal blankets, solar arrays, and space inflatable structures. Atomic oxygen (AO) in low Earth orbit (LEO) causes severe degradation of Kapton. SiO<sub>2</sub> coatings impart remarkable oxidation resistance and have been widely used to protect Kapton, yet imperfections in the SiO<sub>2</sub> application process and micro-meteoroid/debris impact in orbit damage the SiO<sub>2</sub> coating leading to Kapton erosion. A polyimide that is self-passivating by the formation of a silica layer upon exposure to AO has been achieved by the copolymerization of a polyhedral oligomeric silsesquioxane (POSS) diamine. The self-passivating properties have been shown by monitoring a 1 micron deep scratch in POSS-PIs after exposure to AO. During the first AO exposure and outside of the scratch, these samples eroded 5.0 microns, 0 microns, and less than 200 nm respectively. During the second AO exposure, the samples eroded an additional 5.0 microns within the scratch and outside of the scratch, 7.0 microns within the scratch and 0 microns outside of the scratch, and 200 nm within the scratch and 0 microns outside of the scratch respectively.

DTIC

*Oligomers; Polyimide Resins; Polyimides; Siloxanes; Spacecraft Construction Materials*

**20070001573** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Systems Integration Processes for NASA's Crew Launch Vehicle**

Reuter, James L.; Taylor, James L., Jr.; Sexton, Jeffery R.; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain; No Copyright; Avail.: Other Sources; Abstract Only

NASA's Exploration Initiative will require development of many new elements to constitute a robust system of systems. New launch vehicles are needed to place cargo and crew in stable low earth orbit. This paper examines the systems integration processes NASA is utilizing to ensure integration and control of propulsion and non-propulsion elements within NASA's Crew Launch Vehicle (CLV). The objective of the CLV is to provide the transportation capabilities to meet the Constellation Program requirements for delivering a Crew Exploration Vehicle (CEV) or other payload to Low Earth Orbit (LEO) in support of the lunar and Mars missions. The CLV must successfully provide the capability within cost and schedule with an acceptable risk approach. This paper will describe in detail the systems engineering management processes that will be applied to assure CLV Project success through complete and efficient technical integration. Discussion of specific processes for requirements development and verification, integrated design and analysis, integrated simulation and testing and the integration of reliability, maintainability and supportability (RMS) into the design will also be included. The CLV Project is broken logically into elements by the major hardware groupings, and associated management, system engineering, and integration functions. The processes to be described herein are designed to integrate within these CLV elements and among the other Constellation projects. Launch vehicle stack integration (CLV to CEV, and Ground and Flight Operations integration) throughout the life cycle, including integrated vehicle performance through orbital insertion, recovery of the first stage, and reentry of the upper stage will also be discussed. The processes for decomposing requirements to the Elements and ensuring that requirements have been correctly validated, decomposed, allocated, and that the verification requirements are properly defined to ensure that the system design meets requirements will be discussed.

Author

*Design Analysis; Launch Vehicles; Systems Integration; Systems Engineering; Low Earth Orbits; Ground Operational Support System; Engineering Management*

**20070001608** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Evaluation of an Ice Detection System for NASA's Space Shuttle Missions**

Bryk, D; Meitzler, T; Bankowski, E; Sohn, E J; Bienkowski, M; Bednarz, D; Lane, K; Kotwicki, E; Gillis, J; Nov 1, 2005; 30 pp.; In English

Report No.(s): AD-A458478; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458478>; Avail.: CASI: **A03**, Hardcopy

Presentation on the development of an ice detection system for the space shuttle.

DTIC

*Detection; Frost; Ice; Infrared Detectors; Space Shuttle Missions; Space Shuttle Orbiters; Space Shuttles*

**20070001623** Library of Congress, Washington, DC USA

**U.S. Military Space Programs: An Overview of Appropriations and Current Issues**

Figliola, Patricia M; Aug 7, 2006; 10 pp.; In English

Report No.(s): AD-A458503; CRS-RL33601; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458503>; Avail.: CASI: **A02**, Hardcopy

DOD and the intelligence community manage a broad array of space activities, including launch vehicle development, communications satellites, navigation satellites (the Global Positioning System -- GPS), early warning satellites to alert the USA to foreign missile launches, weather satellites, reconnaissance satellites, and developing capabilities to protect U.S. satellite systems and to deny the use of space to adversaries (called 'space control' or 'counterspace systems'). The 1990-1991 Persian Gulf War is dubbed by some as the first 'space war' because support from space displayed great improvement over what was available during the previous major conflict, Vietnam. These systems continue to play significant roles in U.S. military operations. How to organize DOD and the intelligence community to work effectively on space programs has been an issue for many years. Tracking the DOD space budget is extremely difficult since space is not identified as a separate line item in the DOD budget. Additionally, DOD sometimes releases only partial information (omitting funding for classified programs) or will suddenly release without explanation new figures for prior years that are quite different from what was previously reported. Figures provided to CRS show a total (classified and unclassified) DOD space budget of \$19.4 billion for FY2003, \$20 billion for FY2004, \$19.8 billion for FY2005, and a request of \$22.5 billion for FY2006. The actual FY2006 and proposed FY2007 budget figures are not yet available. Two DOD space programs that have been particularly controversial are Space Radar (formerly Space-Based Radar SBR) and TSAT (the transformational communications satellite program). The programs are controversial because their cost estimates are high, and Congress has been skeptical of those estimates and of DOD's ability to manage the programs successfully based on past program performance.

DTIC

*Aerospace Engineering; Aerospace Systems; Appropriations; Artificial Satellites; Defense Program; Space Weapons*

**20070001640** Boston Univ., Boston, MA USA

**The Loss Cone Imager (LCI)**

Beiser, E S; Fritz, T A; Jul 24, 2006; 143 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-05-C-0013; Proj-4400

Report No.(s): AD-A458530; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458530>; Avail.: CASI: **A07**, Hardcopy

The Loss Cone Imager (LCI) will serve as an integral component for an Air Force Research Laboratory (AFRL) experiment called WPIx. The WPIx experiment will be flown on the Demonstration and Science Experiment (DSX) spacecraft, to be launched in 2009, with a nominal one-year mission. The LCI will measure the local population of energetic particles, concentrating on determining their intensity within the magnetospheric loss cone. The LCI will be able to measure fluxes, energy and pitch angle of energetic electrons from 30 keV to approximately 75 keV to 60 MeV.

DTIC

*Experiment Design; Losses; Magnetic Mirrors*

**20070001985** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Building Operations Efficiencies into NASA's Crew Launch Vehicle Design**

Dumbacher, Daniel L.; [2006]; 4 pp.; In English; AIAA Space 2006, 19-21 Sep. 2006, San Jose, CA, USA; Original contains black and white illustrations; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001985>; Avail.: CASI: **A01**,

Hardcopy



The U.S. Vision for Space Exploration guides NASA's challenging missions of technological innovation and scientific investigation. With the Agency's commitment to complete the International Space Station (ISS) and to retire the Space Shuttle by 2010, the NASA Administrator commissioned the Exploration Systems Architecture Study (ESAS) in mid 2005 to analyze options for a safer, simpler, more cost efficient launch system that could deliver timely human-rated space transportation capabilities. NASA's finite resources yield discoveries with infinite possibilities. As the Agency begins the process of replacing the Shuttle with new launch vehicles destined for missions beyond low-Earth orbit to the Moon and Mars, NASA is designing the follow-on crew and cargo systems for maximum operational efficiencies. This mandate is imperative to reduce the \$4.5 billion NASA spends on space transportation each year. This paper gives top-level details of how the follow-on Crew Launch Vehicle (CLV) is being designed for reduced lifecycle costs as a primary catalyst for the expansion of future frontiers. Derived from text

*NASA Space Programs; Crew Exploration Vehicle; Technology Utilization; Operations Research; Launch Vehicle Configurations*

**20070001993** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **Crew Launch Vehicle (CLV) Upper Stage Configuration Selection Process**

Davis, Daniel J.; Cook, Jerry R.; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain; No Copyright; Avail.: Other Sources; Abstract Only

The Crew Launch Vehicle (CLV), a key component of NASA's blueprint for the next generation of spacecraft to take humans back to the moon, is being designed and built by engineers at NASA's Marshall Space Flight Center (MSFC). The vehicle's design is based on the results of NASA's 2005 Exploration Systems Architecture Study (ESAS), which called for development of a crew-launch system to reduce the gap between Shuttle retirement and Crew Exploration Vehicle (CEV) Initial Operating Capability, identification of key technologies required to enable and significantly enhance these reference exploration systems, and a reprioritization of near- and far-term technology investments. The Upper Stage Element (USE) of the CLV is a clean-sheet approach that is being designed and developed in-house, with element management at MSFC. The USE concept is a self-supporting cylindrical structure, approximately 115' long and 216' in diameter, consisting of the following subsystems: Primary Structures (LOX Tank, LH2 Tank, Intertank, Thrust Structure, Spacecraft Payload Adaptor, Interstage, Forward and Aft Skirts), Secondary Structures (Systems Tunnel), Avionics and Software, Main Propulsion System, Reaction Control System, Thrust Vector Control, Auxiliary Power Unit, and Hydraulic Systems. The ESAS originally recommended a CEV to be launched atop a four-segment Space Shuttle Main Engine (SSME) CLV, utilizing an RS-25 engine-powered upper stage. However, Agency decisions to utilize fewer CLV development steps to lunar missions, reduce the overall risk for the lunar program, and provide a more balanced engine production rate requirement prompted engineers to switch to a five-segment design with a single Saturn-derived J-2X engine. This approach provides for single upper stage engine development for the CLV and an Earth Departure Stage, single Reusable Solid Rocket Booster (RSRB) development for the CLV and a Cargo Launch Vehicle, and single core SSME development. While the RSRB design has changed since the CLV Project's inception, the USE design has remained essentially a clean-sheet approach. Although a clean-sheet upper stage design inherently carries more risk than a modified design, it does offer many advantages: a design for increased reliability; built-in extensibility to allow for commonality/growth without major redesign; and incorporation of state-of-the-art materials, hardware, and design, fabrication, and test techniques and processes to facilitate a potentially better, more reliable system. Because consideration was given in the ESAS to both clean-sheet and modified USE designs, this paper will highlight the advantages and disadvantages of both approaches and provide a detailed discussion of trades/selections made that led to the final upper stage configuration.

Author

*Space Shuttle Main Engine; Crew Exploration Vehicle; Launch Vehicles; Upper Stage Rocket Engines; Solid Propellant Rocket Engines; Avionics; Spacecraft Configurations*

**20070002016** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **Ares 1 First Stage Design, Development, Test, and Evaluation**

Williams, Tom; Cannon, Scott; [2006]; 15 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Ares I Crew Launch Vehicle (CLV) is an integral part of NASA's exploration architecture that will provide crew and cargo access to the International Space Station as well as low earth orbit support for lunar missions. Currently in the system definition phase, the CLV is planned to replace the Space Shuttle for crew transport in the post 2010 time frame. It is comprised of a solid rocket booster (SRB) first stage derived from the current Space Shuttle SRB, a liquid oxygen/hydrogen fueled second stage utilizing a derivative of the Apollo upper stage engine for propulsion, and a Crew Exploration Vehicle (CEV)

composed of command and service modules. This paper deals with current design, development, test, and evaluation planning for the CLV first stage SRB. Described are the current overall point-of-departure design and booster subsystems, systems engineering approach, and milestone schedule requirements.

Author

*Ares 1 Launch Vehicle; Ares 1 First Stage; Systems Engineering; Booster Rocket Engines; Systems Analysis; Evaluation*

**20070002089** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Status, Plans, and Initial Results for Crew Launch Vehicle Aerodynamics**

Huebner, Lawrence D.; Haynes, Davy A.; Taylor, Terry L.; Hall, Robert M.; Pamadi, Bandu N.; Seaford, C. Mark; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain; No Copyright; Avail.: Other Sources; Abstract Only

Following the completion of NASA's Exploration Systems Architecture Study in August 2004 for the NASA Exploration Systems Mission Directorate (ESMD), the Exploration Launch Office at the NASA Marshall Space Flight Center began design and development of the first vehicle in the architecture, the Crew Launch Vehicle (CLV), which will be used to launch astronauts to low earth orbit and rendezvous with either the International Space Station or the ESMD's earth departure stage for lunar missions. The primary elements of the CLV project are the first stage, the upper stage, the upper stage engine, and vehicle integration. Within vehicle integration is an effort in integrated design and analysis which is comprised of a number of technical disciplines needed to support vehicle design and development. One of the important disciplines throughout the life of the project is aerodynamics. This paper will present the status, plans, and initial results of CLV aerodynamics as the project was preparing for the CLV Systems Requirements Review. Following a status of the current activities and a discussion of the specific interactions with other technical panels, the plans for aerodynamic support of the CLV until the initial crewed flights will be presented. The paper will conclude with a review of initial results acquired since project inception, including engineering-code vehicle assessment, computational fluid dynamics analysis, and wind tunnel test data.

Author

*Aerodynamics; Ares 5 Cargo Launch Vehicle; Design Analysis; Orbital Rendezvous; Dynamic Tests; Launch Vehicles; Low Earth Orbits*

**20070002105** NASA Marshall Space Flight Center, Huntsville, AL, USA

**An Integrated Approach to Exploration Launch Office Requirements Development**

Holladay, Jon B.; Langford, Gary; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain; No Copyright; Avail.: Other Sources; Abstract Only

The proposed paper will focus on the Project Management and Systems Engineering approach utilized to develop a set of both integrated and cohesive requirements for the Exploration Launch Office, within the Constellation Program. A summary of the programmatic drivers which influenced the approach along with details of the resulting implementation will be discussed as well as metrics evaluating the efficiency and accuracy of the various requirements development activities. Requirements development activities will focus on the procedures utilized to ensure that technical content was valid and mature in preparation for the Crew Launch Vehicle and Constellation System's Requirements Reviews. This discussion will begin at initial requirements development during the Exploration Systems Architecture Study and progress through formal development of the program structure. Specific emphasis will be given to development and validation of the requirements. This discussion will focus on approaches to garner the appropriate requirement owners (or customers), project infrastructure utilized to emphasize proper integration, and finally the procedure to technically mature, verify and validate the requirements. Examples of requirements being implemented on the Launch Vehicle (systems, interfaces, test & verification) will be utilized to demonstrate the various processes and also provide a top level understanding of the launch vehicle(s) performance goals. Details may also be provided on the approaches for verification, which range from typical aerospace hardware development (qualification/acceptance) through flight certification (flight test, etc.). The primary intent of this paper is to provide a demonstrated procedure for the development of a mature, effective, integrated set of requirements on a complex system, which also has the added intricacies of both heritage and new hardware development integration. Ancillary focus of the paper will include discussion of Test and Verification approaches along with top level systems/elements performance capabilities.

Author

*Systems Engineering; Launch Vehicles; Project Management; Requirements*

## SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety*; *15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

**20070001547** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **High Resolution Millimeter Wave Detection of Vertical Cracks in the Space Shuttle External Tank Spray-On-Foam Insulation (SOFI)**

Kharkovsky, S.; Zoughi, R.; Hepburn, F.; [2006]; 6 pp.; In English; 33rd Annual Review of Progress in Quantitative Nondestructive Evaluation (QNDE), 30 Jul. - 4 Aug. 2006, Portland, OR, USA; Original contains black and white illustrations  
Contract(s)/Grant(s): NNM06AA08G; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001547>; Avail.: CASI:

**A02**, Hardcopy

Space Shuttle Columbia's catastrophic failure, the separation of a piece of spray-on-foam insulation (SOFI) from the external tank (ET) in the Space Shuttle Discovery's flight in 2005 and crack detected in its ET foam prior to its successful launch in 2006 emphasize the need for effective nondestructive methods for inspecting the shuttle ET SOFI. Millimeter wave nondestructive testing methods have been considered as potential and effective inspection tools for evaluating the integrity of the SOFI. This paper presents recent results of an investigation for the purpose of detecting vertical cracks in SOFI panels using a focused millimeter wave (150 GHz) reflectometer. The presented images of the SOFI panels show the capability of this reflectometer for detecting tight vertical cracks (also as a function of crack opening dimension) in exposed SOFI panels and while covered by a piece of SOFI ramp simulating a more realistic and challenging situation.

Author

*External Tanks; Foams; Detection; Cracks; Space Shuttles; Nondestructive Tests*

## 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*.

**20070000539** NASA Stennis Space Center, Stennis Space Center, MS, USA

### **ISHM Implementation for Constellation Systems**

Figueroa, Fernando; Holland, Randy; Schmalzel, John; Duncavage, Dan; Crocker, Alan; Alena, Rick; 2006; 21 pp.; In English; 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 9-12 Jul. 2006, Sacramento, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): NNS05AA22G

Report No.(s): SSTI-2220-0083; Copyright; Avail.: CASI: **A03**, Hardcopy

Integrated System Health Management (ISHM) is a capability that focuses on determining the condition (health) of every element in a complex System (detect anomalies, diagnose causes, prognosis of future anomalies), and provide data, information, and knowledge (DIaK) 'not just data' to control systems for safe and effective operation. This capability is currently done by large teams of people, primarily from ground, but needs to be embedded on-board systems to a higher degree to enable NASA's new Exploration Mission (long term travel and stay in space), while increasing safety and decreasing life cycle costs of systems (vehicles; platforms; bases or outposts; and ground test, launch, and processing operations). This viewgraph presentation reviews the use of ISHM for the Constellation system.

Derived from text

*Complex Systems; Systems Management; Fault Detection; Reliability; Maintainability; Component Reliability; Systems Health Monitoring; Satellite Constellations*

**20070001454** Garvey Spacecraft Corp., Long Beach, CA USA

### **Responsive Payload Accommodations and Integration Operations for Dedicated CubeSat Missions (POSTPRINT)**

Apr 13, 2006; 11 pp.; In English

Contract(s)/Grant(s): FA9300-05-M-3010; Proj-3005

Report No.(s): AD-A458397; No Copyright; Avail.: CASI: **A03**, Hardcopy

No abstract available

*Payload Integration; Payloads; Space Missions; Satellites; Mission Planning*

**20070001536** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Design Rules and Analysis of a Capture Mechanism for Rendezvous between a Space Tether and Payload**

Sorensen, Kirk F.; Canfield, Stephen L.; Norris, Marshall A.; [2006]; 14 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNM04AB13C; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001536>; Avail.: CASI: A03, Hardcopy

Momentum-exchange/electrodynamic reboost (MXER) tether systems have been proposed to serve as an 'upper stage in space'. A MXER tether station would boost spacecraft from low Earth orbit to a high-energy orbit quickly, like a high-thrust rocket. Then, it would slowly rebuild its orbital momentum through electrodynamic thrust, minimizing the use of propellant. One of the primary challenges in developing a momentum-exchange/electrodynamic reboost tether system as identified by the 2003 MXER Technology Assessment Group is in the development of a mechanism that will enable the processes of capture, carry and release of a payload by the rotating tether as required by the MXER tether approach. This paper will present a concept that will achieve the desired goals of the capture system. This solution is presented as a multi-DOF (degree-of-freedom) capture mechanism with nearly passive operation that features matching of the capture space and expected window of capture error, efficient use of mass and nearly passive actuation during the capture process. This paper will describe the proposed capture mechanism concept and provide an evaluation of the concept through a dynamic model and experimental tests performed on a prototype article of the mechanism in a dynamically similar environment. This paper will also develop a set of rules to guide the design of such a capture mechanism based on analytical and experimental analyses. The primary contributions of this paper will be a description of the proposed capture mechanism concept, a collection of rules to guide its design, and empirical and model information that can be used to evaluate the capability of the concept

Author

*Tethering; Payloads; Degrees of Freedom; Rendezvous Spacecraft; Low Earth Orbits; Design Analysis*

**20070001570** NASA Marshall Space Flight Center, Huntsville, AL, USA

**CLV First Stage Design, Development, Test and Evaluation**

Burt, Richard K.; Brasfield, F.; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain; Copyright; Avail.: Other Sources; Abstract Only

The Crew Launch Vehicle (CLV) is an integral part of NASA's Exploration architecture that will provide crew and cargo access to the International Space Station as well as low earth orbit support for lunar missions. Currently in the system definition phase, the CLV is planned to replace the Space Shuttle for crew transport in the post 2010 time frame. It is comprised of a solid rocket booster first stage derived from the current Space Shuttle SRB, a LOX/hydrogen liquid fueled second stage utilizing a derivative of the Space Shuttle Main Engine (SSME) for propulsion, and a Crew Exploration Vehicle (GEV) composed of Command and Service Modules. This paper deals with current DDT&E planning for the CLV first stage solid rocket booster. Described are the current overall point-of-departure design and booster subsystems, systems engineering approach, and milestone schedule requirements.

Author

*Liquid Oxygen; Launch Vehicles; Spacecrews; International Space Station; Low Earth Orbits; Space Shuttles; Solid Propellant Rocket Engines; Space Shuttle Boosters; Booster Rocket Engines*

**20070002079** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Advanced Energy Conversion Technologies and Architectures for Earth and Beyond**

Howell, Joe T.; Fikes, John C.; Phillips, Dane J.; Laycock, Rustin L.; O'Neill, Mark; Henley, Mark W.; Fork, Richard L.; [2006]; 2 pp.; In English; 57th International Congress, 2-6 Oct. 2006, Valencia, Spain; Copyright; Avail.: Other Sources; Abstract Only

Research, development and studies of novel space-based solar power systems, technologies and architectures for Earth and beyond are needed to reduce the cost of clean electrical power for terrestrial use and to provide a stepping stone for providing an abundance of power in space, i.e., manufacturing facilities, tourist facilities, delivery of power between objects in space, and between space and surface sites. The architectures, technologies and systems needed for space to Earth applications may also be used for in-space applications. Advances in key technologies, i.e., power generation, power management and distribution, power beaming and conversion of beamed power are needed to achieve the objectives of both terrestrial and extraterrestrial applications. There is a need to produce 'proof-of-concept' validation of critical WPT technologies for both the near-term, as well as far-term applications. Investments may be harvested in near-term beam safe demonstrations of commercial WPT applications. Receiving sites (users) include ground-based stations for terrestrial electrical power, orbital sites to provide power for satellites and other platforms, future space elevator systems, space vehicle propulsion,

and space surface sites. Space surface receiving sites of particular interest include the areas of permanent shadow near the moon's North and South poles, where WPT technologies could enable access to ice and other useful resources for human exploration. This paper discusses work addressing a promising approach to solar power generation and beamed power conversion. The approach is based on a unique high-power solar concentrator array called Stretched Lens Array (SLA) applied to both solar power generation and beamed power conversion. Since both versions (solar and laser) of SLA use many identical components (only the photovoltaic cells need to be different), economies of manufacturing and scale may be realized by using SLA on both ends of the laser power beaming system in a space solar power application. Near-term uses of this SLA-laser-SLA system may include terrestrial and space exploration in near Earth space. Later uses may include beamed power for bases or vehicles on Mars. Strategies for developing energy infrastructures in space which utilize this technology are presented. This dual use system produces electrical energy efficiently from either coherent light, such as from a highly coherent laser, or from conventional solar illumination. This allows, for example, supplementing solar energy with energy provided by highly coherent laser illumination during periods of low solar illumination or no illumination. This reduces the need for batteries and alternate sources of power. The capability of using laser illumination in a lowest order Gaussian laser mode provides means for transmitting power optically with maximum efficiency and precision over the long distances characteristic of space. A preliminary receiving system similar to that described here, has been produced and tested under solar and laser illumination. A summary of results is given.

Author

*Energy Conversion; Technology Utilization; Earth (Planet); Systems Engineering; Solar Generators*

## 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*.

**20070001482** NASA Glenn Research Center, Cleveland, OH, USA

#### **Sensor Data Qualification for Autonomous Operation of Space Systems**

Maul, William A.; Melcher, Kevin J.; Chicatelli, Amy K.; Sowers, T. Shane; November 2006; 15 pp.; In English; 2006 American Association for Artificial Intelligence (AAAI) Fall Symposium Series, 13-15 Oct. 2006, Arlington, VA; Original contains color illustrations

Contract(s)/Grant(s): WBS 905.01.02.03

Report No.(s): NASA/TM-2006-214475; E-15767; FS-06-07; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA's new Exploration initiative for both robotic and manned missions will require higher levels of reliability, autonomy and reconfiguration capability to make the missions safe, successful and affordable. Future systems will require diagnostic reasoning to assess the health of the system in order to maintain the system's functionality. The diagnostic reasoning and assessment will involve data qualification, fault detection, fault isolation and remediation control. A team of researchers at the NASA Glenn Research Center is currently working on a Sensor Data Qualification (SDQ) system that will support these critical evaluation processes, for both automated and human-in-the-loop applications. Data qualification is required as a first step so that critical safety and operational decisions are based on good data. The SDQ system would monitor a network of related sensors to determine the health of individual sensors within that network. Various diagnostic systems such as the Caution and Warning System would then use the sensor health information with confidence. The proposed SDQ technology will be demonstrated on a variety of subsystems that are relevant to NASA's Exploration systems, which currently include an electrical power system and a cryogenic fluid management system. The focus of this paper is the development and demonstration of a SDQ application for a prototype power distribution unit that is representative of a Crew Exploration Vehicle electrical power system; this provides a unique and relevant environment in which to demonstrate the feasibility of the SDQ technology.

Author

*Aerospace Systems; Autonomy; Data Systems; Systems Health Monitoring; Fault Detection; Sensors*

**20070002018** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Developmental Flight Instrumentation System for the Crew Launch Vehicle**

Crawford, Kevin; Thomas, John; [2006]; 1 pp.; In English; International Telemetering Conference, 23-26 Oct. 2006, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The National Aeronautics and Space Administration is developing a new launch vehicle to replace the Space Shuttle. The Crew Launch Vehicle (CLV) will be a combination of new design hardware and heritage Apollo and Space Shuttle hardware. The current CLV configuration is a 5 segment solid rocket booster first stage and a new upper stage design with a modified Apollo era J-2 engine. The current schedule has two test flights with a first stage and a structurally identical, but without engine, upper stage. Then there will be two more test flights with a full complement of flight hardware. After the completion of the test flights, the first manned flight to the International Space Station is scheduled for late 2012. To verify the CLV's design margins a developmental flight instrumentation (DFI) system is needed. The DFI system will collect environmental and health data from the various CLV subsystem's and either transmit it to the ground or store it onboard for later evaluation on the ground. The CLV consists of 4 major elements: the first stage, the upper stage, the upper stage engine and the integration of the first stage, upper stage and upper stage engine. It is anticipated that each of CLV's elements will have some version of DFI. This paper will discuss a conceptual DFI design for each element and also of an integrated CLV DFI system.

Author

*Flight Instruments; Launch Vehicles; Systems Integration; J-2 Engine; Solid Propellant Rocket Engines*

## 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*.

**20070001076** Analex Corp., Brook Park, OH, USA

#### **Heat Rejection Concepts for Lunar Fission Surface Power Applications**

Siamidis, John; November 2006; 19 pp.; In English; Fourth International Energy Conversion Engineering Conference and Exhibit (IECEC), 26-29 Jun. 2006, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS3-00145; WBS 169.04.03

Report No.(s): NASA/CR-2006-214388; E-15666; AIAA Paper 2006-4196; No Copyright; ONLINE:

<http://hdl.handle.net/2060/20070001076>; Avail.: CASI: A03, Hardcopy

This paper describes potential heat rejection design concepts for lunar surface Brayton power conversion systems. Brayton conversion systems are currently under study by NASA for surface power applications. Surface reactors may be used for the moon to power human outposts enabling extended stays and closed loop life support. The Brayton Heat Rejection System (HRS) must dissipate waste heat generated by the power conversion system due to inefficiencies in the thermal-to-electric conversion process. Space Brayton conversion system designs tend to optimize at efficiencies of about 20 to 25 percent with radiator temperatures in the 400 K to 600 K range. A notional HRS was developed for a 100 kWe-class Brayton power system that uses a pumped water heat transport loop coupled to a water heat pipe radiator. The radiator panels employ a tube and fin construction consisting of regularly-spaced circular heat pipes contained within two composite facesheets. The water heat pipes interface to the coolant through curved sections partially contained within the cooling loop. The paper evaluates various design parameters including radiator panel orientation, coolant flow path, and facesheet thickness. Parameters were varied to compare design options on the basis of H<sub>2</sub>O pump pressure rise and required power, heat pipe unit power and radial flux, radiator area, radiator panel areal mass, and overall HRS mass.

Author

*Heat Transfer; Brayton Cycle; Heat Pipes; Thermoelectric Power Generation; Feedback Control*

**20070001563** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **NASA's J-2X Engine Builds on the Apollo Program for Lunar Return Missions**

Snoddy, Jimmy R.; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain; No Copyright; Avail.: Other Sources; Abstract Only

In January 2006, NASA streamlined its U.S. Vision for Space Exploration hardware development approach for replacing the Space Shuttle after it is retired in 2010. The revised CLV upper stage will use the J-2X engine, a derivative of NASA's Apollo Program Saturn V's S-II and S-IVB main propulsion, which will also serve as the Earth Departure Stage (EDS) engine. This paper gives details of how the J-2X engine effort mitigates risk by building on the Apollo Program and other lessons learned to deliver a human-rated engine that is on an aggressive development schedule, with first demonstration flight in 2010 and human test flights in 2012. It is well documented that propulsion is historically a high-risk area. NASA's risk reduction strategy for the J-2X engine design, development, test, and evaluation is to build upon heritage hardware and apply valuable

experience gained from past development efforts. In addition, NASA and its industry partner, Rocketdyne, which originally built the J-2, have tapped into their extensive databases and are applying lessons conveyed firsthand by Apollo-era veterans of America's first round of Moon missions in the 1960s and 1970s. NASA's development approach for the J-2X engine includes early requirements definition and management; designing-in lessons learned from the S-2 heritage programs; initiating long-lead procurement items before Preliminary Design Review; incorporating design features for anticipated EDS requirements; identifying facilities for sea-level and altitude testing; and starting ground support equipment and logistics planning at an early stage. Other risk reduction strategies include utilizing a proven gas generator cycle with recent development experience; utilizing existing turbomachinery; applying current and recent main combustion chamber (Integrated Powerhead Demonstrator) and channel wall nozzle (COBRA) advances; and performing rigorous development, qualification, and certification testing of the engine system, with a philosophy of 'test what you fly, and fly what you test'. These and other active risk management strategies are in place to deliver the J-2X engine for LEO and lunar return missions as outlined in the U.S. Vision for Space Exploration.

Author

*J-2 Engine; Performance Tests; Flight Tests; Engine Design; Combustion Chambers; System Effectiveness; Turbomachinery*

**20070001583** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Recent Advances in Solar Sail Propulsion Systems at NASA**

Johnson, Les; [2006]; In English; 57th International Astronautical Congress 2006, 2-6 Oct. 2006, Valencia, Spain; No Copyright; Avail.: Other Sources; Abstract Only

Supporting NASA's Science Mission Directorate, the In-Space Propulsion Technology Program is developing solar sail propulsion for use in robotic science and exploration of the solar system. Solar sail propulsion has the potential to provide longer on-station operation, increased scientific payload mass fraction, and access to previously inaccessible orbits for multiple potential science missions. Two different 20-meter solar sail systems were produced and successfully completed functional vacuum testing last year in NASA Glenn's Space Power Facility at Plum Brook Station Ohio. The sails were designed and developed by ATK Space Systems and L'Garde, respectively. The sail systems consist of a central structure with four deployable booms that support the sails. The sail designs are robust enough for deployments in a one atmosphere, one gravity environment and are scalable to much larger solar sails - perhaps as large as 150 meters on a side. In addition, computational modeling and analytical simulations have been performed to assess the scalability of the technology to the large sizes (150 meters) required to implement the first generation of missions using solar sails. Life and space environmental effects testing of sail and component materials are also nearly complete. This paper will summarize recent technology advancements in solar sails and their successful ambient and vacuum environment testing.

Author

*Solar Sails; Propulsion System Performance; Aerospace Systems; Environment Effects; Propulsion System Configurations*

## 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*.

**20070000003** Brookhaven National Lab., Upton, NY USA

#### **Gas Phase Molecular Dynamic: High Resolution Spectroscopic Probes of Chemical Dynamics**

Hall, G. E.; Apr. 2006; 10 pp.; In English

Report No.(s): DE2006-884995; BNL-75929-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

This research is carried out as part of the Gas Phase Molecular Dynamics group program in the Chemistry Department at Brookhaven National Laboratory. High-resolution spectroscopic tools are developed and applied to problems in chemical dynamics. Recent topics have included the state-resolved studies of collision-induced electronic energy transfer, dynamics of barrierless unimolecular reactions, and the kinetics and spectroscopy of transient species.

NTIS

*Chemical Reactions; Molecular Dynamics; Reaction Kinetics; Spectroscopy; Vapor Phases*

**2007000005** Pacific Northwest National Lab., Richland, WA, USA

**Computational Analysis of Coriant and PNNL Radioxenon Data Viewers**

McIntyre, J. I.; Carman, A.; Oct. 2005; 18 pp.; In English

Report No.(s): DE2006-885203; PNNL-15412; No Copyright; Avail.: National Technical Information Service (NTIS)

The analysis by Coriant of the beta-gamma coincidence data coming from the ARSA systems show a systematic bias towards lower concentrations for all isotopes and a systematic increase in the minimum detectable concentrations. These variations can be directly traced to the method of analysis that is used by the Coriant software compared to the methods that have been developed by the International Noble Gas Experiment collaboration. This report details the differences and suggests solutions where appropriate. The report writers recommend that the algorithm changes be made to the Coriant software to bring up to the international standards.

NTIS

*Rare Gases; Chemical Detection; Algorithms; Concentration (Composition)*

**2007000008** Westinghouse Savannah River Co., Aiken, SC, USA

**Evaluation of Constant Current Weld Control for Pinch Welding**

Korinko, P. S.; Howard, S. R.; Sep. 2005; 15 pp.; In English

Report No.(s): DE2006-891866; WSRC-TR-2005-00434; No Copyright; Avail.: National Technical Information Service (NTIS)

Modern weld controllers typically use current to control the weld process. SRS uses a legacy voltage control method. This task was undertaken to determine if the improvements in the weld control equipment could be implemented to provide improvements to the process control. The constant current mode of operation will reduce weld variability by about a factor of 4. The constant voltage welds were slightly hotter than the constant current welds of the same nominal current. The control mode did not appear to adversely affect the weld quality, but appropriate current ranges need to be established and a qualification methodology for both welding and shunt calibrations needs to be developed and documented.

NTIS

*Electric Current; Welded Joints; Welding; Control Equipment*

**20070000493** Westinghouse Savannah River Co., Aiken, SC, USA

**Comparison of Air and Deuterium on Pinch Weld Bond Appearance**

Korinko, P. S.; Sep. 2005; 17 pp.; In English

Report No.(s): DE2006-891766; WSRC-TR-2005-00433; No Copyright; Avail.: National Technical Information Service (NTIS)

The effect that air and deuterium internal atmospheres have on the pinch weld bond quality was evaluated by conducting a scoping study using type 304L stainless steel LF-7 test stems that were fabricated for an associated study. Welds were made under cool, yet nominal conditions to exacerbate the influence of the atmosphere. The bond quality of the welds was directly related to the internal atmosphere with the air atmosphere welds being of lower quality than the deuterium atmosphere welds for nominally identical welding conditions. Tritium reservoirs are welded with an internal pressure of hydrogen isotopes, qualification welds in the inert facilities are often welded in air and the results transferred to the appropriate facility.

NTIS

*Deuterium; Joints (Junctions); Pressure Vessels; Stainless Steels; Welded Joints*

**20070000497** Johns Hopkins Univ., Baltimore, MD, USA, Oklahoma Univ., Norman, OK, USA

**High Resolution Mineralogical Characterization and Biogeochemical Modeling of Uranium Reduction Pathways at the NABIR Field-Research Center**

Zhu, C.; Veblen, D. R.; Krumholz, L.; January 2006; 18 pp.; In English

Report No.(s): DE2006-883644; No Copyright; Avail.: National Technical Information Service (NTIS)

We have successfully completed a proof-of-concept, one-year grant on a three-year proposal from the former NABIR program, and here we seek additional two-year funding to complete and publish the research. Using a state-of-the-art 300-kV, atomic resolution, Field Emission Gun Transmission Electron Microscope (TEM), we have successfully identified three categories of mineral hosts for uranium in contaminated soils: (1) iron oxides; (2) mixed manganese-iron oxides; and (3) uranium phosphates. Method development using parallel electron energy loss spectroscopy (EELS) associated with the TEM shows great promise for characterizing the valence states of immobilized U during bioremediation. We have also collected 27



groundwater samples from two push-pull field biostimulation tests, which form two time series from zero to approximately 600 hours.

NTIS

*Biogeochemistry; High Resolution; Migration; Mineralogy; Radioactive Isotopes; Uranium*

**20070000516** Poitiers Univ., France, Ecole Nationale Supérieure d'Electricité et de Mécanique, Nancy, France, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Strain Mapping on Gold Thin Film Buckling and Silicon Blistering**

Goudeau, P.; Tamura, N.; Parry, G.; Colin, J.; Coupeau, C.; January 2005; 10 pp.; In English

Report No.(s): DE2006-883781; No Copyright; Avail.: National Technical Information Service (NTIS)

Stress/Strain fields associated with thin film buckling induced by compressive stresses or blistering due to the presence of gas bubbles underneath single crystal surfaces are difficult to measure owing to the microscale dimensions of these structures. In this work, we show that micro Scanning X-ray diffraction is a well suited technique for mapping the strain/stress tensor of these damaged structures.

NTIS

*Bubbles; Buckling; Gold; Metal Films; Silicon; Thin Films*

**20070000519** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**X-ray Diffraction Characterization of Suspended Structures for MEMS Applications**

Goudeau, P.; Tamura, N.; LAvelle, B.; Rigo, S.; Masri, T.; January 2005; 10 pp.; In English

Report No.(s): DE2006-883782; No Copyright; Avail.: National Technical Information Service (NTIS)

Mechanical stress control is becoming one of the major challenges for the future of micro and nanotechnologies. Micro scanning X-ray diffraction is one of the promising techniques that allows stress characterization in such complex structures at sub micron scales. Two types of MEMS structure have been studied: a bilayer cantilever composed of a gold film deposited on poly-silicon and a boron doped silicon bridge. X-ray diffraction results are discussed in view of numerical simulation experiments.

NTIS

*Microelectromechanical Systems; X Ray Diffraction*

**20070000760** David Taylor Research Center, Bethesda, MD USA

**Evaluation of New Surface Preparation and Coating Repair Techniques in Ballast Tanks**

Haumschilt, Lynwood; Jan 1993; 32 pp.; In English

Report No.(s): AD-A458144; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Ship ballast tanks offer unique corrosion control challenges. Being subjected to intermittent wet and dry cycles of aerated sea water places an extreme demand on corrosion control methods. Harsh service environments are coupled with necessarily complex tank geometries, especially in Navy combatants where weight and hull designs dictate small, irregular tanks with limited accessibility. These difficulties equate to costly corrosion control techniques. The NSRP SP-3 Panel recognized these problems and formulated a series of research and development projects to investigate alternate, cost effective corrosion control solutions for the preservation of ballast tanks. The first project began in 1980 and was entitled 'Cathodic Protection/Partial Coatings Versus Complete Coating in Tanks.' A series of steel mock-up ballast tanks were constructed which duplicate tank geometries. The tanks were also large enough to allow access for surface preparation and installation of the various corrosion control methods. In 1988, the project was redirected to evaluate maintenance procedures and techniques. At that time the tanks had been under test for six years. In 1990, funding was approved to extend the project for an additional two years. This report contains the results of five years of testing under the new program. After eleven years of testing, the inorganic preconstruction primer with zinc anode has finally failed. The VOC compliant surface tolerant epoxy 'A' applied over both the power tool cleaned and abrasive blast cleaned surfaces was essentially equal in performance for the first three years, but the power tool cleaned system was somewhat inferior after five years. Both systems require extensive repair.

DTIC

*Ballast (Mass); Coating; Coatings; Corrosion; Maintenance; Surface Finishing; Tanks (Containers)*

**20070000772** National Steel and Shipbuilding Co., San Diego, CA USA

**Procedure Handbook for Shipboard Thermal Sprayed Coating Applications**

Mar 1992; 216 pp.; In English

Report No.(s): AD-A458160; No Copyright; Avail.: CASI: [A10](#), Hardcopy

This research project was produced for the National Shipbuilding Research Program as a cooperative cost-shared effort between the U.S. Navy and National Steel and Shipbuilding company (NASSCO).

DTIC

*Coatings; Handbooks; Sprayed Coatings; Thermodynamic Properties*

**2007000792** University of Southern California, Los Angeles, CA USA

**Preparation, Characterization, and Crystal Structures of the SO(3)NHF- and SO(3)NF(2)-Anions (PREPRINT)**

Haiges, Ralf; Wagner, Ross; Boatz, Jerry A; Yousufuddin, Muhammed; Etzkorn, Markus; Prakash, G K; Christe, Karl O; Chapman, Robert D; Welker, Mark F; Kreutzberger, Charles B; Mar 16, 2006; 29 pp.; In English  
Report No.(s): AD-A458189; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recently, a new class of high-energy-containing materials, gem-bis(difluoramino)-substituted heterocyclic nitramines, has gained attention as high-energy oxidizers: HNF<sub>2</sub> and TNF<sub>2</sub> have been successfully synthesized under strongly acidic conditions from their corresponding ketone derivatives using an excess of difluoramine. HNF<sub>2</sub> is an unpredictably shock-sensitive and thermally unstable, gaseous compound which can be generated from different precursors, e.g., tetrafluorohydrazine, N,N-difluorourea, N,N-difluorocarbamates, or trityldifluoramine. Out of these precursors, only trityldifluoramine is a stable storable solid. However, it is not useful as a general reagent for the preparation of larger quantities of gem-bis(difluoramines) because its synthesis requires the use of expensive N<sub>2</sub>F<sub>4</sub> which is commercially unavailable and must be prepared from difluoramine, and of equivalent amounts of mercury in an organic solvent. The use of mercury presents environmental problems, and working with N<sub>2</sub>F<sub>4</sub> in an organic solvent can be hazardous. Therefore, it is highly desirable to develop a stable, solid, readily accessible difluoramine source. Obvious candidates for HNF<sub>2</sub> sources were difluorosulfamate salts. Although the parent free acid, HOSO<sub>2</sub>NF<sub>2</sub>, had been known since 1961 and has been widely used as a difluoroaminating reagent, no reports could be found on the existence of its salts. In this paper, we report the results from two independent studies.

DTIC

*Anions; Crystal Structure*

**20070001138** NASA Glenn Research Center, Cleveland, OH, USA

**Aerosol-Assisted Chemical Vapor Deposited Thin Films for Space Photovoltaics**

Hepp, Aloysius F; McNatt, Jeremiah; Dickman, John E.; Jin, Michael H.-C.; Banger, Kulbinder K.; Kelly, Christopher V.; AquinoGonzalez, Angel R.; Rockett, Angus A.; November 2006; 24 pp.; In English; 4th International Energy Conversion Engineering Conference and Exhibit (IECEC), 26-29 Jun. 2006, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 033.01.03.23

Report No.(s): NASA/TM-2006-214445; E-15708; AIAA Paper 2006-4010; No Copyright; ONLINE:

<http://hdl.handle.net/2060/20070001138>; Avail.: CASI: A03, Hardcopy

Copper indium disulfide thin films were deposited via aerosol-assisted chemical vapor deposition using single source precursors. Processing and post-processing parameters were varied in order to modify morphology, stoichiometry, crystallography, electrical properties, and optical properties in order to optimize device-quality material. Growth at atmospheric pressure in a horizontal hot-wall reactor at 395 C yielded best device films. Placing the susceptor closer to the evaporation zone and flowing a more precursor-rich carrier gas through the reactor yielded shinier, smoother, denser-looking films. Growth of (112)-oriented films yielded more Cu-rich films with fewer secondary phases than growth of (204)/(220)-oriented films. Post-deposition sulfur-vapor annealing enhanced stoichiometry and crystallinity of the films. Photoluminescence studies revealed four major emission bands (1.45, 1.43, 1.37, and 1.32 eV) and a broad band associated with deep defects. The highest device efficiency for an aerosol-assisted chemical vapor deposited cell was 1.03 percent.

Author

*Photoluminescence; Copper; Thin Films; Solar Cells; Vapor Deposition; Pyrolysis; Aerosols*

**20070001405** Michigan State Univ., East Lansing, MI, USA

**Imido-Tethered Carbenes of Molybdenum for Ring-Opening Metathesis Polymerization and Ring-Closing Metathesis**

Odom, A. L.; Ciszewski, J. T.; 22 Oct 03; 20 pp.; In English

Contract(s)/Grant(s): ONR-N00014-01-0638

Patent Info.: Filed 22 Oct 03; US-Patent-Appl-SN-10-691-328

Report No.(s): PB2007-100924; No Copyright; Avail.: CASI: A03, Hardcopy

Compounds and processes for catalytic ring-opening cyclooligomerization metathesis and ring-closing metathesis of olefins are described. The compound is a molybdenum or tungsten metal (M) complex which comprises an imido ligand (N-R) bound to the M to provide an M=N-R site, an M=C reaction site wherein the C of the M=C reaction site is tethered to the R of the imido ligand via a carbon or carbon and heteroatom (NOS) chain containing 1 to 12 carbon atoms to form a ring structure, and two to four ligands (R') bound to the M to provide two to four M-R' sites. In particular embodiments, the M-R' sites include each of the oxygens of a dialkoxide ligand or each of the nitrogens of an n(sup 1)-pyrrolyl ligand bound to the M.

NTIS

*Alkenes; Carbenes; Metathesis; Molybdenum; Patent Applications; Polymerization; Tethering*

**20070001406** Chicago Univ., Chicago, IL USA

**Novel Catalyst for Selective Nox Reduction Using Hydrocarbons**

Marshall, C. L.; Neylon, M. K.; 7 Mar 03; 17 pp.; In English

Contract(s)/Grant(s): DE-W-31-109-ENG-38

Patent Info.: Filed Filed 7 Mar 03; US-Patent-Appl-SN-10-384-344

Report No.(s): PB2007-100923; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A two phase catalyst is disclosed with one or more transition metals such as Cu, Co, Fe, Ag and Mo supported on a molecular sieve having a pore size not greater than 8 angstrom along with a stabilizing oxide of one or more of the oxides of Zr, Mo, V, Nb or the rare earths coating the molecular sieve. A method of preparing the two phase catalyst and using same to remediate NOx in combustion gas is also described.

NTIS

*Catalysts; Hydrocarbons; Nitrogen Oxides; Patent Applications*

**20070001410** Quarles and Brady LLP, Milwaukee, WI, USA

**Fluorescent Polysiloxanes**

Toulokhonova, I. S.; West, R. C.; 5 Nov 04; 5 pp.; In English

Contract(s)/Grant(s): NSF-9901266

Patent Info.: Filed Filed 5 Nov 04; US-Patent-Appl-SN-10-982-065

Report No.(s): PB2007-100913; No Copyright; Avail.: CASI: [A01](#), Hardcopy

Fluorescent polymers are useful both for research purposes and for commercial applications, such as paints for highway signs. Some fluorescent compounds are also electroluminescent, making them useful in polymeric light emitting diodes (PLEDS) for advanced display technology. Several fluorescent polysiloxanes have been identified; however, currently known fluorescent polysiloxane compounds have several flaws, including weak fluorescence and high cost, which make them unsuitable for many commercial purposes. This invention provides improved fluorescent polysiloxane compounds. Fluorescent groups are added to the polysiloxane chain by reacting fluorescent aryl alcohols or fluorescent aryl carbinols with hypopolysiloxanes in the presence of a catalyst. The resulting fluorescent polysiloxanes have well-defined and intense light properties, and can be readily incorporated into commercial products.

NTIS

*Fluorescence; Patent Applications; Polysiloxanes*

**20070001739** National Steel and Shipbuilding Co., San Diego, CA USA

**Feasibility Study: Tank Blasting Using Recoverable Steel Grit**

Keener, Jerry; Coffey, Alan; Hitzrot, H W; Hansen, Les; Hamilton, Al; Jul 1993; 74 pp.; In English

Report No.(s): AD-A458692; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458692>; Avail.: CASI: [A04](#), Hardcopy

Abrasive blasting of tanks and other enclosed spaces on-board ships comprises a large part of the work effort and budget allocated to surface preparation and coating for both new construction and repair contracts. Traditionally, disposable abrasives such as copper and coal slag have been used for tank blasting. The use of recoverable steel grit for tank blasting would appear to reduce or eliminate many of the problems associated with slag and mineral abrasives. Due to the durability and toughness of steel, steel grit can be reused many hundreds of times. Significantly smaller volumes of abrasive waste are generated for disposal. The durability of steel grit also results in very low dust generation, since the particles do not readily break down into fines. The recovery of steel abrasive through a vacuum recovery system greatly decreases environmental hazards by trapping paint chips and dust, which are segregated from the reusable abrasive. The higher density of steel grit in comparison to other

abrasives produces increased cutting ability, while improving worker visibility through decreased dust generation. The increased cutting and low dust equate to increased productivity. Finally, the use of steel grit would not trigger the costly sampling and testing requirements of MILA- 22262A, since steel abrasive is not covered under this specification.

DTIC

*Abrasives; Feasibility; Grit; Steels*

**20070001981** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Determining Kinetic Parameters for Isothermal Crystallization of Glasses**

Ray, C. S.; Zhang, T.; Reis, S. T.; Brow, R. K.; [2006]; 1 pp.; In English; 8th International Symposium on Crystallization of Glasses and Liquids, 24-28 Sep. 2006, Jackson Hole, WY, USA; Copyright; Avail.: Other Sources; Abstract Only

Non-isothermal crystallization techniques are frequently used to determine the kinetic parameters for crystallization in glasses. These techniques are experimentally simple and quick compared to the isothermal techniques. However, the analytical models used for non-isothermal data analysis, originally developed for describing isothermal transformation kinetics, are fundamentally flawed. The present paper describes a technique for determining the kinetic parameters for isothermal crystallization in glasses, which eliminates most of the common problems that generally make the studies of isothermal crystallization laborious and time consuming. In this technique, the volume fraction of glass that is crystallized as a function of time during an isothermal hold was determined using differential thermal analysis (DTA). The crystallization parameters for the lithium-disilicate (Li<sub>2</sub>O.2SiO<sub>2</sub>) model glass were first determined and compared to the same parameters determined by other techniques to establish the accuracy and usefulness of the present technique. This technique was then used to describe the crystallization kinetics of a complex Ca-Sr-Zn-silicate glass developed for sealing solid oxide fuel cells.

Author

*Crystallization; Time Dependence; Thermal Analysis; Lithium; Silicates; Concentration (Composition)*

**20070002039** International Trade Commission, Washington, DC USA

**Sebacic Acid from China. Investigation No. 731-TA-653 (Second Review)**

May 2005; 116 pp.; In English

Report No.(s): PB2007-101201; USITC/PUB-3775; No Copyright; Avail.: CASI: [A06](#), Hardcopy

On the basis of the record developed in the subject five-year review, the USA International Trade Commission (Commission) determines, pursuant to section 751(c) of the Tariff Act of 1930 (19 U.S.C. SC 1675(c)) (the Act), that revocation of the antidumping duty order on sebacic acid from China would not be likely to lead to continuation or recurrence of material injury to an industry in the USA within a reasonably foreseeable time.

NTIS

*China; International Trade; Sebacic Acid*

**20070002042** International Trade Commission, Washington, DC USA

**Superalloy Degassed Chromium from Japan. Investigation No. 731-TA-1090 (Preliminary)**

Apr. 2005; 76 pp.; In English

Report No.(s): PB2007-101175; USITC/PUB-3768; No Copyright; Avail.: CASI: [A05](#), Hardcopy

On the basis of the record developed in the subject investigation, the USA International Trade Commission determines, pursuant to section 733(a) of the Tariff Act of 1930 (19 U.S.C. Section 1673b(a)) (the Act), that there is a reasonable indication that an industry in the USA is materially injured by reason of imports from Japan of superalloy degassed chromium, provided for in subheading 8112.21.00 of the Harmonized Tariff Schedule of the USA, that are alleged to be sold in the USA at less than fair value (LTFV). Based on the record in this preliminary phase investigation, the Commission found that there is a reasonable indication that an industry in the USA is materially injured by reason of imports of superalloy degassed chromium from Japan that is allegedly sold in the USA at less than fair value (LTFV).

NTIS

*Chromium; Heat Resistant Alloys; Industries; Japan*

**20070002044** International Trade Commission, Washington, DC USA

**Superalloy Degassed Chromium from Japan. Investigation No. 731-TA-1090 (Final)**

Dec. 2005; 68 pp.; In English

Report No.(s): PB2007-101168; USITC/PUB-3825; No Copyright; Avail.: CASI: [A04](#), Hardcopy

On the basis of the record developed in the subject investigation, the USA International Trade Commission determines,

pursuant to section 735(b) of the Tariff Act of 1930 (19 U.S.C. Section 1673d(b)) (the Act), that an industry in the USA is materially injured by reason of imports from Japan of superalloy degassed chromium, provided for in subheading 8112.21.00 of the Harmonized Tariff Schedule of the USA, that have been found by the Department of Commerce to be sold in the USA at less than fair value (LTFV). Based on the record of this investigation, the Commission found that an industry in the USA is materially injured by reason of imports of superalloy degassed chromium (SD chromium) from Japan found to be sold in the USA at less than fair value (LTFV).

NTIS

*Chromium; Heat Resistant Alloys; Industries; Japan*

**20070002046** Northwestern Univ., Chicago, IL, USA

**Determination of Young's Modulus and Poisson's Ratio of Coatings from Indentation Data**

Liu, S.; Wang, Q.; 13 Oct 04; 20 pp.; In English

Contract(s)/Grant(s): ONR-N00014-01-1-0392/P00001

Patent Info.: Filed Filed 13 Oct 04; US-Patent-Appl-SN-10-964-589

Report No.(s): PB2007-100934; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method is provided for determining Young's modulus and, if desired, Poisson's ratio of a coating on a substrate wherein load-displacement indentation data in the elastic region (either elastic loading or unloading) generated using an indenter is analyzed to interpret the elastic response of a coated material. The data analysis pursuant to the invention is based on an extended Hertzian analysis developed for thin-film coatings.

NTIS

*Coating; Displacement; Indentation; Loads (Forces); Modulus of Elasticity; Patent Applications; Poisson Ratio*

## 24

### COMPOSITE MATERIALS

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

**20070000534** NASA Langley Research Center, Hampton, VA, USA

**User-Defined Material Model for Progressive Failure Analysis**

Knight, Norman F. Jr.; Reeder, James R., Technical Monitor; December 2006; 93 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNL06AA48T; WBS 759.07.09

Report No.(s): NASA/CR-2006-214526; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070000534>; Avail.: CASI: [A05](#), Hardcopy

An overview of different types of composite material system architectures and a brief review of progressive failure material modeling methods used for structural analysis including failure initiation and material degradation are presented. Different failure initiation criteria and material degradation models are described that define progressive failure formulations. These progressive failure formulations are implemented in a user-defined material model (or UMAT) for use with the ABAQUS/Standard1 nonlinear finite element analysis tool. The failure initiation criteria include the maximum stress criteria, maximum strain criteria, the Tsai-Wu failure polynomial, and the Hashin criteria. The material degradation model is based on the ply-discounting approach where the local material constitutive coefficients are degraded. Applications and extensions of the progressive failure analysis material model address two-dimensional plate and shell finite elements and three-dimensional solid finite elements. Implementation details and use of the UMAT subroutine are described in the present paper. Parametric studies for composite structures are discussed to illustrate the features of the progressive failure modeling methods that have been implemented.

Author

*Composite Materials; Computer Programs; Finite Element Method; Structural Analysis; Mathematical Models; Structural Failure; Failure; Materials Science*

**20070000768** Dayton Univ. Research Inst., OH USA

**Effect of Ply Thickness on the Damage Development in Composite Laminates (Preprint)**

Kim, Ran Y; Sih, Sangwook; Donaldson, Steven L; Feb 2006; 13 pp.; In English

Contract(s)/Grant(s): FA8650-05-D-5052; Proj-4347

Report No.(s): AD-A458156; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes the experimental investigation on the effect of ply thickness on the first ply failure, delamination, and the subsequent final failure of graphite/epoxy composite laminates. The laminates considered in this paper are a cross-ply and two quasi-isotropic laminates containing thin plies in the desired interface. The onset of the first ply failure and delamination, and the stress-free temperature are experimentally determined. The experimental results for ply crack and delamination development were compared with an analytical model. The results indicated that ply thickness played a significant role on delaying damage onset. The experimental results were compared with the Weibull statistical theory in conjunction with the weakest link theory and discussed on the effect of size (ply thickness) on damage initiation.

DTIC

*Damage; Delaminating; Laminates; Residual Stress; Thickness*

**20070001481** Missouri Univ., Rolla, MO USA

**A Comparison of Bulk Precipitated Cerium Oxide Powders and Cerium Conversion Coatings and the Influence of Hydrogen Peroxide on Their Formation (Preprint)**

Mar 2006; 23 pp.; In English

Contract(s)/Grant(s): F33615-03-C-5011; Proj-3005

Report No.(s): AD-A458368; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Cerium Oxides; Hydrogen Peroxide; Powder (Particles); Coatings; Precipitation (Chemistry)*

**20070001509** Trex Enterprises Coup., Lihue, HI USA

**CVC Silicon Carbide Optical Properties and Systems (Preprint)**

Jul 29, 2005; 11 pp.; In English

Contract(s)/Grant(s): FA9451-04-M-0085; Proj-3005

Report No.(s): AD-A458382; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Optical Properties; Silicon Carbides; Vapors*

**20070002000** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Mode I Toughness Measurements of Core/Facesheet Bonds in Honeycomb Sandwich Structures**

Nettles, Alan T.; Ratcliffe, James G.; [2006]; 4 pp.; In English; 21st Annual Technical Conference on the American Society for Composites, 17-22 Sep. 2006, Dearborn, MI, USA; Original contains black and white illustrations; Copyright; Avail.:

CASI: [A01](#), Hardcopy

Composite sandwich structures will be used in many future applications in aerospace, marine and offshore industries due to the fact that the strength and stiffness to mass ratios surpass any other structural type. Sandwich structure also offers advantages over traditional stiffened panels such as ease of manufacturing and repair. During the last three decades, sandwich structure has been used extensively for secondary structure in aircraft (fuselage floors, rudders and radome structure). Sandwich structure is also used as primary structure in rotorcraft, the most common example being the trailing edge of rotor blades. As with other types of composite construction, sandwich structure exhibits several types of failure mode such as facesheet wrinkling, core crushing and sandwich buckling. Facesheet/core debonding has also been observed in the marine and aerospace industry. During this failure mode, peel stresses applied to an existing facesheet/core debond or an interface low in toughness, results in the facesheet being peeled from the core material, possibly leading to a significant loss in structural integrity of the sandwich panel. In an incident during a test on a liquid hydrogen fuel tank of the X-33 prototype vehicle, the outer graphite/epoxy facesheet and honeycomb core became debonded from the inner facesheet along significant areas, leading to failure of the tank. As a consequence of the accident; significant efforts were made to characterize the toughness of the facesheet/core bond. Currently, the only standardized method available for assessing the quality of the facesheet/core interface is the climbing drum peel test (ASTM D1781). During this test a sandwich beam is removed from a panel and the lip of one of the facesheets is attached to a drum, as shown in Fig. 1. The drum is then rotated along the sandwich beam, causing the facesheet to peel from the core. This method has two major drawbacks. First, it is not possible to obtain quantitative fracture data from the test and so the results can only be used in a qualitative manner. Second, only sandwich structure with thin facesheets can be tested (to facilitate wrapping of the facesheet around the climbing drum). In recognition of the need for a more quantitative facesheet/core fracture test, several workers have devised experimental techniques for characterizing the toughness of the facesheet/core interface. In all of these cases, the tests are designed to yield a mode I-dominated fracture toughness of the facesheet/core interface in a manner similar to that used to determine mode I fracture

toughness of composite laminates. In the current work, a modified double cantilever beam is used to measure the mode I-dominated fracture toughness of the interface in a sandwich consisting of glass/phenolic honeycomb core reinforced with graphite epoxy facesheets. Two specimen configurations were tested as shown in Fig 2. The first configuration consisted of reinforcing the facesheets with aluminum blocks (Fig. 2a). In the second configuration unreinforced specimens were tested (Fig. 2b). Climbing drum peel tests were also conducted to compare the fracture behavior observed between this test and the modified double cantilever beam. This paper outlines the test procedures and data reduction strategies used to compute fracture toughness values from the tests. The effect of specimen reinforcement on fracture toughness of the facesheet/core interface is discussed.

Author

*Bonding; Honeycomb Cores; Sandwich Structures; Toughness; Composite Structures*

**20070002012** Mide Technology Corp., Medford, MA USA

**Investigation of Adaptive Control Approaches to Mitigate Shock Impact With Piezoceramics (Armor)**

Nov 2006; 61 pp.; In English

Contract(s)/Grant(s): DAAD19-02-D-0001

Report No.(s): AD-A458320; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Adaptive Control; Piezoelectric Ceramics; Armor*

**20070002013** Army Research Lab., Adelphi, MD USA

**Pulsed Capacitance Measurement of Silicon Carbide (SiC) Schottky Diode and SiC Metal Oxide Semiconductor**

Nov 2006; 28 pp.; In English

Report No.(s): AD-A458317; ARL-TR-3993; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Capacitance; Metal Oxide Semiconductors; Schottky Diodes; Silicon Carbides*

**20070002038** International Trade Commission, Washington, DC USA

**Certain Wax and Wax/Resin Thermal Transfer Ribbons from France, Japan, and Korea (Revised Issue). Investigation Nos. 731-TA-1039-1041 (Preliminary)**

Jul. 2003; 121 pp.; In English

Report No.(s): PB2007-101203; USITC/PUB-3613; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The USA International Trade Commission (ITC) determined that a U.S. industry is neither materially injured nor threatened with material injury by reason of imports of certain wax and wax/resin thermal transfer ribbons from France and Japan that the U.S. Department of Commerce has determined are sold in the USA at less than fair value.

NTIS

*France; Heat Transfer; Japan; Korea; Resins; Ribbons; Waxes*

**20070002075** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Analytical, Numerical, and Experimental Investigation on a Non-Contact Method for the Measurements of Creep Properties of Ultra-High-Temperature Materials**

Lee, Jonghyun; Hyers, Robert W.; Rogers, Jan R.; Rathz, Thomas J.; Choo, Hahn; Liaw, Peter; [2006]; 1 pp.; In English; Materials for Responsive Space Access, 15-19 Oct. 2006, Cincinnati, OH, USA; Copyright; Avail.: Other Sources; Abstract Only

Responsive access to space requires re-use of components such as rocket nozzles that operate at extremely high temperatures. For such applications, new ultra-high-temperature materials that can operate over 2,000 C are required. At the temperatures higher than the fifty percent of the melting temperature, the characterization of creep properties is indispensable. Since conventional methods for the measurement of creep is limited below 1,700 C, a new technique that can be applied at higher temperatures is strongly demanded. This research develops a non-contact method for the measurement of creep at the temperatures over 2,300 C. Using the electrostatic levitator in NASA MSFC, a spherical sample was rotated to cause creep deformation by centrifugal acceleration. The deforming sample was captured with a digital camera and analyzed to measure creep deformation. Numerical and analytical analyses have also been conducted to compare the experimental results.

Analytical, numerical, and experimental results showed a good agreement with one another.

Author

*Creep Properties; High Temperature; Numerical Analysis; Refractory Materials*

## 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*.

**2007000001** Pacific Northwest National Lab., Richland, WA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

#### **Stability Constants of NP(V) Complexes with Fluoride and Sulfate at Variable Temperatures**

Xia, Y.; Friese, J. I.; Moore, D. A.; Rao, L.; January 2006; 36 pp.; In English

Report No.(s): DE2006-884904; No Copyright; Avail.: Department of Energy Information Bridge

A solvent extraction method was used to determine the stability constants of Np(V) complexes with fluoride and sulfate in 1.0 M NaClO(sub 4) from 25 C to 60 C. The distribution ratio of Np(V) between the organic and aqueous phases was found to decrease as the concentrations of fluoride and sulfate were increased. Stability constants of the 1:1 Np(V)-fluoride complexes and the 1:1 Np(V)-sulfate and 1:2 Np(V)-sulfate complexes, dominant in the aqueous phase under the experimental conditions, were calculated from the effect of (F(sup -)) and (SO(sub 4)(sup 2-)) on the distribution ratio. The enthalpy and entropy of complexation were calculated from the stability constants at different temperatures by using the Van't Hoff equation.

NTIS

*Fluorides; Neptunium; Solvent Extraction; Stability; Sulfates*

**2007000012** Texas A&M Univ., College Station, TX, USA

#### **Kinetics of Slurry Phase Fischer-Tropsch Synthesis. Third Annual Technical Progress Report for October 1, 2005 to September 30, 2005**

Jan. 27, 2006; 65 pp.; In English

Report No.(s): DE2006-891890; No Copyright; Avail.: Department of Energy Information Bridge

This report covers the third year of this research grant under the University Coal Research program. The overall objective of this project is to develop a comprehensive kinetic model for slurry phase Fischer-Tropsch synthesis (FTS) on iron catalysts. This model will be validated with experimental data obtained in a stirred tank slurry reactor (STSR) over a wide range of process conditions. The model will be able to predict molar flow rates and concentrations of all reactants and major product species (H<sub>2</sub>O, CO<sub>2</sub>, linear 1- and 2-olefins, and linear paraffins) as a function of reaction conditions in the STSR.

NTIS

*Catalysts; Fischer-Tropsch Process; Iron; Kinetics; Slurries*

**20070000467** Brown Univ., Providence, RI, USA, California Univ., Berkeley, CA USA

#### **Nanoscale Chemical and Mechanical Characterization of Thin Films: Sum Frequency Generation (SFG) Vibrational Spectroscopy at Buried Interfaces**

Kweskin, S. J.; Apr. 2006; 212 pp.; In English

Report No.(s): DE2006-885254; No Copyright; Avail.: National Technical Information Service (NTIS)

Sum frequency generation (SFG) surface vibrational spectroscopy was used to characterize interfaces pertinent to current surface engineering applications, such as thin film polymers and novel catalysts. An array of advanced surface science techniques like scanning probe microscopy (SPM), x-ray photoelectron spectroscopy (XPS), gas chromatography (GC) and electron microscopy were used to obtain experimental measurements complementary to SFG data elucidating polymer and catalyst surface composition, surface structure, and surface mechanical behavior. Experiments reported in this dissertation concentrate on three fundamental questions: (1) How does the interfacial molecular structure differ from that of the bulk in real world applications. (2) How do differences in chemical environment affect interface composition or conformation. (3) How do these changes correlate to properties such as mechanical or catalytic performance.

NTIS

*Chemical Reactions; Frequencies; Mechanical Properties; Spectroscopy; Surface Reactions; Thin Films; Vibration*



**20070000469** Geological Survey, Reston, VA USA, Geological Survey, USA

**Methodology to Evaluate the Effect of Sorption in the Unsaturated Zone on the Storage of Nitrate and Other Ions and Their Transport Across the Water Table, Southern New Jersey**

Reilly, T. J.; Baehr, A. L.; January 2006; 28 pp.; In English

Report No.(s): PB2007-102662; USGS-SIR-2006-5074; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes a field-based methodology developed to evaluate the flux of nitrate and other ions across the water table in a small agricultural watershed in the New Jersey Coastal Plain. This methodology is unique in that ion-concentration data from the shallow ground water are coupled with ion-concentration data from the lower unsaturated zone to estimate the flux and partitioning of chemicals simultaneously. Recharge, as well as chemical storage and sorption within the lower unsaturated zone, is quantified. Storage, sorption, and mass flux are documented to assess the physical/chemical assimilative capacity of the entire unsaturated zone and the effect of sediment variability on the distribution of nitrate loading to the underlying aquifer.

NTIS

*Coastal Plains; Ions; New Jersey; Nitrates; Sorption; Water Tables*

**20070000471** Geological Survey, Reston, VA USA, Startex Jackson Wellford Duncan Water District, Lyman, SC, USA  
**Hydraulic and Field Water-Chemistry Characteristics of Piedmont Alluvial Deposits in the Middle Tyger River Near Lyman, Spartanburg County, South Carolina, 2005**

Harrelson, L. G.; Addison, A. D.; January 2006; 32 pp.; In English

Report No.(s): PB2007-102676; USGS-SIR-2006-5133; No Copyright; Avail.: National Technical Information Service (NTIS)

This study explores the possibility of developing a bank-filtration process to improve water quality in which alluvial deposits serve as a natural sand filter to pretreat water to be used as a secondary drinking-water source in a small piedmont reservoir along the Middle Tyger River near Lyman in Spartanburg County, South Carolina. From January 2004 to September 2005, data from 10 auger borings, 2 sediment cores, 29 ground-penetrating radar transects, and 3 temporary observation wells, and field water-chemistry data were collected and analyzed. These data were collected and used to characterize the lithology, geometry, hydraulic properties, yield potential, and water-chemistry characteristics of the alluvial deposits in the channel and on the right bank of the reservoir. The assessment was undertaken to determine if an adequate amount of water could be withdrawn from the alluvial deposits to sustain a bank-filtration process and to characterize the water chemistry of the surface water and pore water.

NTIS

*Alluvium; Deposits; Filtration; Piedmonts; Rivers; Sands; South Carolina; Water; Water Quality*

**20070000495** Pacific Northwest National Lab., Richland, WA, USA

**Computational Thermochemistry and Benchmarking of Reliable Methods**

Feller, D. F.; Dixon, D. A.; Dunning, T. H.; Dupuis, M.; Apr. 2006; 24 pp.; In English

Report No.(s): DE2006-884826; No Copyright; Avail.: National Technical Information Service (NTIS)

During the first and second years of the Computational Thermochemistry and Benchmarking of Reliable Methods project, we completed several studies using the parallel computing capabilities of the NWChem software and Molecular Science Computing Facility (MSCF), including large-scale density functional theory (DFT), second-order Moeller-Plesset (MP2) perturbation theory, and CCSD(T) calculations. During the third year, we continued to pursue the computational thermodynamic and benchmarking studies outlined in our proposal. With the issues affecting the robustness of the coupled cluster part of NWChem resolved, we pursued studies of the heats-of-formation of compounds containing 5 to 7 first- and/or second-row elements and approximately 10 to 14 hydrogens. The size of these systems, when combined with the large basis sets (cc-pVQZ and aug-cc-pVQZ) that are necessary for extrapolating to the complete basis set limit, creates a formidable computational challenge, for which NWChem on NWMPP1 is well suited.

NTIS

*Thermochemistry; Robustness (Mathematics); Extrapolation*

**20070000556** Kansas State Univ., Manhattan, KS, USA

**New Vistas for Functionalized Polyoxometalates**

Maatta, E. A.; January 2006; 8 pp.; In English

Report No.(s): DE2006-881336; No Copyright; Avail.: National Technical Information Service (NTIS)

Polyoxometalates (POMs)--the multimetallic oxoanions (M<sub>x</sub>O<sub>y</sub>X<sub>z</sub>)<sub>n</sub> formed by Mo, W, and, to a lesser extent, V, Nb and Ta have been described as 'a class of inorganic compounds that is unmatched in terms of molecular and electronic structural versatility, reactivity, and relevance'. The remarkable breadth of POM chemistry, which extends to areas as diverse as catalysis, medicine, imaging, photo- and electrochromism, and magnetic materials, derives from the confluence of the species' attractive intrinsic characteristics and their extraordinary compositional range. While many of these systems are easy to prepare, it is often difficult to modify POMs in a rational manner. The goal is to provide for the intrinsic modification of POM systems so as to enable their further utility: our approach has provided many examples of fundamentally new types of polyoxometalates in which their ubiquitous oxo (O)<sub>2</sub> ligands have been replaced by other isoelectronic entities including organoimido (N-R)<sub>2</sub> and diazoalkane (NNCR)<sub>2</sub> ligands.

NTIS

*Organic Compounds; Anions*

**20070000558** California Univ., Berkeley, CA USA

**Ligand Rearrangements of Organometallic Complexes in Solution**

Shanoski, J. E.; Apr. 2006; 162 pp.; In English

Report No.(s): DE2006-883798; No Copyright; Avail.: Department of Energy Information Bridge

Many chemical reactions utilize organometallic complexes as catalysts. These complexes find use in reactions as varied as bond activation, polymerization, and isomerization. This thesis outlines the construction of a new ultrafast laser system with an emphasis on the generation of tunable mid-infrared pulses, data collection, and data analysis.

NTIS

*Catalysts; Ligands; Organometallic Compounds*

**20070000559** Bettis Atomic Power Lab., West Mifflin, PA, USA

**On-line Coolant Chemistry Analysis**

Bachman, L.; Jul. 19, 2006; 14 pp.; In English

Report No.(s): DE2006-884664; No Copyright; Avail.: Department of Energy Information Bridge

Impurities in the gas coolant of the space nuclear power plant (SNPP) can provide valuable indications of problems in the reactor and an overall view of system health. By monitoring the types and amounts of these impurities, much can be implied regarding the status of the reactor plant. However, a preliminary understanding of the expected impurities is important before evaluating prospective detection and monitoring systems. Currently, a spectroscopy system is judged to hold the greatest promise for monitoring the impurities of interest in the coolant because it minimizes the number of entry and exit points to the plant and provides the ability to detect impurities down to the 1 ppm level.

NTIS

*Coolants; Nuclear Power Plants; On-Line Systems*

**20070000672** Space and Naval Warfare Systems Center, San Diego, CA USA

**Surface Diffusion Enhanced Chemical Sensing by Surface Acoustic Waves**

Schmera, Gabor; Kish, Laszlo B; Jan 2003; 6 pp.; In English

Report No.(s): AD-A457970; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A new chemical sensing method that enhances sensitivity and selectivity is proposed and verified by theoretical analysis. This method is based on the spectral analysis of the dynamics of adsorbed molecules on surface acoustic wave (SAW) delay lines and resonators. Various sources of noise, including diffusion and adsorption-desorption noise is considered.

DTIC

*Adsorption; Delay Lines; Desorption; Detection; Diffusion; Sound Waves; Spectrum Analysis; Surface Diffusion; Surface Waves*

**20070000764** Dayton Univ. Research Inst., OH USA

**Strength Prediction in Composites with Stress Concentrations: Classical Weibull and Critical Failure Volume Methods With Micromechanical Considerations (Preprint)**

Iarve, E V; Mollenhauer, D; Whitney, T J; Kim, R; Feb 2006; 26 pp.; In English

Contract(s)/Grant(s): FA8650-05-D-5052; Proj-4347

Report No.(s): AD-A458152; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Application of Weibull statistics to tensile strength prediction in laminated composites with open holes is revisited.

Quasi-isotropic carbon fiber laminates with two stacking sequences [45/0/-45/90]<sub>s</sub> and [0/45/90/-45]<sub>s</sub> with three different hole sizes of 2.54mm, 6.35mm and 12.7mm were considered for analysis and experimental examination. The first laminate showed 20% lower strength for smaller and 10% for the larger hole sizes. A novel Critical Failure Volume (CFV) method with minimum scaling length constraint as well as the traditional Weibull integral method were applied. The strength prediction was based on the state of stress in the 00 ply by taking into account the redistribution of stress due to matrix damage in the form of splitting, delamination and matrix cracking of off axis plies. The measured extent of damage was then included in a 3D stress analysis procedure by using a mesh independent crack modeling method to account for fiber direction stress redistribution. The CFV method gave results within one standard deviation from experimentally observed strength values for both laminates and all three hole sizes. The Weibull integral method underpredicted the strength in all cases from as much as 20-30% for smaller hole sizes to 8% for the large holes. The accuracy of failure predictions using CFV is attributed to the introduction of a minimum scaling length. This length has a physical meaning of the width of a process zone of formation of fiber macro-crack as a result of single fiber break interaction.

DTIC

*Composite Materials; Failure; Micromechanics; Stress Concentration; Weibull Density Functions*

**20070000771** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

**Characteristics and Sampling Efficiencies of SpinCon and Pre-Production Omni Model Aerosol Samplers**

Kesavan, Jana S; Schepers, Deborah R; Oct 2006; 19 pp.; In English

Contract(s)/Grant(s): Proj-206023; Proj-4BPO

Report No.(s): AD-A458159; ECBC-TN-027; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Characteristics and aerosol sampling efficiencies of one SpinCon and two pre-production (PP) Omni model aerosol samplers Omni-2 and Omni-3 (Sceptor Industries, Inc., Kansas, MO) were determined at the U.S. Army Edgewood Chemical Biological Center. All three samplers have non-traditional wetted-wall cyclones to collect and concentrate aerosols in liquid. The Omni aerosol sampler is designed to be approximately half the weight, half the size, and a quarter of the power of the SpinCon. The sampling efficiency tests were conducted with monodisperses 1- and 3-um fluorescent polystyrene latex (PSL) microspheres and 3.5- and 5-um fluorescent oleic acid particles.

DTIC

*Aerosols; Efficiency; Samplers; Sampling*

**20070000787** Air Force Research Lab., Edwards AFB, CA USA

**Polyazide Chemistry: Synthesis and Properties of [Nb(N<sub>3</sub>)<sub>7</sub>]<sub>2</sub>- and [Ta(N<sub>3</sub>)<sub>7</sub>]<sub>2</sub>- (PREPRINT)**

Haiges, Ralf; Boatz, Jerry A; Yousufuddin, Muhammed; Christe, Karl O; Mar 16, 2006; 39 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A458180; AFRL-PR-ED-JA-2006-102; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the last decade, inorganic polyazido compounds have received much attention. Besides being of academic interest, azides and polyazides are viable candidates for high energy-density materials (HEDM). The azido group is very energetic and polyazides are highly endothermic compounds, whose energy content increases with an increasing number of azido ligands. It is, therefore, not surprising that the synthesis of molecules with a high number of azido groups is very challenging due to their explosive nature and shock sensitivity. Despite such obstacles, a number of pentaazido and anionic hexaazido compounds had been reported. Very recently, unprecedented neutral hexaazido species M(N<sub>3</sub>)<sub>6</sub> (M = Mo, W) have been prepared, and in case of W(N<sub>3</sub>)<sub>6</sub> also structurally characterized. Treatment of M(N<sub>3</sub>)<sub>6</sub> (M = Mo, W) with ionic azides yielded the first binary heptaazido compounds.

DTIC

*Azides (Inorganic); Azides (Organic); Chemical Properties*

**20070000788** Air Force Research Lab., Edwards AFB, CA USA

**Experimental Evidence for Linear Metal-Azide Bonds. The Binary Group 5 Azides Nb(N<sub>3</sub>)<sub>5</sub>, Ta(N<sub>3</sub>)<sub>5</sub>, [Nb(N<sub>3</sub>)<sub>6</sub>]- and [Ta(N<sub>3</sub>)<sub>6</sub>]-, and 1:1 Adducts of Nb(N<sub>3</sub>)<sub>5</sub> and Ta(N<sub>3</sub>)<sub>5</sub> with CH<sub>3</sub>CN (PREPRINT)**

Haiges, Ralf; Boatz, Jerry A; Schroer, Thorsten; Yousufuddin, Muhammed; Christe, Karl O; Mar 20, 2006; 37 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A458181; AFRL-PR-ED-JA-2006-103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Whereas the existence of numerous binary transition metal azido-complexes has been reported, no binary Group 5 azides are known. Only a limited number of partially azide-substituted compounds of vanadium, niobium and tantalum have previously been reported. In this paper, we wish to communicate the synthesis and characterization of Nb(N<sub>3</sub>)<sub>5</sub>, Ta(N<sub>3</sub>)<sub>5</sub> and their 1:1 adducts with CH<sub>3</sub>CN, and of the anions [Nb(N<sub>3</sub>)<sub>6</sub>]<sup>-</sup> and [Ta(N<sub>3</sub>)<sub>6</sub>]<sup>-</sup>. The crystal structures of Nb(N<sub>3</sub>)<sub>5</sub>-CH<sub>3</sub>CN and [PPh<sub>4</sub>][Nb(N<sub>3</sub>)<sub>6</sub>] and the first experimental evidence for the existence of azido compounds with linear metal-N-N bonds are also reported.

DTIC

*Acetonitrile; Adducts; Azides (Inorganic); Azides (Organic); Bonding; Chemical Bonds*

**20070000798** Cornerstone Research Group, Inc., Dayton, OH USA

**Processing and Characterization of Shape Memory Polymer Nanocomposites (Preprint)**

Fortener, David; Feb 2006; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-C-5047; Proj-3005

Report No.(s): AD-A458203; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report was developed under a SBIR contract. Cornerstone Research Group, Inc. (CRG) has demonstrated the feasibility of adding nanoparticulates into their shape memory polymer (SMP) resin systems. Under thermal or other stimuli, SMPs can exhibit a radical change from a rigid polymer to a flexible, elastic state, and then back to a rigid state again. Nanoparticles, including carbon nanofibers and carbon nanotubes, are expected to increase material properties such as electrical conductivity, thermal conductivity, and mechanical properties. CRG has demonstrated this on a lab-scale. For end use purposes, these results must be transitioned to large-scale manufacturing. This paper will discuss the process of transitioning SMP nanocomposites from lab-scale to large-scale production. In order to verify the properties after scale-up, the scaled-up samples of various percent loading of nanoparticles will undergo thorough testing to include, but not be limited to, electrical conductivity, thermal conductivity, and dispersion study in the resin using a scanning electron microscope (SEM).

DTIC

*Composite Materials; Nanocomposites; Nanostructures (Devices); Plastics; Polymers; Shapes*

**20070000805** State Univ. of New York, Stony Brook, NY USA

**In Situ Studies of Defect Nucleation During the PVT and CVD Growth of Silicon Carbide Single Crystals**

Dudley, Michael; Mar 2006; 4 pp.; In English

Contract(s)/Grant(s): N00014-02-1-1014

Report No.(s): AD-A458217; No Copyright; Avail.: CASI: [A01](#), Hardcopy

A complete chemical vapor deposition (CVD) system for growing SiC epitaxial films and bulk crystals was set up using commercially procured gas flow controls and scrubber units, and integrating them with a modified in-house designed growth chamber that has options for in situ X-ray topographic study. This CVD system uses silicon tetrachloride (SiCl<sub>4</sub>), silane (SiH<sub>4</sub>), propane (C<sub>3</sub>H<sub>8</sub>), hydrogen (H<sub>2</sub>) and argon (Ar) gases. The aggressive SiCl<sub>4</sub> corrosion in the chamber and the gas lines has been investigated and found to be predominantly related to moisture, and this severe problem has been solved by keeping the gas lines and the growth reactor in vacuum or in inert atmosphere when the CVD system is not running.

DTIC

*Crystal Defects; Defects; Nucleation; Silicon Carbides; Single Crystals; Vapor Deposition*

**20070000822** Academy of Sciences (Russia), Chernogolovka, Russian Federation

**International Conference on Low Temperature Chemistry (6th) Held in Chernogolovka, Russia on 27 August - 1 September 2006**

Sep 20, 2006; 117 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-06-1-5008

Report No.(s): AD-A458245; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The Final Proceedings for Sixth International Conference on Low Temperature Chemistry 29 August - 2 September 2006. This conference will cover the following sections: Section 1: Cryosynthesis structure and properties of chemical compounds with unusual chemical bonding. Topics: (a) novel cryogenic media clusters and nanostructures; (b) noble gas containing compounds; (b) active intermediate structures reactivity and spectroscopy. Section 2: Novel reaction pathways in cryogenic solids. Topics: (a) reactions in quantum media: liquids crystals nanodroplets; (b) cooled biomolecules and cryo-pharmacology;

(c) astro- and stratospheric chemistry. Section 3: Quantum phenomena and reaction dynamics. Topics: (a) coherence and ultrafast dynamics; (b) tunneling and transport processes.

DTIC

*Conferences; Low Temperature; Russian Federation*

**20070000825** Air Force Research Lab., Edwards AFB, CA USA

**Correlation of Calculated Halonium Ion Structures with Experimental Product Distributions from Terminal Alkenes: The Effect of Electron-Withdrawing Fluorine Substituents on the Structure and Charge Localization of Halonium Ions (PREPRINT)**

Shellhamer, Dale F; Gleason, David C; Rodriguez, Sean J; Heasley, Victor L; Boatz, Jerry A; Lehman, Jeffrey J; Apr 3, 2006; 24 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A458251; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The structures and charge densities of halonium ions, derived from addition of halogen electrophiles to fluoro-substituted terminal alkenes, were computed using quantum chemical methods. Geometry optimizations were performed at the second-order perturbation theory level (MP2, also known as MBPT(2)), using the Spartan02 program and also at the density functional theory level, using the GAMESS quantum chemistry code with the B3LYP hybrid functional. An additional set of B3LYP calculations incorporating the Polarizable Continuum Model (PCM) to probe methanol solvent effects was also performed. The halonium ions from terminal fluoroalkenes were found to be symmetrical (C), unsymmetrical (B or D), or open-ions described by A or E. These calculated data support experimental product distributions and they can predict the product regiochemistry from halonium ions opened by anions in aprotic solvents or when opened by protic solvents like methanol. Electron-withdrawing alkyl groups tend to decrease the SN1-character of the product-determining ring-opening transition state, and an SN-2-like process occurs which is more susceptible to steric effects.

DTIC

*Alkenes; Fluorine; Halogens; Ions; Position (Location)*

**20070001111** University of Southern California, Los Angeles, CA USA

**Experimental Evidence for Linear Metal-Azide Bonds. The Binary Group 5 Azides Nb(N3)5, Ta(N3)5, [Nb(N3)6]- and [Ta(N3)6]-, and 1:1 Adducts of Nb(N3)5 and [Ta(N3)5 with CH3CN] (POSTPRINT)**

Apr 27, 2006; 7 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A458436; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Adducts; Azides (Inorganic); Azides (Organic); Bonding; Linearity*

**20070001143** Army Communications-Electronics Command, Fort Belvoir, VA USA

**In-Situ Landmine Neutralization by Chemical versus Thermal Initiation Deminer Preferences**

Jan 2006; 7 pp.; In English

Report No.(s): AD-A458418; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Mines (Excavations); Neutralizers; Thermal Emission; Initiation; Chemical Effects*

**20070001145** Defence Science and Technology Organisation, Victoria, Australia

**Vaporous Decontamination Methods: Potential Uses and Research Priorities for Chemical and Biological Contamination Control**

McAnoy, Andrew M; Jun 2006; 22 pp.; In English

Report No.(s): AD-A458291; DSTO-GD-0465; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Vaporous decontamination methods were used in the remediation of anthrax contaminated buildings following the 2001 attacks in the U.S.A. Since then the development of vaporous decontamination methods has received considerable interest with significant advancements in the area of CB decontamination of buildings and sensitive equipment. This document reviews the current state of vaporous decontamination methods, with reference to potential uses in CB contamination control. Common decontaminants considered are; formaldehyde, chlorine dioxide and hydrogen peroxide. The benefit of vaporous hydrogen peroxide is discussed in detail, and areas of research in which DSTO can contribute significantly to an international

collaborative research program into the VHP decontamination process are outlined.

DTIC

*Biological Effects; Contamination; Decontamination; Vapors*

**20070001403** Woodcock Washburn LLP, Philadelphia, PA, USA

**Amino Thiol Compounds and Compositions for Use in Conjunction with Cancer Therapy**

Fahl, W. E.; Peebles, D. D.; Copp, R. R.; 9 Aug 04; 78 pp.; In English

Contract(s)/Grant(s): NIH-CA-22484

Patent Info.: Filed Filed 9 Aug 04; US-Patent-Appl-SN-10-915-089

Report No.(s): PB2007-100932; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The invention provides novel polyamine and amino thiol compounds and pharmaceutical compositions for administration in conjunction with cancer chemotherapy or radiation therapy. The compounds are administered locally to provide protection against the adverse side-effects of chemotherapy or radiation therapy, such as alopecia, mucositis and dermatitis. Pharmaceutical preparations comprising one or more chemoprotective polyamines or amino thiols formulated for topical or local delivery to epithelial or mucosal cells are disclosed. Methods of administering the pharmaceutical preparations are also disclosed.

NTIS

*Amines; Cancer; Patent Applications; Therapy; Thiols*

**20070001404** Smith, Gambrell and Russel, Washington, DC, USA

**Coumarin Compounds as Microtubule Stabilizing Agents and Therapeutic Uses Thereof**

Jacobs, R. S.; Wilson, L.; Madari, H.; 13 Aug 03; 34 pp.; In English

Contract(s)/Grant(s): NOAA-R/MP-81

Patent Info.: Filed Filed 13 Aug 03; US-Patent-Appl-SN-10-639-577

Report No.(s): PB2007-100931; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Compounds and compositions for stabilizing microtubules are disclosed. Also disclosed are methods of inhibiting, preventing, regulating, modulating, attenuating, stabilizing, or affecting microtubule formation or function. Methods of treating, preventing, or inhibiting diseases and disorders associated with microtubule formation, function, or both by administering a microtubule stabilizing agent such as coumarin is also disclosed.

NTIS

*Anhydrides; Esters; Patent Applications; Stabilization; Therapy*

**20070001407** Idaho National Engineering Lab., Idaho Falls, ID, USA

**Underground Corrosion after 32 Years: A Study of Fate and Transport (Annual Report)**

January 2006; 10 pp.; In English

Report No.(s): DE2006-885077; INL/EXT-05-00379; No Copyright; Avail.: National Technical Information Service (NTIS)

Improved estimates for corrosion rates in variably saturated porous media are required by the U.S. Department of Energy to maintain long-term storage of radioactive contaminants in stainless steel containers. To better define these parameters, research was undertaken to complete the National Institute of Standards and Technology's (NIST) long-term study of buried stainless steel began 35 years ago. The 1970 study was initiated by the National Bureau of Standards (NBS), now known as NIST, when over 1000 specimens--including stainless steel Types 201, 202, 301, 304, 316, 409, 410, 430, and 434--configured as plates, U-bend, and tubes in both annealed and cold worked conditions with various treatments--were buried at six distinctive soil-type sites throughout the USA. During the first eight years of the study, four of five planned removals were completed with specimens retrieved after one, two, four, and eight years at each of the six sites. The fifth and final set of specimens remained undisturbed for over 34 years.

NTIS

*Corrosion; Radioactive Wastes; Waste Management*

**20070001413** Los Alamos National Lab., NM USA

**Method and Apparatus for Detecting Chemical Binding**

Waner, B. P.; Havrilla, G. J.; Miller, T. C.; Wells, C. A.; 10 Nov 04; 9 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-36

Patent Info.: Filed 10 Nov 04; US-Patent-Appl-SN-10-086-519

Report No.(s): PB2007-100849; No Copyright; Avail.: CASI: A02, Hardcopy

The method for screening binding between a target binder and potential pharmaceutical chemicals involves sending a solution (preferably an aqueous solution) of the target binder through a conduit to a size exclusion filter, the target binder being too large to pass through the size exclusion filter, and then sending a solution of one or more potential pharmaceutical chemicals (preferably an aqueous solution) through the same conduit to the size exclusion filter after target binder has collected on the filter. The potential pharmaceutical chemicals are small enough to pass through the filter. Afterwards, x-rays are sent from an x-ray source to the size exclusion filter, and if the potential pharmaceutical chemicals form a complex with the target binder, the complex produces an x-ray fluorescence signal having an intensity that indicates that a complex has formed.

NTIS

*Detection; Fluid Flow; Patent Applications*

**20070001641** Houston Univ., TX USA

**Miniaturization Science for Space: Lubrication of Micro-Electro-Mechanical Systems (MEMS) for Space Environments**

Perry, Scott S; Aug 15, 2006; 12 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0113

Report No.(s): AD-A458531; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458531>; Avail.: CASI: A03, Hardcopy

In this study, the vapor phase lubrication of interacting gold surfaces has been investigated on the atomic and molecular level using the quartz crystal microbalance (QCM), atomic force microscopy (AFM) and scanning tunneling microscopy (STM). These techniques have provided a fundamental understanding of the molecular nature of adsorption, adhesion, and current flow occurring at gold interfaces through the formation of self-assembled monolayers (SAMs) of conjugated aromatic thiol molecules. The issues of static adhesion and contact performance have been addressed simultaneously in relation to the nature and composition of the interface. Maps of both current and adhesion demonstrated the potential of using conjugated species with fluorine substituents on the basis of their tribological and electrical behavior as candidates for lubricating Au/Au interfaces in MEMS devices. Although they do not form a closely-packed geometry compared to n-alkanethiol SAMs, they however provide hydrophobic, 'Teflon-like' surfaces which accounts for the observed low adhesion.

DTIC

*Aerospace Environments; Lubrication; Lubrication Systems; Microelectromechanical Systems; Miniaturization; Vapor Phase Lubrication*

**20070001650** Jackson (Henry M.) Foundation, Rockville, MD USA

**Using Human Life Stage PBPK/PD Model Predictions of Perchlorate-Induced Iodide Inhibition to Inform Risk Assessment in Sensitive Populations**

Mattie, David R; Sterner, Teresa R; Merrill, Elaine A; Clewell, Rebecca A; Feb 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-05-2-6518; Proj-7184

Report No.(s): AD-A458548; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458548>; Avail.: CASI: A03, Hardcopy

Iodide inhibition was considered to be the key biochemical event preceding disruption of thyroid hormone homeostasis. The RfD was based on the No Observable Effect Level (NOEL) of 0.007 mg/kg-day, which resulted in no significant iodide inhibition in normal adults. An uncertainty factor of 10 was applied to the NOEL to account for intraspecies variability, including life-stage specific susceptibility. Recently, existing physiologically based pharmacokinetics/pharmacodynamic (PBPK/PD) models across life-stages in rat and in adult human were expanded to describe inhibition kinetics during-perinatal development in humans. Chemical-specific parameters were estimated from life-stage and species-specific relationships established in previously published PBPK/PD models. The human perinatal models successfully simulate literature radioiodide data for gestation and lactation, as well as data from populations exposed to perchlorate contaminated drinking water. These validated models were used to examine the effect of developmental stage on susceptibility to thyroid perturbation across a range of doses. At environmentally relevant doses, the perinatal woman, fetus and nursing infant are predicted to have higher blood perchlorate concentrations and greater thyroid iodide uptake inhibition than either the non-pregnant adult or older child. At exposure levels equal to the NOEL and RfD, the PBPK/PD model predicted iodide inhibition in fetuses is within

normal variation (less than 10%) and insignificant (less than 1%), respectively, indicating that the newly adopted RfD) is in fact protective of the population most sensitive to thyroid inhibition.

DTIC

*Assessments; Iodides; Perchlorates; Populations; Risk; Sensitivity*

**20070001686** Stanford Univ., Stanford, CA USA

**Chalcopyrite and Orientation-Patterned Semiconductors for Mid-IR Sources: Modeling, Growth, and Characterization**

Fejer, M] M M; Giles, N; Ketterson, J; Pandey, R; Kuo, P; Lin, A; Levi, O; Route, R; Vodopyanov, K; Nov 2006; 34 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0428

Report No.(s): AD-A458616; SPO-24498; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458616>; Avail.: CASI: A03, Hardcopy

The goal of this MURI was to advance the technology in chalcopyrite and microstructured zincblende semiconductors, and to demonstrate devices based on them. The program involved modeling, synthesis, characterization, and device demonstration. Research was focused on, (1) nonlinear chalcopyrites and microstructured zincblende crystals for applications to mid-infrared coherent sources, and (2) magnetic chalcopyrites for future application to spintronic and magneto-optic devices. We sought to enable applications such as compact high-power mid-IR sources for IRCM, and frequency-agile sources suitable for local and remote sensing of chemical and biological species. Research involved: (a) growth and characterization of orientation-patterned GaAs (OP-GaAs), a novel microstructured material with precisely engineerable properties for a wide variety of mid-infrared devices, (b) demonstration of mid-IR sources based on these materials, and their use in applications such as trace-gas detection, (c) understanding and ameliorating the effects of point defects and dislocations on the properties of established nonlinear chalcopyrites such as ZnGeP<sub>2</sub>, and enabling the use of extremely promising but previously impractical materials such as CdGeAs<sub>2</sub>, (d) pushing beyond microstructured into nanostructured GaAs nonlinear devices, a more speculative approach offering orders-of-magnitude improvements in device performance. For the magnetic chalcopyrites, the goal was synthesis of bulk and thin-film ferromagnetic semiconductors with Curie points above room temperature, and characterization of their magnetic and transport properties.

DTIC

*Characterization; Gallium Arsenides; Infrared Radiation; Magneto-Optics; Optical Properties; Semiconductors (Materials)*

**20070001710** Geological Survey, Reston, VA USA

**Chemical Analyses of Stream Sediment in the Tar Creek Basin of the Picher Mining Area, Northeast Oklahoma**

Parkhurst, David L; Doughten, Michael; Hearn, Paul P; Jan 1988; 25 pp.; In English

Report No.(s): AD-A458652; OFR-88-469; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458652>; Avail.: Defense Technical Information Center (DTIC)

Chemical analyses are presented for 47 sediment samples from the Tar Creek drainage in the Picher mining area of northeast Oklahoma. The samples were taken in December 1983, June 1984, and June 1985. All of the samples were taken downstream from mine-water discharge points of abandoned lead and zinc mines. The 34 samples taken in December 1983 and June 1984 were analyzed semiquantitatively by emission spectrography for 64 elements and quantitatively for cadmium, copper, iron manganese, molybdenum, nickel, phosphorus, lead, sulfur, silicon, titanium, vanadium, zinc, and organic carbon.

DTIC

*Chemical Analysis; Mining; Oklahoma; Sediments; Streams; Tars*

**20070001734** California State Coll., Long Beach, CA USA

**The Distribution of Transport Current in YBCO Coated Conductor With Zipper Striations**

Wang, L B; Selby, P; Khanal, C; Levin, George; Haugan, Timothy J; Barnes, Paul N; Kwon, C; Oct 2004; 6 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0493; Proj-3145

Report No.(s): AD-A458681; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458681>; Avail.: CASI: A02, Hardcopy

An YBCO coated conductor with a zipper pattern striation is investigated by scanning laser microscopy (SLM). The distribution of transport current deduced from the VTSLM images shows that striations act as artificial barriers forcing the current to flow around them. Current sharing and redistribution are observed at the zipper area. We find the major dissipation mechanism in the sample in the superconducting state to be the current crowding at bottleneck areas. The bottleneck seems



to be caused by the disabled filaments at and around the zipper area. Some filaments show the dissipation away from the zipper area. In general, we find that the lower  $J_c$  areas have lower  $T_c$  and high  $\delta V_m$ , which we consider as a sign of the current crowding. For the first time, we have demonstrated that there is a high temperature signature of the lower  $J_c$  (high dissipation) area and VTSLM can detect the signature.

DTIC

*Coatings; Conductors; Critical Current; Current Density; Microscopy; Striation; Superconductors (Materials); YBCO Superconductors; Zippers*

**20070001859** Army Engineer Research and Development Center, Vicksburg, MS USA

**Distribution and Fate of Energetics on DoD Test and Training Ranges: Interim Report 6**

Pennington, J C; Jenkins, T F; Ampleman, G; Thiboutot, S; Hewitt, A D; Brochu, S; Robb, J; Diaz, E; Lewis, J; Colby, H; Martel, R; Poe, K; Groff, K; Bjella, K L; Ramsey, C A; Hayes, C A; Yost, S; Marois, A; Gagnon, A; Silverblatt, B; Nov 2006; 308 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458384; ERDC-TR-06-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Understanding the potential for generation and transport of residual explosives is necessary to sustain live-fire training ranges. The objective of this study was to characterize the distribution and fate of explosive residues from various training activities. The physical and chemical properties, concentrations, and distribution of residues in soils, and the potential for transport to groundwater were defined. Surface soils associated with impact craters, target areas, and firing points on U.S. and Canadian ranges were characterized. Residues from high-order, low-order, and blow-in-place detonations were described and quantified. Parameters suitable for use in fate and transport models and environmental risk assessments were determined for constituents of concern. Results demonstrated that residues are specific to range activities. Demolition areas, low-order detonations sites, and firing positions have great potential for accumulation of residues. Demolition typically generates small areas of relatively high concentrations. Low-order detonations generate primarily large solid particles reflecting the composition of the predetonation explosive. Artillery and mortar impact areas tend to have low concentrations of widely distributed constituents. Firing positions may exhibit high concentrations of propellants. Results of this study provide a realistic evaluation of training range residues and a scientific basis for development of control measures for explosives residues.

DTIC

*Detonation; Education; Explosives; Propellants; Transport Properties*

**20070001891** California State Univ., Northridge, CA USA

**Observation of Nonuniform Current Transport in Epitaxial YBa<sub>2</sub>Cu<sub>3</sub>O<sub>(7-x)</sub> Film Near the Superconducting Transition Temperature**

Wang, L B; Price, M B; Young, J L; Kwon, C; Haugan, Timothy J; Barnes, Paul N; Dec 2004; 7 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0493; Proj-3145

Report No.(s): AD-A458784; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We have studied the local transport properties in an epitaxial YBa<sub>2</sub>Cu<sub>3</sub>O<sub>(7-x)</sub> (YBCO) film on LaAlO<sub>3</sub> (LAO) using variable temperature scanning laser microscope (VTSLM) near the superconducting transition. A map of the superconducting transition temperature ( $T_c$ ) is generated from a series of VTSLM images. The map of  $T_c$  indicates there are inhomogeneities in the film large enough to create nonuniform current flow near the superconducting transition. The evaluated  $T_c$  varies between 90.3 and 91.0 K in the film. Even though such change in  $T_c$  is not large enough to be detected by other localized compositional and structural characterization techniques, this along with an area of lower  $T_c$  and/or higher resistance affects current flow near the superconducting transition temperature as shown in VTSLM images. This inhomogeneity may be caused by slight variations of the stoichiometry and/or oxidation of the YBCO film.

DTIC

*Epitaxy; Inhomogeneity; Laser Microscopy; Microscopes; Superconductivity; Transition Temperature; YBCO Superconductors*

**20070001913** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Addition of Nanoparticle Dispersions to Enhance Flux Pinning of the YBa<sub>2</sub>Cu<sub>3</sub>O<sub>(7-x)</sub> Superconductor**

Haugan, T; Barnes, P N; Wheeler, R; Meisenkothen, F; Sumption, M; Aug 2004; 6 pp.; In English

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

Report No.(s): AD-A458885; No Copyright; Avail.: Defense Technical Information Center (DTIC)

After the discovery of type-II HTS, focus is to develop these materials for power applications. One of the problems has been that magnetic flux is not completely expelled but rather contained within magnetic fluxons, whose motion stops larger supercurrents. It's known that the critical current of these materials can be enhanced by incorporating a high density of extended defects to act as pinning centres for the fluxons. YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> (YBCO or 123) is the most promising material for such applications at higher temperatures. Pinning is optimized when the size of the defects approaches the superconducting coherence length (~2-4nm for YBCO at temperatures ≤ 77 K) and when the areal number density of defects is of the order of (H/2) x 10<sup>11</sup> cm<sup>-2</sup>, where H is the applied magnetic field in tesla. Such a high density has been hard to get by material-processing methods that keep a nanosize defect, except through irradiation. Here we report a method for achieving a dispersion of ~8-nm-sized nanoparticles in YBCO with a high number density, which increases critical current (at 77 K) by a factor of two to three for high magnetic fields.

DTIC

*Flux Pinning; Nanoparticles; Superconductors (Materials); YBCO Superconductors*

**20070002043** Central Coast Patent Agency, Aromas, CA, USA

**Method and Apparatus for Providing and Integrating a General Metal Delivery Source (GMDS) with Atomic Layer Deposition (ALD)**

Sneh, O.; 15 Dec 04; 11 pp.; In English

Contract(s)/Grant(s): ASMD-C-F33615-99-C-2961

Patent Info.: Filed 15 Dec 04; US-Patent-Appl-SN-11-014-104

Report No.(s): PB2007-100936; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A General Metal Delivery Source (GMDS) for delivery of volatile metal compounds in gaseous form to processing apparatus has a reaction chamber holding a solid metal source material and connecting to the processing apparatus, and having an outlet for provision of the volatile compounds, a source heater coupled to the reaction chamber for heating said solid source material, a gas source for providing a reactive gas, a gas delivery conduit from the gas source to the reaction chamber; and a plasma generation apparatus coupled to the gas delivery conduit. The plasma generation apparatus dissociates reactive gas molecules providing monatomic reactive species to the reaction chamber, and the monatomic reactive species combine with metal from the heated solid metal source material forming the volatile metal compounds

NTIS

*Atoms; Deposition; Patent Applications*

**20070002061** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Protein Crystallization Using Room Temperature Ionic Fluids**

Pusey, Marc L.; Paley, Mark Steve; Turner, Megan B.; Rogers, Robin D.; [2006]; 2 pp.; In English

Contract(s)/Grant(s): GM071581-01; No Copyright; Avail.: Other Sources; Abstract Only

The ionic liquids (ILs) 1-butyl-3-methylimidazolium chloride (C<sub>4</sub>mim-C1), 1-butyl-3-methylimidazolium diethyleneglycol monomethylethersulfate ([C<sub>4</sub>mim]DEMGS), and 1-butyl-1-methylpyrrolidinium dihydrogenphosphate ([p1,4]dhp) were tested for their effects on the crystallization of the proteins canavalin, beta-lactoglobulin B, xylanase, and glucose isomerase, using a standard high throughput screen. The crystallization experiments were set up with the ILs added to the protein solutions at 0.2 and 0.4 M final concentrations. Crystallization droplets were set up at three proteixprecipitant ratios (1:1, 2:1, and 4:1), which served to progressively dilute the effects of the screen components while increasing the equilibrium protein and IL concentrations. Crystals were obtained for all four proteins at a number of conditions where they were not obtained from the IL-free control experiment. Over half of the protein-IL combinations tested had more successful outcomes than negative, where the IL-free crystallization was better than the corresponding IL-containing outcome, relative to the control. One of the most common causes of a negative outcome was solubilization of the protein by the IL, resulting in a clear drop. In one instance, we were able to use the IL-induced solubilizing to obtain beta-lactoglobulin B crystals from conditions that gave precipitated protein in the absence of IL. The results suggest that it may be feasible to develop ILs specifically for the task of macromolecule crystallization.

Author

*Liquids; Protein Crystal Growth; Room Temperature; Salts; Organic Chemistry*

**20070002087** Air Force Research Lab., Edwards AFB, CA USA

**Chemical Modification of Fluorinated Polyimides: New Thermally Curing Hybrid-Polymers With POSS (PREPRINT)**

Mar 15, 2006; 33 pp.; In English

Report No.(s): AD-A458338; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Curing; Polymers; Imides; Revisions*

**26**

**METALS AND METALLIC MATERIALS**

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

**20070000014** Powdermet, Inc., Euclid, OH, USA

**Oxide Dispersion Strengthened Iron Aluminide by CVD Coated Powders**

Biswas, A.; Sherman, A. J.; January 2006; 72 pp.; In English

Report No.(s): DE2006-891910; No Copyright; Avail.: National Technical Information Service (NTIS)

This program developed chemical vapor deposition (CVD) of iron, aluminum and aluminum oxide coated iron powders and the availability of high temperature oxidation, corrosion and erosion resistant coating for future power generation equipment and can be used for retrofitting existing fossil-fired power plant equipment. This coating will provide enhanced life and performance of Coal-Fired Boilers components such as fire side corrosion on the outer diameter (OD) of the water wall and superheater tubing as well as on the inner diameter (ID) and OD of larger diameter headers. The program also developed a manufacturing route for readily available thermal spray powders for iron aluminide coating and fabrication of net shape component by powder metallurgy route using this CVD coated powders.

NTIS

*Aluminides; Iron Alloys; Iron Aluminides; Metal Coatings; Oxidation; Oxide Dispersion Strengthening; Powder (Particles); Powder Metallurgy; Vapor Deposition*

**20070000020** Westinghouse Savannah River Co., Aiken, SC, USA

**Evaluation of Internal Brushing on Pinch Weld Quality**

Korinko, P. S.; Dec. 2005; 35 pp.; In English

Report No.(s): DE2006-891768; WSRC-TR-2005-00436; No Copyright; Avail.: Department of Energy Information Bridge

Post machining operations such as borescope inspection can cause linear indications down the length of the bore of fill stems. Often these indications are removed or obscured using rotary wire brushing. This study evaluated the effect this mechanical operation may have on pinch weld quality when relatively cold welds were made. A total of four stems with two levels of brushing of both Type 304L and 21-6-9 stainless steels were tested. In addition, two each of the Type 304L stems were Nitradd cleaned and the other two were aqueously cleaned; all four 21-6-9 stems were aqueously cleaned. All of the brushed stem areas exhibited more surface anomalies based on borescope evaluation. On average, the bond rating was a higher value (worse) for the brushed areas than the unadulterated areas for both Type 304L and 21-6-9 stems. The test method used may have biased the results towards a lesser quality bond for the brushed areas so additional testing is recommended.

NTIS

*Stainless Steels; Weld Strength; Welded Joints; Quality Control; Inspection*

**20070000472** International Trade Commission, Washington, DC USA

**Malleable Iron Pipe Fittings from China. Investigation No. 731-TA-1021 (Final)**

Dec. 2003; 88 pp.; In English

Report No.(s): PB2007-101181; USITC/PUB-3649; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The U.S. International Trade Commission (ITC) today determined that revoking the existing antidumping duty orders on malleable cast iron pipe fittings from Japan and Korea would be likely to lead to continuation or recurrence of material injury within a reasonably foreseeable time, but that revoking the existing antidumping duty orders on imports of these products from Brazil, Taiwan, and Thailand would not be likely to lead to continuation or recurrence of material injury within a reasonably foreseeable time. As a result of the Commission's determinations and the Department of Commerce's recent affirmative findings, the existing antidumping duty orders on imports of this product from Japan and Korea will remain in place, and the

existing antidumping duty orders on imports of this product from Brazil, Taiwan, and Thailand will be revoked.

NTIS

*Brazil; Cast Alloys; China; Fittings; International Trade; Iron; Iron Alloys; Japan; Korea; Malleability; Taiwan; Thailand; Pipes (Tubes)*

**20070000474** International Trade Commission, Washington, DC USA

**Forged Stainless Steel Flanges from India and Taiwan. Investigation Nos. 731-TA-639 and 640 (Second Review)**

Dec. 2005; 103 pp.; In English

Report No.(s): PB2007-101192; USITC/PUB-3827; No Copyright; Avail.: CASI: [A06](#), Hardcopy

On the basis of the record developed in the subject five-year reviews, the USA International Trade Commission (Commission) determines, pursuant to section 751(c) of the Tariff Act of 1930 (19 U.S.C. SC 1675(c)) (the Act), that revocation of the antidumping duty orders on forged stainless steel flanges from India and Taiwan would be likely to lead to continuation or recurrence of material injury to an industry in the USA within a reasonably foreseeable time.

NTIS

*Flanges; India; International Trade; Stainless Steels; Taiwan*

**20070000484** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Processing of Refractory Metal Alloys for JOYO Irradiations**

Feb. 21, 2006; 102 pp.; In English

Report No.(s): DE2006-884676; No Copyright; Avail.: Department of Energy Information Bridge

This is a summary of the refractory metal processing experienced by candidate Prometheus materials as they were fabricated into specimens destined for testing within the JOYO test reactor, ex-reactor testing at Oak Ridge National Laboratory (ORNL), or testing within the NRPCT. The processing is described for each alloy from the point of inception to the point where processing was terminated due to the cancellation of Naval Reactor's involvement in the Prometheus Project. The alloys included three tantalum-base alloys (T-111, Ta-10W, and ASTAR-811C), a niobium-base alloy, (FS-85), and two molybdenum-rhenium alloys, one containing 44.5 w/o rhenium, and the other 47.5 w/o rhenium. Each of these alloys was either a primary candidate or back-up candidate for cladding and structural applications within the space reactor. Their production was intended to serve as a forerunner for large scale production ingots that were to be procured from commercial refractory metal vendors such as Wah Chang.

NTIS

*Irradiation; Niobium Alloys; Refractory Metal Alloys; Rhenium*

**20070000487** E3M, Inc., North Potomac, MD, USA

**Development of Next Generation Heating System for Scale Free Steel Reheating**

Aug. 2006; 73 pp.; In English

Report No.(s): DE2006-891950; No Copyright; Avail.: National Technical Information Service (NTIS)

The primary objective of this program is to develop and test a scale free heating system that reduces scale formation in the steel reheating process, resulting in a substantial reduction in energy use, improvement in steel quality, and significant cost advantages for the U.S. steel industry. The program is divided in two phases. This report describes work performed, results, and conclusions for Phase I with recommendations for Phase II work to achieve the objectives and goals of the program.

NTIS

*Heating; Steels*

**20070000498** International Trade Commission, Washington, DC USA

**Grain-Oriented Silicon Electrical Steel from Italy and Japan. Investigations Nos. 701-TA-355 (Review) (Second Remand) and 731-TA-659-660 (Review) (Second Remand)**

Mar. 2004; 78 pp.; In English

Report No.(s): PB2007-101176; USITC/PUB-3680; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The Uruguay Round Agreements Act requires the Department of Commerce to revoke an antidumping or countervailing duty order, or terminate a suspension agreement, after five years unless the Department of Commerce and the ITC determine that revoking the order or terminating the suspension agreement would be likely to lead to continuation or recurrence of dumping or subsidies (Commerce) and of material injury (ITC) within a reasonably foreseeable time. The Commission's institution notice in five-year reviews requests that interested parties file responses with the Commission concerning the likely

effects of revoking the order under review as well as other information. Generally within 95 days from institution, the Commission will determine whether the responses it has received reflect an adequate or inadequate level of interest in a full review. If responses to the ITC's notice of institution are adequate, or if other circumstances warrant a full review, the Commission conducts a full review, which includes a public hearing and issuance of questionnaires. The Commission generally does not hold a hearing or conduct further investigative activities in expedited reviews. Commissioners base their injury determination in expedited reviews on the facts available, including the Commission's prior injury determination, responses received to its notice of institution, data collected by staff in connection with the review, and information provided by the Department of Commerce. The five-year (sunset) reviews concerning Grain-Oriented Silicon Electrical Steel from Italy and Japan were instituted on December 1, 1999.

NTIS

*Industries; Iron; Italy; Japan; Silicon; Steels*

**20070000501** International Trade Commission, Washington, DC USA  
**Certain Iron Construction Castings from Brazil, Canada, and China. Investigation Nos. 701-TA-249 and 731-TA-262, 263, and 265. (Second Review)**

Jun. 2005; 69 pp.; In English

Report No.(s): PB2007-101169; USITC/PUB-3781; No Copyright; Avail.: CASI: [A04](#), Hardcopy

On the basis of the record developed in the subject five-year review, the USA International Trade Commission (Commission) determines, pursuant to section 751(c) of the Tariff Act of 1930 (19 U.S.C. SC1675(c)) (the Act), that revocation of the countervailing duty order on heavy iron construction castings from Brazil would be likely to lead to continuation or recurrence of material injury to an industry in the USA within a reasonably foreseeable time. The Commission also determines that revocation of the antidumping duty order on heavy iron construction castings from Canada would be likely to lead to continuation or recurrence of material injury to an industry in the USA within a reasonably foreseeable time. The Commission further determines that revocation of the antidumping duty orders on iron construction castings (both heavy and light) from Brazil and China would be likely to lead to continuation or recurrence of material injury to an industry in the USA within a reasonably foreseeable time.

NTIS

*Brazil; Canada; Castings; China; Construction; International Trade; Iron; Iron Alloys*

**20070000505** Bettis Atomic Power Lab., West Mifflin, PA, USA  
**Summary of Dissimilar Metal Joining Trials Conducted by Edison Welding Institute**

Lambert, M. J.; Nov. 18, 2005; 82 pp.; In English

Report No.(s): DE2006-884671; No Copyright; Avail.: Department of Energy Information Bridge

Under the direction of the NASA-Glenn Research Center, the Edison Welding Institute (EWI) in Columbus, OH performed a series of non-fusion joining experiments to determine the feasibility of joining refractory metals or refractory metal alloys to Ni-based superalloys. Results, as reported by EWI, can be found in the project report for EWI Project 48819GTH (Attachment A, at the end of this document), dated October 10, 2005. The three joining methods used in this investigation were inertia welding, magnetic pulse welding, and electro-spark deposition joining. Five materials were used in these experiments: Mo-47Re, T-111, Hastelloy X, Mar M-247 (coarse-grained, 0.5 mm to several millimeter average grain size), and Mar M-247 (fine-grained, approximately 50 (micro)m average grain size). Several iterative trials of each material combination with each joining method were performed to determine the best practice joining method. Mo-47Re was found to be joined easily to Hastelloy X via inertia welding, but inertia welding of the Mo-alloy to both Mar M-247 alloys resulted in inconsistent joint strength and large reaction layers between the two metals. T-111 was found to join well to Hastelloy X and coarse-grained Mar M-247 via inertia welding, but joining to fine-grained Mar M-247 resulted in low joint strength. Magnetic pulse welding (MPW) was only successful in joining T-111 tubing to Hastelloy X bar stock. The joint integrity and reaction layer between the metals were found to be acceptable. This single joining trial, however, caused damage to the electromagnetic concentrators used in this process. Subsequent design efforts to eliminate the problem resulted in a loss of power imparted to the accelerating work piece, and results could not be reproduced. Welding trials of Mar M-247 to T-111 resulted in catastrophic failure of the bar stock, even at lower power. Electro-spark deposition joining of Mo-47Re, in which the deposited material was Hastelloy X, did not have a noticeable reaction layer. T-111 was found to have a small reaction layer at the interface with deposited Hastelloy X. Mar M-247 had a reaction layer larger than T-111. Hastelloy X joined well with a substrate of the same alloy, and throughout the experiments was found to have a density of (approx)99%, based on metallographic observations of porosity in the deposit. Of the three joining methods tested, inertial welding of bar stock appears to be the most mature at this time. MPW may be an attractive alternative due to the potential for high bond integrity,

similar to that seen in explosion bonding. However, all three joining methods used in this work will require adaptation in order to join piping and tubing. Further investigations into the change in mechanical properties of these joints with time, temperature, irradiation, and the use of interlayers between the two materials must also be performed.

NTIS

*Bonding; Heat Resistant Alloys; Metal Bonding; Welding*

**20070000507** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Closeout of JOYO-1 Sement Fabrication Efforts**

Petrichek, M. E.; Bump, J. L.; Luther, R. F.; Oct. 31, 2005; 18 pp.; In English

Report No.(s): DE2006-884673; No Copyright; Avail.: Department of Energy Information Bridge

Fabrication was well under way for the JOYO biaxial creep and tensile specimens when the NR Space program was canceled. Tubes of FS-85, ASTAR-811C, and T-111 for biaxial creep specimens had been drawn at True Tube (Paso Robles, CA), while tubes of Mo-47.5 Re were being drawn at Rhenium Alloys (Cleveland, OH). The Mo-47.5 Re tubes are now approximately 95% complete. Their fabrication and the quantities produced will be documented at a later date. End cap material for FS-85, ASTAR-811C, and T-111 had been swaged at Pittsburgh Materials Technology, Inc. (PMTI) (Large, PA) and machined at Vangura (Clairton, PA). Cutting of tubes, pickling, annealing, and laser engraving were in process at PMTI. Several biaxial creep specimen sets of FS-85, ASTAR-811C, and T-111 had already been sent to Pacific Northwest National Laboratory (PNNL) for weld development. In addition, tensile specimens of FS-85, ASTAR-811C, T-111, and Mo-47.5 Re had been machined at Kin-Tech (North Huntingdon, PA). Actual machining of the other specimen types had not been initiated. Flowcharts 1-3 detail the major processing steps each piece of material has experienced. A more detailed description of processing will be provided in a separate document (B-MT(SRME)-51).

NTIS

*Annealing; Fabrication; Lasers; Rhenium Alloys*

**20070000508** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Biaxial Creep Specimen Fabrication**

Bump, J. L.; Luther, R. F.; Feb. 09, 2006; 232 pp.; In English

Report No.(s): DE2006-884675; No Copyright; Avail.: National Technical Information Service (NTIS)

This report documents the results of the weld development and abbreviated weld qualification efforts performed by Pacific Northwest National Laboratory (PNNL) for refractory metal and superalloy biaxial creep specimens. Biaxial creep specimens were to be assembled, electron beam welded, laser-seal welded, and pressurized at PNNL for both in-pile (JOYO reactor, O-arai, Japan) and out-of-pile creep testing. The objective of this test campaign was to evaluate the creep behavior of primary cladding and structural alloys under consideration for the Prometheus space reactor. PNNL successfully developed electron beam weld parameters for six of these materials prior to the termination of the Naval Reactors program effort to deliver a space reactor for Project Prometheus. These materials were FS-85, ASTAR-811C, T-111, Alloy 617, Haynes 230, and Nirnonic PE16. Early termination of the NR space program precluded the development of laser welding parameters for post-pressurization seal weldments.

NTIS

*Creep Properties; Fabrication; Welding*

**20070000514** California Univ., Los Angeles, CA, USA

**Evolution of Ni(sub 3) Precipitation Kinetics, Morphology and Spatial Correlations in Binary Ni-X Alloys Aged Under Externally Applied Stress**

Jan. 31, 2006; 20 pp.; In English

Report No.(s): DE2006-875895; No Copyright; Avail.: Department of Energy Information Bridge

Experiments were performed on cylindrically symmetric specimens with the axis of the applied compressive stress parallel to (100). The geometries employed included doubly tapered (DT) specimens approx. 10 mm long with diameters varying from approx. 3 to 6 mm and right cylindrical (RC) specimens approx. 4 mm in diameter and approx. 3 mm in length. The DT geometry was chosen because microstructural evolution under stress could be investigated without requiring a unique specimen for each stress. We chose to vary the diameter of the cross section by factor of approximately 2, so that the stress varied by about factor of 4. The experiments on the RC specimens were done, in part, to evaluate the possible effects of the stress gradient that is always present in the DT samples. The state of stress is multiaxial near the periphery of the DT specimens, but the microstructures were examined near the axis of each specimen where the stress is uniaxial. A single crystal

Ni-Al alloy approx. 25 mm in diameter and 80 mm long, grown by the Bridgman method, was purchased from Alloy Preparation Facility of the Ames Laboratory. The nominal composition of the alloy was 13.36 at. % Al, but during solidification some variation of the Al concentration along the entire length of the bulk crystal is inevitable.

NTIS

*Binary Alloys; Correlation; Kinetics; Morphology; Nickel Alloys*

**20070000770** Dayton Univ. Research Inst., OH USA

**Challenges in Detecting Damage in the Presence of Microstructural Inhomogeneities in a Friction Stir Welded Aluminum Alloy for Reusable Cryotanks (Preprint)**

Sathish, Shamachary; Jata, Kumar V; Martin, Richard W; Reibel, Richard; Mar 2006; 12 pp.; In English

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

Report No.(s): AD-A458158; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Continuous real time structural health monitoring will be a requirement for future space launch missions. Reusable metallic cryotanks manufactured using Friction Stir Welding (FSW) technology for multiple missions, demands weld and microstructural integrity. The FS weld contains multiple interfaces and a variety of microstructures. To develop NDE-based health monitoring capability which detects damage and monitors the progression of damage, in the presence of these microstructural inhomogeneities, is a challenging task. Most structural health monitoring techniques are based on acoustic wave propagation. To design and develop efficient and optimized health monitoring capability based on acoustics, it is necessary to incorporate local elastic property variations that arise due to differences in the weld microstructure. These local elastic property changes across FSW regions have been measured using a focused acoustic beam. Measurements across the weld line show variations with a maximum change of 1% in the sound velocities. Macroscopic measurements of velocity of surface acoustic waves propagating across and also parallel the weld line in a large plate show significant variation. Experimental results of local and macroscopic sound velocity measurements from the changing microstructure along with their impact on the design of structural health monitoring system are discussed.

DTIC

*Aluminum Alloys; Damage; Detection; Detectors; Friction Stir Welding; Microstructure; Welding*

**20070000773** Air Force Research Lab., Wright-Patterson AFB, OH USA

**A Life Prediction Approach for Reliable Improvement in Utilization Potential of P/M Nickel-Based Superalloy Components (Preprint)**

Jha, Sushant K; Caton, Michael J; Porter, III, William J; Li, Kezhong; Larsen, James M; Rosenberger, Andrew H; Feb 2006; 14 pp.; In English

Contract(s)/Grant(s): Proj-M02R

Report No.(s): AD-A458164; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The fatigue variability behavior of a powder processed nickel-based superalloy, IN-100 was studied and is discussed with respect to the design life prediction. We found that the stress level, and other loading variables produce distinct effects on the mean behavior and the life-limiting (or the worst-case) behavior. This was because; while the mean was dominated by the conventionally expected fatigue response to these variables the life-limiting behavior was controlled by a different mechanism. Therefore, the total uncertainty in lifetime at given stress level was due to superposition of variability associated with the worst-case and the long-life mechanisms such that, their mean lifetimes separated with decreasing stress level causing an increase in the total variability. Furthermore, the uncertainty in the worst-case mechanism was controlled by the variability in small + long crack growth from the relevant microstructural size scale. In the present IN-100 material, this behavior was found to be related to the number density of constituent particles vs. that of voids and the sequence of selection of the failure mechanisms. Based on this, and our study on other turbine engine materials, we propose an alternate life prediction methodology that has the potential of significantly reducing the uncertainty associated with the traditional approach. The results are discussed with reference to our earlier work on a different nickel-based superalloy with a relatively larger  $\gamma$  grain size that showed a similar fatigue variability behavior but caused both, due to the crystallographic initiation as well as the non-metallic particle initiated failures.

DTIC

*Heat Resistant Alloys; Life (Durability); Nickel Alloys; Predictions*

**20070000780** Missouri Univ., Rolla, MO USA

**Automatic Gap Detection in Friction Stir Welding Processes (Preprint)**

Yang, Yu; Kalya, Prabhanjana; Landers, Robert G; Krishnamurthy, K; Feb 2006; 23 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2865

Report No.(s): AD-A458171; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A common issue that arises when welding two plates is when a gap exists between the plates. This gap may be due to improper fixturing, imprecision in the processes used to manufacture the plates, etc. This paper develops a monitoring algorithm to detect gaps in Friction Stir Welding (FSW) processes. Experimental studies are conducted to determine how the process parameters and the gap width affect the welding process; particularly, the plunge force. The proposed monitoring algorithm examines the filtered plunge force in the frequency domain to determine the presence of gaps in FSW processes reliably.

DTIC

*Algorithms; Detection; Friction Stir Welding*

**20070000791** Missouri Univ., Rolla, MO USA

**Automated Slicing for a Multi-Axis Metal Deposition System (Preprint)**

Ruan, Jianzhong; Sparks, Todd E; Panackal, Ajay; Eiamsa-ard, Kunnayut; Liou, F W; Slattery, Kevin; Chou, Hsin-Nan; Kinsella, Mary; Mar 2006; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2510

Report No.(s): AD-A458187; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A multi-axis adaptive slicing algorithm for multi-axis layered manufacturing which can generate optimal slices to achieve deposition without support structures is presented in this paper. Different from current adaptive slicing, this technique varies not only layer thickness but also in slicing/building direction. Aware of potential problems of previous research on slicing, the work in this paper focuses on innovative geometry reasoning and analysis tool-centroidal axis. Similar to medial axis, it contains geometry and topological information but is significantly computationally cheaper. Using a centroidal axis as a guide, the multi-axis slicing procedure is able to generate a '3-D' layer or change slicing direction as needed automatically to build the part with better surface quality. This paper presents various examples to demonstrate the feasibility and advantages of centroidal axis and its usage in the multi-axis slicing process.

DTIC

*Computer Aided Manufacturing; Metallizing; Slicing*

**20070001144** International Trade Commission, Washington, DC USA

**Certain Stainless Steel Plate from Belgium, Canada, Italy, Korea, South Africa, and Taiwan. Investigation Nos. 701-TA-376, 377, and 379, and 731-TA-793 (Review)**

Jun. 2005; 230 pp.; In English

Report No.(s): PB2007-101229; USITC/PUB-3784; No Copyright; Avail.: CASI: [A11](#), Hardcopy

The USA International Trade Commission (ITC) made its final phase countervailing duty and antidumping duty determinations regarding imports of certain stainless steel plate in coils from Belgium, Canada, Italy, Korea, South Africa, and Taiwan. The Commission found two like products in these investigations: cold-rolled stainless steel plate in coils and hot-rolled stainless steel plate in coils. The Commission made affirmative determinations that an industry in the USA is materially injured by reason of imports of hot-rolled stainless steel plate in coils from Belgium, Canada, Italy, Korea, South Africa, and Taiwan that the Department of Commerce has determined are sold in the USA at less than fair value, and those from Belgium, Italy, and South Africa that the Department of Commerce has determined are also subsidized.

NTIS

*Belgium; Canada; International Trade; Italy; Korea; Metal Plates; Republic of South Africa; Stainless Steels; Steels; Taiwan*

**20070001147** International Trade Commission, Washington, DC USA

**Cut-to-Length Carbon Steel Plate from China, Russia, South Africa, and Ukraine. Investigations Nos. 731-TA-753-756 (Review)**

Sep. 2003; 200 pp.; In English

Report No.(s): PB2007-101227; USITC/PUB-3626; No Copyright; Avail.: CASI: [A09](#), Hardcopy

The U.S. International Trade Commission (ITC) determined that terminating the suspended investigations on cut-to-length carbon steel plate from China, Russia, and Ukraine would be likely to lead to continuation or recurrence of material



injury within a reasonably foreseeable time, but that terminating the suspended investigation on cut-to-length carbon steel plate from South Africa would not. As a result of the Commission's affirmative determinations and the Department of Commerce's recent affirmative findings, the suspension agreements on cut-to-length carbon steel plate from China, Russia, and Ukraine will remain in place. As a result of the Commission's negative determination, the suspension agreement on cut-to-length carbon steel plate from South Africa will not remain in effect.

NTIS

*Carbon Steels; China; Cutting; International Trade; Metal Plates; Republic of South Africa; Russian Federation; Steels; Ukraine*

**20070001557** International Trade Commission, Washington, DC USA

**Certain Aluminum Plate from South Africa. Investigation No. 731-TA-1056 (Preliminary)**

Dec. 2003; 92 pp.; In English

Report No.(s): PB2007-101185; USITC/PUB-3654; No Copyright; Avail.: CASI: [A05](#), Hardcopy

On the basis of the record developed in the subject investigation, the USA International Trade Commission determines that there is a reasonable indication that an industry in the USA is materially injured by reason of imports from South Africa of certain aluminum plate, provided for in the Harmonized Tariff Schedule of the USA, that are alleged to be sold in the USA at less than fair value (LTFV).

NTIS

*Aluminum; Republic of South Africa*

**20070001579** Northwestern Univ., Evanston, IL USA

**Ultratough High-Strength Weldable Plate Steel**

Saha, A.; Olson, G. B.; 12 Nov 04; 80 pp.; In English

Contract(s)/Grant(s): ONR-N00014-01-10953

Patent Info.: Filed Filed 12 Nov 04; US-Patent-Appl-SN-10-987-878

Report No.(s): PB2007-103781; No Copyright; Avail.: CASI: [A05](#), Hardcopy

A transformation toughened, high-strength steel alloy useful in plate steel applications achieves extreme fracture toughness (C.sub.v\g80 ft-lbs corresponding to K.sub(Id) greater than or equal to 200 ksi.in.sup.1/2) at strength levels of 150-180 ksi yield strength, is weldable and formable. The alloy is characterized by dispersed austenite stabilization for transformation toughening to a weldable, bainitic plate steel and is strengthened by precipitation of M.sub.2C carbides in combination with copper and nickel. The desired microstructure is a matrix containing a bainite-martensite mix, BCC copper and M.sub.2C carbide particles for strengthening with a fine dispersion of optimum stability austenite for transformation toughening. The bainite-martensite mix is formed by air-cooling from solution treatment temperature and subsequent aging at secondary hardening temperatures to precipitate the toughening and strengthening dispersions.

NTIS

*High Strength Steels; Patent Applications; Weldability*

**20070001581** International Trade Commission, Washington, DC USA

**Electrolytic Manganese Dioxide from Australia, China, Greece, Ireland, Japan, and South Africa. Investigations Nos. 731-TA-1048-1053 (Preliminary)**

Sep. 2003; 91 pp.; In English

Report No.(s): PB2007-101184; USITC/PUB-3633; No Copyright; Avail.: CASI: [A05](#), Hardcopy

On the basis of the record developed in the subject investigation, the USA International Trade Commission determines that there is a reasonable indication that an industry in the USA is materially injured by reason of imports from Australia, Greece, Ireland, Japan, and South Africa of electrolytic manganese dioxide, provided for in the Harmonized Tariff Schedule of the USA, that are alleged to be sold in the USA at less than fair value (LTFV).

NTIS

*Australia; China; Dioxides; Greece; Ireland; Japan; Manganese Oxides; Republic of South Africa*

**20070001624** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Corrosion Preventing Characteristics of Military Hydraulic Fluids Part II**

Jackman, Rachel; Tebbe, Jill M; Villahermosa, Luis A; Oct 18, 2006; 10 pp.; In English

Report No.(s): AD-A458505; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458505>; Avail.: CASI: [A02](#), Hardcopy

Hydraulic systems are widely used in a variety of military applications including ground vehicles, aircraft, and weapon systems. The impact of corrosion on hydraulic systems and its components is well understood; however, the protection provided by different hydraulic fluids is not equal. Review of military vehicle hydraulic systems identified the most common occurrences of critical corrosion are found in hoses, hose end fittings, actuator arms, pistons, cylinders, and rams. To prevent corrosion in hydraulic systems, the U.S. Army has specified the use of hydraulic fluids with corrosion preventing and rust inhibiting characteristics for ground vehicles. Currently, the Army uses three different types of fluids in the hydraulic systems of military ground vehicles and equipment: MIL-PRF-46170, MIL-PRF-6083, and MIL-PRF-2104. To verify the corrosion protection performance of the fluids, the Fuels and Lubricants Technology Team (FLTT) of U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC) continued an investigation to compare the corrosion preventing characteristics of military hydraulic fluids and engine oils based on standardized hydraulic fluid corrosion tests found in the hydraulic fluid specifications. The test results continue to show that MIL-PRF-6083 and MIL-PRF-46170 provide better corrosion protection than other non-rust inhibiting military hydraulic fluids. This follow-up report will provide updated test results demonstrating improved corrosion protection can be achieved for Army ground vehicle systems.

DTIC

*Corrosion; Corrosion Prevention; Hydraulic Equipment; Hydraulic Fluids; Lubricating Oils*

**20070001653** Ohio State Univ., Columbus, OH USA

**Microstructure-Based Modeling for Life-Limited Components**

Fraser, Hamish L; Nov 14, 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-02-1-0056

Report No.(s): AD-A458554; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458554>; Avail.: CASI: A03, Hardcopy

The principle objective of the project was to bring together computational and experimental efforts in a comprehensive program to develop an integrated set of computational tools that would permit predictions of microstructural development and microstructure-based modeling of life-limited components in advanced titanium alloys (Ti-64 and Ti -6242). These computational tools are anticipated to significantly reduce extensive testing schedules and processing and inspection procedures, and permit development and insertion of new materials within acceptable costs and time frames. This AFOSR support underscored the activities of the Center for Accelerated Maturation of Materials (CA MM) at the Ohio State University (OSU). Significant progress has been made in integrating both experimental and computational efforts and different computational methods, ranging from CALPHAD thermodynamic modeling to phase field microstructure modeling, phenomenological equations, FEM crystal plasticity modeling and neural networks. The MEANS program involved graduate students and postdoctoral fellows in two departments (MSE and Mechanical Engineering) at OSU. Close and highly productive collaborations among the PIs have been established, leading to many publications in leading scientific journals. Moreover, strong interactions have been established between the MEANS and other on-going programs at CAMM, including the AFRL Metal Affordability Initiative (MAI) program and STW-21 program, and its industry partners. The outcomes of the project have made significant impact on developing and incorporating robust, predictive and physics-based materials models into new design philosophy for accelerated maturation and insertion of advanced titanium alloys. The major accomplishments are summarized below according to the three tasks, namely the modeling of fatigue in Ti-based alloys, microstructural modeling, and multi- time scale integration method for cyclic deformation in polycrystalline metals.

DTIC

*Microstructure; Models; Titanium Alloys*

**20070001670** Virginia Univ., Charlottesville, VA USA

**Corrosion of Cellular Metals in Marine Environments**

Scully, John R; Sep 30, 2006; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0497

Report No.(s): AD-A458584; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458584>; Avail.: CASI: A03, Hardcopy

The specific objective of this research is to establish the foundation to enable the next generation of corrosion resistance cellular metals for high performance naval applications. The basis for this work is an interdisciplinary approach that aims to understand: (a) the electrochemical, chemical, and metallurgical conditions that corrode cellular metals in marine environments when fabricated by brazing processes, (b) the impact of braze fabrication time, temperature and diffusion length on corrosion resistance and optimization of the same, and (c) elucidation of corrosion mechanisms so as to provide fundamental information on processes that govern corrosive attack and guide mitigation strategies whether by protection of

existing braze materials or by design of new brazing materials. Specifically FY 2005 was dedicated to elucidating the corrosion mechanisms of a super-austenitic stainless steel Al-6XN (Fe-24Ni-20Cr-6.3Mo-0.22N) when brazed with a commercial Microbraze alloy (Microbraze 31: Ni-22Cr-6.3Si-3.8P).

DTIC

*Brazing; Corrosion; Corrosion Resistance; Marine Environments; Metal Foams; Metals*

**20070001798** International Trade Commission, Washington, DC USA

**Stainless Steel Sheet and Strip from France, Germany, Italy, Japan, Korea, Mexico, Taiwan, and the UK. Investigations Nos. 701-TA-381-382 and 731-TA-797-804 (Review)**

Jul. 2005; 270 pp.; In English

Report No.(s): PB2007-101233; USITC/PUB-3788; No Copyright; Avail.: CASI: [A12](#), Hardcopy

The USA International Trade Commission (ITC) made its final countervailing duty and antidumping duty determinations regarding imports of certain stainless steel sheet and strip from France, Germany, Italy, Japan, Mexico, the Republic of Korea, Taiwan, and the UK. The Commission made affirmative determinations that an industry in the USA is materially injured by reason of imports of certain stainless steel sheet and strip from France, Germany, Italy, Japan, Mexico, the Republic of Korea, Taiwan, and the UK that the Department of Commerce has determined are sold in the USA at less than fair value, and those from France, Italy, and the Republic of Korea that the Department of Commerce has determined are also subsidized.

NTIS

*France; Germany; Italy; Japan; Korea; Metal Sheets; Stainless Steels; Steels; Taiwan; United Kingdom*

**20070001898** Air Force Research Lab., Wright-Patterson AFB, OH USA

**The Effect of Strain-Path Reversal on Cavitation During Hot Torsion Of Ti-6Al-4V (Preprint)**

Nicolaou, P D; Semiatin, S L; Sep 2006; 38 pp.; In English

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

Report No.(s): AD-A458795; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The effect of strain-path reversal on cavitation behavior during the hot torsion testing of an alpha/beta titanium alloy, Ti6Al-4V, with a colony-alpha microstructure was established. Optical microscopy was used to measure cavitation parameters such as cavity size, density, and area fraction. It was observed that when the torsion direction is reversed, the cavitation process is reversed as well; i.e., cavity shrinkage takes place. The experimental observations were interpreted in the context of previous models developed for the densification of porous bodies. For this purpose, the models were modified to treat the effect of colony orientation on the local stress state and the accommodation of the externally-imposed strain, both of which affect the rate of densification/cavity shrinkage. A modified version of the AFRL PM-consolidation model was shown to provide reasonable estimates of the shrinkage kinetics. An alternate description of cavity shrinkage during reversed torsion, analogous to prior descriptions of cavity growth, was also developed. It was concluded that the absolute magnitude of the cavity shrinkage rate is smaller than its counterpart during growth because the local stress ratio is lower during reversed straining compared to that during forward straining.

DTIC

*Cavitation Flow; Titanium Alloys; Torsion*

**20070001967** International Trade Commission, Washington, DC USA

**Cut-to-Length Carbon-Quality Steel Plate from France, India, Indonesia, Italy, Japan, and Korea. Investigation Nos. 701-TA-388-391 and 731-TA-816-821 (Reviews)**

Nov. 2005; 251 pp.; In English

Report No.(s): PB2007-101231; USITC/PUB-3816; No Copyright; Avail.: CASI: [A12](#), Hardcopy

On the basis of the record developed in the subject five-year reviews, the USA International Trade Commission (Commission) determines, pursuant to section 751(c) of the Tariff Act of 1930 (19 U.S.C. 1675(c)) (the Act), that revocation of the antidumping duty and countervailing duty orders on cut-to-length carbon quality steel plate from India, Indonesia, Italy, and Korea, and the antidumping duty order on cut-to-length carbon quality steel plate from Japan would be likely to lead to continuation or recurrence of material injury to an industry in the USA within a reasonably foreseeable time. In addition, the Commission determines that revocation of the antidumping duty order on cut-to-length carbon-quality steel plate from France would not be likely to lead to continuation or recurrence of material injury to an industry in the USA within a reasonably foreseeable time.

NTIS

*Carbon Steels; Cutting; France; India; Indonesia; International Trade; Italy; Japan; Korea; Metal Plates; Steels*

**20070001969** International Trade Commission, Washington, DC USA  
**Magnesium from China and Russia. Investigations Nos. 731-TA-1071 and 1072 (Final)**

Apr. 2005; 154 pp.; In English

Report No.(s): PB2007-101216; USITC/PUB-3763; No Copyright; Avail.: CASI: [A08](#), Hardcopy

On the basis of the record developed in the subject investigations, the USA International Trade Commission (Commission) determines, pursuant to section 735(b) of the Tariff Act of 1930 (19 U.S.C. 1673d(b)) (the Act), that an industry in the USA is materially injured by reason of imports from China and Russia of magnesium, provided for in subheadings 8104.11.00, 8104.19.00, 8104.30.00, and 8104.90.00 of the Harmonized Tariff Schedule of the USA, that have been found by the Department of Commerce (Commerce) to be sold in the USA at less than fair value (LTFV). With regard to U.S. imports from China, the Commission also makes a negative finding with regard to critical circumstances.

NTIS

*China; Magnesium; Russian Federation; Ukraine*

**20070001990** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Metal Flow in Friction Stir Welding**

Numes, Arthur C., Jr.; [2006]; 12 pp.; In English; Materials Science and Technology 2006/ASM International, The Minerals, Metals and Materials Society, 15-19 Oct. 2006, Cincinnati, OH, USA; Original contains black and white illustrations; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001990>; Avail.: CASI: [A03](#), Hardcopy

The plastic deformation field in Friction Stir Welding (FSW) is compared to that in metal cutting. A shear surface around the FSW tool analogous to the metal cutting shear plane is identified and comprises the basis of the 'rotating plug' flow field model and the 'wiping' model of tool interaction with weld metal. Within the context of these models: The FSW shear rate is estimated to be comparable to metal cutting shear rates. The effect of tool geometry on the FSW shear surface is discussed and related to published torque measurements. Various FS W structural features are explained, including a difference in structure of bimetallic welds when alloys on the advancing and retreating sides of the weld seam are exchanged. The joining mechanism and critical parameters of the FSW process are made clear.

Author

*Friction Stir Welding; Metal Cutting; Plastic Deformation; Welded Joints; Bimetals; Flow Distribution*

**20070002069** Case Western Reserve Univ., Cleveland, OH USA

**Partial Thermodynamic Properties of gamma-(Ni,Pt)3Al in the Ni-Al-Pt System (Preprint)**

Copland, Evan; Feb 2006; 27 pp.; In English

Contract(s)/Grant(s): F4FBFN5097G001

Report No.(s): AD-A458183; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A series of measurements were made to determine how Pt influences the partial thermodynamic properties of Al and Ni in gamma-(Ni,Pt)3Al and liquid in the Ni-Al-Pt system. The activities of Al and Ni were measured by the vapor pressure technique with a multiple effusion-cell vapor source coupled to a mass spectrometer (multi-cell KEMS). For a consistent  $X_{Al} = 0.24$ , adding Pt, from  $X_{Pt} = 0.02$  to 0.25, reduces  $\alpha(Al)$  almost an order of magnitude, from about  $2 \times 10^{-4}$  to  $2 \times 10^{-5}$ , at 1560K. This occurred with a consistent  $\Delta H(Al)$  of  $-203 \pm 10$  kJmol<sup>-1</sup> and the decrease in  $\alpha(Al)$  was due to an increase in  $\Delta S(Al)$ , from -60 to -40 Jmol<sup>-1</sup>K<sup>-1</sup> with a decrease in the Ni/Pt ratio.

DTIC

*Thermodynamic Properties; Metals*

**20070002078** Missouri Univ., Rolla, MO USA

**Application of Millimeter Wave, Eddy Current and Thermographic Methods for Detection of Corrosion in Aluminum Substrate (Preprint)**

Sep 2006; 10 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2510

Report No.(s): AD-A458360; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Aluminum; Eddy Currents; Millimeter Waves; Substrates; Thermography; Detection; Corrosion Tests*

**20070002101** Executive Control Board of the National Shipbuilding Program, Charleston, SC USA

**Welding Research for Shipbuilding: SP-7 Panel Program From 1972 to 1992**

Nov 1992; 25 pp.; In English

Report No.(s): AD-A458687; NSRP-0364; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458687>; Avail.: CASI: A03, Hardcopy

SP-7 is the Welding R&D panel of the National Shipbuilding Research Program (NSRP) and is a panel of the Ship Production Committee of the Society of Naval Architects and Marine Engineers. It is chartered to perform research and development tasks for the advancement of shipbuilding technology and methodology. Its goal is to develop and implement materials and processes which will result in the improvement of the competitive position of U.S. shipbuilding in the world marketplace. A copy of the charter and statement of objectives of SP-7 is given in the Appendix. The primary purpose of this report is to provide current and future members of SP-7 with a comprehensive overview of major SP-7 projects and activities. Over 40 evaluations of technology and projects relating to welding and have been performed under SP-7. Prior to showing a complete listing of the projects since 1973, a brief description will be given of the structure and functions of the National Shipbuilding Research Program.

DTIC

*Welding; Ships*

**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*.

**20070000551** Brookhaven National Lab., Upton, NY USA, Two Phase Engineering and Research, Inc., Upton, NY, USA  
**Polytetrafluoroethylene-Rich Polyphenylenesulfide Blend Top Coatings for Mitigating Corrosion of Carbon Steel in 300 degree C Brine**

Sugama, T.; Jung, D.; Jun. 2005; 36 pp.; In English

Report No.(s): DE2006-875882; BNL-75394-2006-IR; No Copyright; Avail.: Department of Energy Information Bridge

We evaluated usefulness of a coating system consisting of an underlying polyphenylenesulfide (PPS) layer and top polytetrafluoroethylene (PTFE)-blended PPS layer as low friction, water repellent, anti-corrosion barrier film for carbon steel steam separators in geothermal power plants. The experiments were designed to obtain information on kinetic coefficient of friction, surface free energy, hydrothermal oxidation, alteration of molecular structure, thermal stability, and corrosion protection of the coating after immersing the coated carbon steel coupons for up to 35 days in CO<sub>2</sub>-laden brine at 300 degrees C. The superficial layer of the assembled coating was occupied by PTFE self-segregated from PPS during the melt-flowing process of this blend polymer; it conferred an outstanding slipperiness and water repellent properties because of its low friction and surface free energy. However, PTFE underwent hydrothermal oxidation in hot brine, transforming its molecular structure into an alkylated polyfluorocarboxylate salt complex linked to Na. Although such molecular transformation increased the friction and surface free energy, and also impaired the thermal stability of PTFE, the top PTFE-rich PPS layer significantly contributed to preventing the permeation of moisture and corrosive electrolytes through the coating film, so mitigating the corrosion of carbon steel.

NTIS

*Brines; Carbon Steels; Corrosion; Mixtures; Polytetrafluoroethylene*

**20070000759** Auburn Univ., AL USA

**Biocidal Polyester**

Lin, Jian; Winkelmann, Catherine; Worley, S D; Kim, Jangho; Wei, C -I; Cho, Unchin; Broughton, R M; Santiago, J I; Williams, J F; Jan 2002; 7 pp.; In English

Contract(s)/Grant(s): F08637-02-C-7020; Proj-ARMT

Report No.(s): AD-A458142; No Copyright; Avail.: CASI: A02, Hardcopy

Polyester fabrics were modified by covalently linking heterocyclic moieties, which could be halogenated, to the surfaces of the polyester fabrics. Antimicrobial activity was introduced into the fabrics and fibers by exposure to a source of oxidative chlorine (chlorine bleach) that converted the heterocyclic polymer moieties into N-chloramine functionalites. The antimicrobial activity could be repeatedly regenerated following its loss on challenge with suspensions of bacteria by further washing with aqueous oxidative chlorine. Biocidal polyester fabrics, fibers, and other materials potentially will be effective

in reducing, or eliminating entirely, pathogenic microorganisms and odor causing microorganisms which directly contact them.

DTIC

*Antibiotics; Antiinfectives and Antibacterials; Fabrics; Microorganisms; Odors; Pathogens; Pesticides; Polyesters*

**20070000790** Connecticut Univ., Storrs, CT USA

**Modification of Bisphenol-A Based Bismaleimide Resin (BPA-BMI) with an Allyl-Terminated Hyperbranched Polyimide (AT-PAEKI)**

Qin, Haihu; Mather, Patrick T; Baek, Jong-Beom; Tan, Loon-Seng; Mar 2006; 12 pp.; In English

Contract(s)/Grant(s): F33615-00-D-5008; Proj-4347

Report No.(s): AD-A458184; No Copyright; Avail.: CASI: [A03](#), Hardcopy

As a continuation of previous work involving synthesis of an allyl-functionalized hyperbranched polyimide, AT-PAEKI, we have studied the use of this reactive polymer as a modifier of bisphenol-A based bismaleimide resin (BPA-BMI). This was pursued in anticipation of improvements in processability as well as physical properties including glass transition temperature, elastic modulus, and fracture toughness. Apparent miscibility, indicated by optical clarity with a single T<sub>g</sub>, was observed for compositions containing up to 16 wt% AT-PAEKI. Additionally, we observed complete suppression of monomer crystallization and a slight increase in the overall cure exotherm. By rheological characterization, blends containing 4 wt% AT-PAEKI were found to feature a dramatic (65-fold) reduction in the viscosity minimum during heating. Dynamic mechanical analysis (DMA) showed that the addition of 2, 4, 8 wt% AT-PAEKI increases the cured modulus by approximately 10% from a base value of 3.4 GPa, while adding 16 wt% AT-PAEKI decreases the modulus slightly to 3.3 GPa. DMA also revealed that the cured glass transition temperature increases monotonically with the addition of AT-PAEKI. Our results showed a modest toughening effect upon the addition of AT-PAEKI. We conclude that AT-PAEKI may serve as an effective reactive processing aid with slight improvements in T<sub>g</sub>, modulus, and fracture toughness.

DTIC

*Additives; Bismaleimide; Bisphenols; Plastics; Polyimides; Resins*

**20070000795** Executive Control Board of the National Shipbuilding Program, Charleston, SC USA

**Standard Practice for the Selection and Application of Marine Deck Coverings**

O'Donnell, Joseph F; Jul 1992; 328 pp.; In English

Report No.(s): AD-A458198; NSRP-0354; No Copyright; Avail.: CASI: [A15](#), Hardcopy

The 'Standard Practice for the Selection and Application of Marine Deck Covering' has been designed to easily direct those who use it to the proper decking system for the various spaces in all types of commercial and military ships. Each individual will determine the best and most comprehensive way to obtain the facts they need to best answer each decking requirement.

DTIC

*Coverings; Ships*

**20070001408** Crawford Maunu PLLC, Saint Paul, MN, USA

**Noncovalent Sidewall Functionalization of Carbon Nanotubes**

Dai, H.; Chen, R. J.; 29 Mar 02; 9 pp.; In English

Contract(s)/Grant(s): NSF-ECS-9871947

Patent Info.: Filed Filed 29 Mar 02; US-Patent-Appl-SN-10-473-101

Report No.(s): PB2007-100916; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Carbon nanotubes are functionalized in a broadly applicable manner. According to an example embodiment of the present invention, single-wall carbon nanotubes (SWNTs) are noncovalently functionalized. The functionalized SWNTs are highly versatile, being useful for a variety of implementations, including for the immobilization of molecules, for circuit arrangements, molecular electronics and for molecular sensors. In addition, stable suspensions of functionalized SWNTs in solutions can be achieved, as well as the self-assembly of nanotubes with unperturbed sp<sup>2</sup> structures and thus their electronic characteristics.

NTIS

*Carbon Nanotubes; Patent Applications*

**20070001588** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Lightweight Ablative and Ceramic Thermal Protection System Materials for NASA Exploration Systems Vehicles**

Valentine, Peter G.; Lawrence, Timothy W.; Gubert, Michael K.; Milos, Frank S.; Kiser, James D.; Ohlhorst, Craig W.; Koenig, John R.; [2006]; 1 pp.; In English; Materials Science and Technology 2006 Conference and Exhibition (MS&T'06), 15-19 Oct. 2006, Cincinnati, OH, USA; No Copyright; Avail.: Other Sources; Abstract Only

As a collaborative effort among NASA Centers, the 'Lightweight Nonmetallic Thermal Protection Materials Technology' Project was set up to assist mission/vehicle design trade studies, to support risk reduction in thermal protection system (TPS) material selections, to facilitate vehicle mass optimization, and to aid development of human-rated TPS qualification and certification plans. Missions performing aerocapture, aerobraking, or direct aeroentry rely on advanced heatshields that allow reductions in spacecraft mass by minimizing propellant requirements. Information will be presented on candidate materials for such reentry approaches and on screening tests conducted (material property and space environmental effects tests) to evaluate viable candidates. Seventeen materials, in three classes (ablatives, tiles, and ceramic matrix composites), were studied. In addition to physical, mechanical, and thermal property tests, high heat flux laser tests and simulated-reentry oxidation tests were performed. Space environmental effects testing, which included exposures to electrons, atomic oxygen, and hypervelocity impacts, was also conducted.

Author

*Ablative Materials; Ceramic Matrix Composites; Thermal Protection; Thermodynamic Properties; Heat Shielding; Tiles; Aerospace Environments*

**20070001674** Naval Undersea Warfare Center, Newport, RI USA

**Air-Inflated Fabric Structures**

Cavallaro, Paul V; Sadegh, Ali M; Nov 5, 2006; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458590; NUWC-NPT-RR-11774; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458590>;

Avail.: CASI: [A03](#), Hardcopy

Air-inflated fabric structures fall within the category of tensioned structures and provide unique advantages in their use over traditional structures. These advantages include light weight designs, rapid and self-erecting deployment, enhanced mobility, large deployed-to-packaged volume ratios, fail-safe collapse, and possible rigidification. Most of the research and development pursued in air-inflated structures can be traced to space, military, commercial, marine engineering and recreational applications. Examples include air ships, weather balloons, inflatable antennas and radomes, temporary shelters, pneumatic muscles and actuators, inflatable boats, temporary bridging, and energy absorbers such as automotive air bags. However, the advent of today's high performance fibers combined with continuous textile manufacturing processes has produced an emerging interest in air-inflated structures. Air-inflated structures can be designed as viable alternatives to conventional structures.

DTIC

*Fabrics; Inflatable Structures*

**20070002037** International Trade Commission, Washington, DC USA

**Granular Polytetrafluoroethylene Resin from Italy and Japan. Investigation Nos. 731-TA-385 and 386 (Second Review)**

Dec. 2005; 130 pp.; In English

Report No.(s): PB2007-101208; USITC/PUB-3823; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The U.S. International Trade Commission (ITC) determined that revoking the existing antidumping duty orders on granular polytetrafluoroethylene resin from Italy and Japan would be likely to lead to continuation or recurrence of material injury within a reasonably foreseeable time. As a result of the Commission's affirmative determinations and the Department of Commerce's recent affirmative findings, the existing orders on imports of granular polytetrafluoroethylene resin from Italy and Japan will remain in place.

NTIS

*International Trade; Italy; Japan; Polytetrafluoroethylene; Resins*

## 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*.

**2007000540** NASA Johnson Space Center, Houston, TX, USA

### **A Prototype Cryogenic Oxygen Storage and Delivery Subsystem for Advanced Spacesuits**

Overbeeke, Arend; Hodgson, Edward; Paul, Heather; Geier, Harold; Bradt, Howard; July 2007; 1 pp.; In English; 37th International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA

Contract(s)/Grant(s): WBS 384.06.04.01.05.10; Copyright; Avail.: Other Sources; Abstract Only

Future spacesuit systems for the exploration of Mars will need to be much lighter than current designs while at the same time reducing the consumption of water for crew cooling. One of the technology paths NASA has identified to achieve these objectives is the replacement of current high pressure oxygen storage technology in EVA systems with cryogenic technology that can simultaneously reduce the mass of tankage required for oxygen storage and enable the use of the stored oxygen as a means of cooling the EVA astronaut. During the past year NASA has funded Hamilton Sundstrand production of a prototype system demonstrating this capability in a design that will allow the cryogenic oxygen to be used in any attitude and gravity environment. This paper will describe the design and manufacture of the prototype system and present the results of preliminary testing to verify its performance characteristics. The potential significance and application of the system will also be discussed.

Author

*Cryogenics; Prototypes; Space Suits; Storable Propellants; High Pressure Oxygen*

**20070001089** Med-Eng Systems, Inc., Ottawa, Ontario Canada

### **Reduction of Blast Induced Head Acceleration in the Field of Anti-Personnel Mine Clearance**

Jan 2006; 13 pp.; In English

Report No.(s): AD-A458451; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Mines; Pressure Heads; Acceleration (Physics); Blast Loads*

**20070001517** Library of Congress, Washington, DC USA

### **Conventional Arms Transfers to Developing Nations, 1998-2005**

Oct 23, 2006; 99 pp.; In English

Report No.(s): AD-A458399; CRS-RL33696; No Copyright; Avail.: CASI: [A05](#), Hardcopy

No abstract available

*Developing Nations; Weapons*

**20070001530** Army Research Lab., Aberdeen Proving Ground, MD USA

### **Small-Caliber Projectile Target Impact Angle Determined From Close Proximity Radiographs**

Oct 2006; 50 pp.; In English

Report No.(s): AD-A458409; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Projectiles; Radiography; Targets*

## SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see 84 *Law, Political Science and Space Policy*.

**20070002071** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **Experiments Conducted Aboard the International Space Station: The Pore Formation and Mobility Investigation (PFMI) and the In-Space Soldering Investigation (ISSI): A Current Study of Results**

Grugel, R. N.; Luz, P.; Smith, G. A.; Spivey, R.; Jeter, L.; Gillies, D. C.; Hua, F.; Anilkumar, A. V.; [2006]; 1 pp.; In English; 57th International Astronautical Congress (IAC) Conference, 2-6 Oct. 2006, Valencia, Spain; Copyright; Avail.: Other

Sources; Abstract Only



Experiments in support of the Pore Formation and Mobility Investigation (PFMI) and the In-Space Soldering Investigation (ISSI) were conducted aboard the International Space Station (ISS) with the goal of promoting our fundamental understanding of melting dynamics, solidification phenomena, and defect generation during materials processing in a microgravity environment. Through the course of many experiments a number of observations, expected and unexpected, have been directly made. These include gradient-driven bubble migration, thermocapillary flow, and novel microstructural development. The experimental results are presented and found to be in good agreement with models pertinent to a microgravity environment. Based on the space station results, and noting the futility of duplicating them in Earth's unit-gravity environment, attention is drawn to the role ISS experiments hardware can play to provide insight to potential materials processing techniques and/or repair scenarios that might arise during long duration space transport and/or on the lunar/Mars surface.

Author

*International Space Station; Spaceborne Experiments; Soldering; Mobility; Porosity*

**20070002073** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Materials Research Conducted Aboard the International Space Station: Facilities Overview, Operational Procedures, and Experimental Outcomes**

Grugel, R. N.; Luz, P.; Smith, G. A.; Spivey, R.; Jeter, L.; Gillies, D. C.; Hua, F.; Anilkumar, A. V.; [2006]; 1 pp.; In English; 57th International Astronautical Congress (IAC) Conference, 2-6 Oct. 2006, Valencia, Spain; Copyright; Avail.: Other Sources; Abstract Only

The Microgravity Science Glovebox (MSG) and Maintenance Work Area (MWA) are facilities aboard the International Space Station (ISS) that were used to successfully conduct experiments in support of, respectively, the Pore Formation and Mobility Investigation (PFMI) and the In-Space Soldering Investigation (ISSI). The capabilities of these facilities are briefly discussed and then demonstrated by presenting real-time and subsequently down-linked video-taped examples from the abovementioned experiments. Data interpretation, ISS telepresence, some lessons learned, and the need of such facilities for conducting work in support of understanding materials behavior, particularly fluid processing and transport scenarios, in low-gravity environments is discussed.

Author

*International Space Station; Materials Science; Spaceborne Experiments; Microgravity; General Overviews*

## 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*.

**20070000747** Iowa Univ., Iowa City, IA USA

**Stream-Flow Measurements at Selected Gaging Stations in the Iowa and Des Moines River Basins and Development of Stage-Discharge Relationships**

Nakato, Tatsuaki; Jul 2003; 122 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458123; IIHR-TR-431; No Copyright; Avail.: CASI: [A06](#), Hardcopy

Field velocity measurements were taken four times at fifteen stream gaging sites within the Iowa River and Des Moines River basins during 3 September 2002 and 18 April 2003. Using the historical data available and the data collected in this study, log-linear stage-discharge relationships, as well as a rating table, were developed for each station.

DTIC

*Flow Measurement; Iowa; Measuring Instruments; River Basins; Rivers; Streams*

**20070000754** Army Tank-Automotive and Armaments Command, Warren, MI USA

**Use of the Fisher Exact Test for the Design of Observer Tests**

Bennett, John G; Jan 2001; 18 pp.; In English

Report No.(s): AD-A458136; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents techniques to aid in the design of an observer test. To select an appropriate number of observation opportunities, the test designer can use the Fisher Exact Test to calculate the number of observation opportunities required so that a given experimental difference in probability of detection will be statistically significant. Alternatively, the designer can select the number of observation opportunities to guard against rejecting a real difference in probability of detection. These

criteria require calculating the probabilities of so-called Type I and Type II errors in hypothesis testing.

DTIC

*Evaluation; Planning; System Effectiveness*

**20070000774** Mitre Corp., McLean, VA USA

**TEASG Step 3 Report on APB Step 3 Test, Evaluation, and Analysis Process**

Beasley, Michael; Colella, David; Fico, Ronald; Lane, W R; Rice, Gregory C; Seil, Michael K; Apr 2000; 13 pp.; In English  
Contract(s)/Grant(s): DAAB07-99-C-C201

Report No.(s): AD-A458165; MP-00W0000124; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A subcommittee of the Test, Evaluation, and Assessment Support Group was formed to address issues and procedures relating to the Advanced Processor Build Step 3 test and analysis procedures. This examination was prompted by the recent APB-99 Step 4 test, wherein a number of system deficiencies were noted with little or no perceived forewarning from the APB-99 Step 3 evaluation. This report discusses the subcommittee's assessment of the overall Step 3 process and its implementation. The report provides conclusions regarding the implementation of the APB Step 3 mechanism and recommendations for the modification of Step 3 procedures so that more effective functional and integrated system testing can be attained. The failure to adequately address the Step 3 procedural issues raised here can increase performance risk associated with each new generation APB sonar system build. A majority of the system deficiencies highlighted during the APB-99 Step 4 sea test were either observed during prior lab tests or could not be tested during Step 3 lab tests due to a lack of testing capabilities. Nonetheless, the appearance of these problems was not sufficiently disseminated to the general community in a timely fashion. The most significant reason for this was that the primary focus of APB-99 testing was to enable a stable and fully functional system in preparation for the Step 4 sea test. This distracted the test team from assessing functional performance. Recommendations are presented to help correct some of the shortcomings of the testing implementation. These include minimizing system modifications and retuning during the Step 3 test; increasing communication between the testing groups and other support groups and developers; providing a more focused approach to Step 3 testing; and extending the Step 3 test period to provide a find, fix, repair, and retest phase that examines the impact of post-test modifications.

DTIC

*Data Processing; Signal Processing; Sonar*

**20070001146** Optical Sciences Corp., Huntsville, AL USA

**Progress in the Development of a Cold Background, Flight Motion Simulator Mounted, Infrared Scene Projector for use in the AMRDEC Hardware-in-the-Loop Facilities**

Cantey, Thomas M; Beasley, D B; Bender, Matt; Messer, Tim; Saylor, Daniel A; Buford, Jim; Jan 2005; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458232; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper will present the progress on AMRDEC's development of a cold background, flight motion simulator (FMS) mountable, emitter array based projector for use in hardware-in-the-loop systems simulation. The goal for this development is the ability to simulate realistic low temperature backgrounds for windowed/domed seekers operating in tactical and exo-atmospheric simulations. The projector has been developed to operate at -10 degrees Celsius in order to reduce the apparent background temperature presented to the sensor under test. The projector system includes a low temperature operated Honeywell BRITE II emitter array, refractive optical system with zoom optics, integrated steerable point source and high-frequency jitter mirror contained within an FMS-mountable environmental chamber. This system provides a full-FOV cold background, two-dimensional dynamic IR scene projection, a high dynamic range independently steerable point source and combined optical path high frequency jitter control. The projector is designed to be compatible with operation on a 5 axis electric motor driven Carco flight motion simulator.

DTIC

*Flight Simulators; Infrared Instruments; Infrared Radiation; Low Temperature; Missiles; Motion Simulators; Progress; Projectors*

**20070001615** Army Engineer Research and Development Center, Vicksburg, MS USA

**Summary of Measurement Protocols for Sediment Resuspended from Dredging Operations**

Jul 2006; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458491; ERDC-TN-DOER-D8; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458491>;

Avail.: CASI: [A02](#), Hardcopy

A detailed review of published reports on sediment release from dredging operations revealed that field measurement methods were inconsistent and frequently failed to result in the collection of all the data required to assess releases and mechanisms of releases from different types of dredges working in different sediment conditions such as cohesive, noncohesive, and rock materials. The inconsistencies prevented direct and meaningful comparison of the measurements, thus reducing their value. This data vacuum indicated the urgent need for a set of standard field measurement protocols to provide calibration data. HR Wallingford Ltd. and Dredging Research Ltd. authored 'Protocol for the Field Measurement of Sediment Release from Dredgers' in August 2003. This document was made available to the U.S. Army Engineer Research and Development Center (ERDC) through a cooperative research contract. This technical note is intended to summarize the content, layout, and capabilities of the Protocol report (also referred to as the TASS Protocol); it does not replace the Protocol or serve as a substitute for the Protocol. Use of any content herein should be undertaken only after consulting the Protocol Report. Portions of this technical note are taken verbatim from the Protocol document. All content within this document is cited to 'Protocol for the Field Measurement of Sediment Release from Dredgers' by HR Wallingford Ltd. and Dredging Research Ltd. The Protocol is available for download from the ERDC.

DTIC

*Dredging; Protocol (Computers); Sediments*

**20070002100** Southwest Research Inst., San Antonio, TX USA

### **Improved Tank Testing Methods**

Bass, R L; Cox, P A; Bowles, E B; Hokanson, J C; Mason, R L; Jan 1980; 141 pp.; In English

Report No.(s): AD-A458698; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458698>; Avail.: Defense Technical Information Center (DTIC)

The purpose of this project was to seek new methods for testing integral tanks in ships which would improve shipbuilders productivity while not detracting from assurances for safety of shipbuilders' test personnel, regulators' inspectors, operators' crews and ships. This research program addresses itself exclusively to integral tanks on ships. Independent tanks, including all LNG tank primary boundaries, are excluded. Of principal interest are new test methods to improve productivity in tank testing. Weld quality, ship design and scheduling, either affect, or are affected by, tank testing and so are of secondary interest. Both tightness testing and structural testing are covered in the study, but the major effort was directed toward improved tightness testing.

DTIC

*Liquefied Natural Gas; Storage Tanks*

## **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*.

**20070000688** Ericsson Microwave Systems A.B., Moelndal, Sweden

### **Information and Communication Infrastructure for National Security and Public Safety**

Wallmark, Magnus; Oct 25, 2004; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A457997; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Communication Networks; Safety; Security; Telecommunication*

**20070000698** Texas A&M Univ., College Station, TX USA

### **Modeling Command and Control in Multi-Agent Systems**

Ioerger, thomas R; He, Linli; Jun 2003; 33 pp.; In English

Contract(s)/Grant(s): F49620-00-I-326

Report No.(s): AD-A458020; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Intelligent agents can be quite useful as entities in combat simulations. Recently, there has been a great deal of research on developing enhanced methods for implementing intelligent agents in combat simulations, such as by introducing models of teamwork and collaborative behavior. However, modeling of command-and-control has lagged behind. Much is known about command-and-control in human tactical decision-making (TDM) teams from studies in cognitive science and

organizational psychology. These studies suggest that human decision-makers tend to follow a Naturalistic Decision-Making process, in which situation awareness plays a key role. Hence command-and-control is heavily focused on information-gathering and information-fusion activities, oriented toward reducing uncertainty and identifying the situation, based on which an appropriate response can be applied (or adapted) from experience or training. In this paper, we provide a brief survey of multi-agent systems architectures, with a focus on combat simulations, and a survey of the cognitive literature on human situation awareness and tactical decision-making. Then we describe a new computational model for command-and-control in multi-agent systems. Primarily, the model focuses on a procedural representation of situation assessment and attempts to capture the decisions regarding information-gathering and information management activities, though we also discuss how to integrate these activities with other on-going aspects of C2 (mission, threat-handling, etc.) using prioritization. We then discuss an approach to extending this procedure to a team task, which should automatically generate the interactions and information flow necessary to simulate distributed situation awareness.

DTIC

*Combat; Command and Control; Decision Making; Simulation; Situational Awareness*

**20070000714** Space and Naval Warfare Systems Center, San Diego, CA USA

**Command & Control Environment Timeliness Characterization**

Drummond, John; Jan 2000; 6 pp.; In English

Report No.(s): AD-A458056; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The objective of this work is to characterize a method for providing timeliness quality to the distributed collaboration environment. Timeliness is an important principle in the coherence of data within a given flow. This flow in turn has a direct bearing on the consistency of a given situation perception. Resource management within a given system, residing on a distributed command and control environment, is a critical element of maintaining a timely flow of cognitive data. Yet this critical element has been given minimal attention at best, during the development of command and control systems. This paper will present a current approach for the management of resources within this environment.

DTIC

*Characterization; Command and Control*

**20070000717** Aptima, Inc., Woburn, MA USA

**Awareness and C2 Organizational Structure**

Entin, Elliot E; Diedrich, Frederick J; MacMillan, Jean; Serfaty, Daniel; Jan 2002; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-95-C-0125

Report No.(s): AD-A458069; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we test the hypothesis that organizational structure, and the history of that structure, influences mutual workload awareness. More specifically, we explored the congruence of workload awareness among a number of decision makers acting in two organizational structures (functional vs. divisional) with different histories (divisional followed by functional vs. functional followed by divisional). Seven teams comprised of military officers were assigned to one of the two orders and performed a simulated mission. Findings show that workload awareness was higher in the functional-divisional than in the divisional- functional order indicating that workload awareness can be influenced by factors such as organizational structure and how that structure changes over time. There is also evidence that high workloads may foster higher workload awareness, and that high workload awareness may ameliorate some of the negative effects of high workload.

DTIC

*Command and Control; Workloads (Psychophysiology)*

**20070000722** Air Force Research Lab., Rome, NY USA

**Intelligent C2 Information Technology**

Anken, Craig S; Jan 1999; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458077; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Present day and future joint warfare will increasingly demand rapid processing and transfer of data for Command and Control (C2). Improved capabilities to take this data and effectively utilize it for decisions is critical. Commanders need to obtain and use timely battle space information to make informed decisions. While capabilities for Air Force C2 has seen some technology improvements in recent years, there still remains a considerable number of legacy systems designed towards independent commands and missions. The C2 system can still be characterized as data-rich, but information poor. A better way

of integrating operations, and providing consistent, tactically relevant, accurate, and timely information across commands and services is needed. The real challenge is not just having access to diverse data sources, but in being able to effectively process, analyze and interpret this data to form information, and ultimately knowledge for use in the C2 decision process. Intelligent C2 information technology will enable the Air Force to manage and control its information flows in a manner that is faster, more efficient, and more precise than that of our adversaries. The Research and Development community is currently working a number of technology areas which will have an impact on C2 as we know it today. This paper will present an overview of some of these initiatives. It will look at some of the technology products coming out of these programs and identify areas where current and future intelligent information technology could be utilized within the C2 decision making process.

DTIC

*Command and Control; Information Systems; Information Transfer*

**20070000724** Science Applications International Corp., Arlington, VA USA

**Naval Network-Centric Sensor Resource Management**

Worth Johnson, Bonnie; Green, John M; Apr 2002; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458080; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The benefits of implementing a network-centric Navy lie in the new capabilities made possible by enhanced information sharing between Naval platforms. Foremost is the potential to enable, enhance, and automate dispersed decision-making to support real-time critical mission areas. This paper explores a network-centric paradigm-enabled application: multi-platform sensor resource management. Sensors in platform centric Naval Battle Forces are generally utilized and managed to support a single weapon or combat system. The networking of combat systems and platforms creates an information architecture in which sensor management can shift to a Battle Force (BF) focus. In such a network-centric paradigm, individual sensors address the needs of the BF as a whole, overcoming the platform-centric architecture, which constrains sensor use to individual platform's needs. This paper explores design concepts for an automated sensor resource manager that tasks sensors to address BF needs. Network-centric sensor resource management relies on viewing the BF as a single integrated interoperable combat system of systems, rather than a collection of loosely connected surface, subsurface, and air platforms. Such BF level thinking shifts the focus from legacy stovepipe systems and platforms with little or no collaboration incentive, to optimized uses of resources that transcend platform boundaries and span multi-threat dimensions. This paper explores interoperability problems and root causes associated with legacy Naval BF sensor management and poses solutions and considerations for a network-centric sensor resource manager that functions as part of a BF system of systems.

DTIC

*Communication Networks; Resources Management*

**20070000761** Massachusetts Inst. of Tech., Cambridge, MA USA

**Frequency Stabilization Using Matched Fabry-Perots as References**

Li, Peter C; Humblet, Pierre A; Apr 1991; 8 pp.; In English

Contract(s)/Grant(s): F19628-90-C-0002

Report No.(s): AD-A458149; LIDS-P-2032; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We propose a matched Fabry-Perot configuration for frequency stabilization where each user locks its laser to a local Fabry-Perot interferometer which is perfectly matched to a master Fabry-Perot. Experimentally, a user Fabry-Perot was matched and locked to a remote master Fabry-Perot.

DTIC

*Frequency Division Multiplexing; Frequency Stability*

**20070000853** Library of Congress, Washington, DC USA

**Televising Supreme Court and Other Federal Court Proceedings: Legislation and Issues**

Tong, Lorraine H; Nov 8, 2006; 24 pp.; In English

Report No.(s): AD-A458314; CRS-RL33706; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Over the years, some in Congress, the public, and the media have expressed interest in television or other electronic media coverage of Supreme Court and other federal court proceedings. The Supreme Court has never allowed live electronic media coverage of its proceedings, but the Court posts opinions and transcripts of oral arguments on its website. The public has access to audiotapes of the oral arguments and opinions that the Court gives to the National Archives and Records Administration. Currently, Rule 53 of the Federal Rules of Criminal Procedure prohibits the photographing or broadcasting of judicial proceedings in criminal cases in federal courts. The Judicial Conference of the USA prohibits the televising,

recording, and broadcasting of district trial (civil and criminal) court proceedings. Under conference policy, each court of appeals may permit television and other electronic media coverage of its proceedings. Only two of the 13 courts of appeals, the Second and Ninth Circuit Courts of Appeals, have chosen to do so. Although legislation to allow camera coverage of the Supreme Court and other federal court proceedings has been introduced in the current and previous Congresses, none has been enacted.

DTIC

*Law (Jurisprudence); Television Systems; United States*

**20070001151** Office of the Assistant Secretary of Defense, Washington, DC USA

**The Big Issue: Command and Combat in the Information Age**

Potts, David; Feb 2003; 331 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458363; No Copyright; Avail.: CASI: [A15](#), Hardcopy

This Occasional Paper considers command and combat in the information age. A small team in the British Army's conceptual 'think tank,' the Directorate General Development and Doctrine, worked together on this issue for 18 months. While nobody has any certain answers, their views represent some of the current forward thinking within the British Army. They argue that the information age will be defined as much by the blossoming of regional conflict and global terrorism as by technology. However, the technology offers Britain the potential to change the way it chooses to fight and this notion lies at the core of the so-called Revolution in Military Affairs (RMA). The facts are inescapable -- the age we live in demands Armed Forces characterized by new thinking, new concepts, new doctrine, new tactics, and new organizations fired by committed leadership and enabled by state-of-the-art information age technology. Topics addressed include the nature of future warfare; the nature of the Revolution in Military Affairs and the innate British reluctance to embrace it; the potential benefits of a fully digitized and networked command and control system; mission command as a prerequisite for the successful exploitation of information age command systems; the Commander as expert decision maker; a commander-centric approach to future command structures; future disparities between digitized and nondigitized forces and the inherent frictions of multinationality; information-sharing post-9/11 at the strategic intergovernmental level; intelligence, surveillance, target acquisition, and reconnaissance; aerial surveillance systems; the need for manned reconnaissance; vulnerabilities of digital systems; tactical combat with the new C4ISTAR; the end of the close battle as we know it; asymmetric warfare, the new face of warfare in the 21st century; and a fictional account of a possible future conflict.

DTIC

*Combat; Command and Control; Forecasting; United Kingdom; Warfare*

**20070001438** Army Research Lab., Adelphi, MD USA

**Ad Hoc Networking for Unmanned Ground Vehicles: Design and Evaluation at Command, Control, Communications, Intelligence, Surveillance and Reconnaissance On-the-Move**

Nov 2006; 36 pp.; In English

Report No.(s): AD-A458327; ARL-TR-3991; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Unmanned Ground Vehicles; Surveillance; Command and Control; Network Control; Communication; Reconnaissance*

**20070001556** Army Research Inst. for the Behavioral and Social Sciences, Fort Knox, KY USA

**Command and Control Planning and Teamwork: Exploring the Future**

Sterling, Bruce S; Lickteig, Carl W; Jan 2000; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458374; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Teams are increasingly important as organizations reengineer to meet information age conditions and objectives. This paper examines how participant ratings of command and control planning and observer assessments of teamwork were related in a series of futuristic missions conducted by the Mounted Maneuver Battlespace Lab at Fort Knox, KY. The exploratory results indicate that planning and teamwork may be closely related, particularly in the reengineered command and control organizations envisioned in the 2010+ timeframe.

DTIC

*Command and Control; Organizations*

**20070001577** National Telecommunications and Information Administration, Boulder, CO USA

**Institute for Telecommunication Sciences Technical Progress Report, 2005**

Jan. 2006; 93 pp.; In English

Report No.(s): PB2007-103650; No Copyright; Avail.: National Technical Information Service (NTIS)

The Institute for Telecommunication Sciences (ITS), located in Boulder, Colorado, is the research and engineering arm of the National Telecommunications and Information Administration (NTIA), of the U.S. Department of Commerce (DOC). The Institutes staff of Federal employees provides strong engineering and scientific skills and experience to our technical programs. The majority of employees are electronics engineers, but the staff also includes mathematicians, physicists, computer scientists, and specialists in other fields. ITS support during Fiscal Year 2005 consisted of \$6 million of direct funding from the DOC and approximately \$8 million for work sponsored by other Federal agencies and U.S. industry.

NTIS

*Communication Satellites; Telecommunication*

**20070001631** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

**Advanced Wireless Integrated Navy Network (AWINN)**

Stutzman, Warren; Habayeb, Rick; Sep 30, 2006; 140 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0179

Report No.(s): AD-A458521; 6; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458521>; Avail.: CASI: [A07](#),  
Hardcopy

Final progress report on AWINN hardware and software configurations of smart, wideband, multi-function antennas, secure configurable platform, close-in command and control for Sea Basing visualization of wireless technologies, Ad Hoc networks, network protocols, real-time resource allocation, Ultra Wideband (UWB) communications network and ranging sensors, cross layer optimization and network interoperability.

DTIC

*Communication Networks; Navy; Wireless Communication*

**20070001660** Horizons Technology, Inc., Billerica, MA USA

**From Lab to Tent (Bringing Integrated C2ISR Technology to the Warfighter)**

Schaefer, Ron; Donatelli, Delia E; Jan 2000; 17 pp.; In English

Contract(s)/Grant(s): F19628-99-F-8055

Report No.(s): AD-A458564; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458564>; Avail.: CASI: [A03](#),  
Hardcopy

The transition of new C2ISR technologies and capabilities to the warfighter in a useful and timely manner is a longstanding challenge, which is often met through unique solutions to specific warfighter problems, and often compromising interoperability in combat and other field operations. Interoperability is now a major concern and the focus of C2ISR development. The most effective way to address this concern is through the integrated development of C2ISR components. However, integration is not readily accommodated in the present acquisition and PPBS processes, one reason why there has been lots of discussion with modest results. In this paper we recommend a new approach to integration, namely that integration be viewed as an explicit result, not just as an attribute of C2ISR systems. We then look at the processes and the problems from this perspective and make some recommendations for providing integrated and interoperable new technology to the warfighter in a timely manner.

DTIC

*Command and Control; Interoperability; Systems Integration*

**20070001663** Air Force Research Lab., Rome, NY USA

**Global Connectivity to Aerospace Forces Via SATCOM**

Cook, William G; Jan 1999; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458568; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458568>; Avail.: CASI: [A02](#),  
Hardcopy

There is an evolving need in the commercial markets for low cost airborne receive antennas and potentially, low cost steerable antennas for 2-way fixed satellite service. These requirements are initially emerging from the slowly developing Ku-band pay-per-view TV market for commercial airlines. In the early 2000's, Low Earth Orbit (LEO) based satellite systems will be providing initial service for wideband 2-way communications at 30 and 20 GHz. One such system, Teledesic, will primarily offer fixed satellite service, however there are tentative plans on providing 2-way communications service for commercial aircraft. The baseline plan is to use phased array antennas on commercial aircraft to provide this connectivity. Spaceway NGSO is also planning on the use of phased arrays antennas for ground terminals earmarked for many home and business sites. This paper will discuss some Ku-band mechanical and electrically steered aircraft antennas currently being

developed for commercial applications. The paper will also discuss the differences between the commercial and military aircraft antenna requirements and what steps should be taken to leverage the commercial antenna developments.

DTIC

*Communication Satellites; Satellite Communication*

**20070001693** Naval Research Lab., Washington, DC USA

**Investigation of the Factors Involved in the Development of a Continuously-Variable Receiver (Model XCS-2) for the 225-400 MC Frequency Range**

Maiden, R M; Steckel, J K; Sep 19, 1946; 29 pp.; In English

Report No.(s): AD-A458626; NRL-R-2978; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458626>; Avail.:

CASI: [A03](#), Hardcopy

The preliminary research and development on a continuously-variable receiver (Model XCS-2) for the 225-400 Mc frequency range is described. The development of an i-f amplifier and calibrator for this receiver is also discussed. Recommendations for future research and development are proposed.

DTIC

*Frequency Ranges; Radio Receivers; Receivers*

**20070001701** Aptima, Inc., Woburn, MA USA

**Designing the Information Space and Physical Layout for a Command Center Based on an Optimized Organizational Structure**

MacMillan, Jean; Paley, Michael J; Levchuk, Yuri N; Serfaty, Daniel; Jan 1999; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458636; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458636>; Avail.: CASI: [A02](#),

Hardcopy

This paper presents a method for designing the physical layout of a command center to best support team performance, based on the communication and information structure of the team. The command center design method is based on an optimized team design model that produces the best team structure for a specific mission. Using information about the team's communication patterns and information needs, we apply model-based principles to evaluate candidate designs for the physical layout of the command center and to develop designs best suited to the team structure.

DTIC

*Command and Control; Layouts*

**20070001711** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Multiple Approaches to Robust Speech Recognition**

Stern, Richard M; Liu, Fu-Hua; Ohshima, Yoshiaki; Sullivan, Thomas M; Acero, Alejandro; Jan 1992; 7 pp.; In English

Contract(s)/Grant(s): N00039-91-C-0158

Report No.(s): AD-A458653; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458653>; Avail.: CASI: [A02](#),

Hardcopy

This paper compares several different approaches to robust speech recognition. We review CMU's ongoing research in the use of acoustical pre-processing to achieve robust speech recognition, and we present the results of the first evaluation of pre-processing in the context of the DARPA standard ATIS domain for spoken language systems. We also describe and compare the effectiveness of three complementary methods of signal processing for robust speech recognition: acoustical pre-processing, microphone array processing, and the use of physiologically-motivated models of peripheral signal processing. Recognition error rates are presented using these three approaches in isolation and in combination with each other for the speaker-independent continuous alphanumeric census speech recognition task.

DTIC

*Signal Processing; Speech Recognition; Telephones*

**20070001715** Carnegie-Mellon Univ., Pittsburgh, PA USA

**An Overview of the SPHINX-II Speech Recognition System**

Huang, Xuedong; Alleva, Fileno; Hwang, Mei-Yuh; Rosenfeld, Ronald; Jan 1993; 7 pp.; In English

Contract(s)/Grant(s): N00039-91-C-0158

Report No.(s): AD-A458658; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458658>; Avail.: CASI: [A02](#),

Hardcopy



ABSTRACT In the past year at Carnegie Mellon steady progress has been made in the area of acoustic and language modeling. The result has been a dramatic reduction in speech recognition errors in the SPHINX-II system. In this paper, we review SPHINX-I/and summarize our recent efforts on improved speech recognition. Recently SPHINX-I/ achieved the lowest error rate in the November 1992 DARPA evaluations. For 5000-word, speaker-independent, continuous, speech recognition, the error rate was reduced to 5%.

DTIC

*Errors; Speech Recognition; Sphinx*

**20070001724** SRI International Corp., Menlo Park, CA USA

**Progressive-Search Algorithms for Large-Vocabulary Speech Recognition**

Murveit, Hy; Butzberger, John; Digalakis, Vassilios; Weintraub, Mitch; Jan 1993; 5 pp.; In English

Contract(s)/Grant(s): N00014-92-C-0154

Report No.(s): AD-A458668; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458668>; Avail.: CASI: A01, Hardcopy

The authors describe a technique they call 'Progressive Search,' which is useful for developing and implementing speech recognition systems with high computational requirements. The scheme iteratively uses more and more complex recognition schemes, where each iteration constrains the search space of the next. An algorithm, the 'Forward-Backward Word-Life Algorithm,' is described. It can generate a word lattice in a progressive search that would be used as a language model embedded in a succeeding recognition pass to reduce computation requirements. They show that speed-ups of more than an order of magnitude are achievable with only minor costs in accuracy.

DTIC

*Accuracy; Algorithms; Search Profiles; Speech Recognition*

**20070001894** Massachusetts Inst. of Tech., Cambridge, MA USA

**Distributed Asynchronous Optimal Routing in Data Networks**

Tsitsiklis, John N; Bertsekas, Dimitri P; Aug 1984; 9 pp.; In English

Contract(s)/Grant(s): N00014-75-C-1183

Report No.(s): AD-A458791; LIDS-P-1399; No Copyright; Avail.: CASI: A02, Hardcopy

We prove convergence of a distributed gradient projection method for optimal routing in a data communication network. The analysis is carried out without any synchronization assumptions and takes into account the possibility of transients caused by updates in the routing strategy being used.

DTIC

*Communication Networks; Convergence; Data Management; Synchronism*

**20070001901** Naval Research Lab., Washington, DC USA

**A Direct-Reading Four-Decade Divider**

McGeogh, J E; Jensen, G K; Oct 31, 1952; 25 pp.; In English

Report No.(s): AD-A458801; NRL-TR-4070; No Copyright; Avail.: CASI: A03, Hardcopy

A proposal for a direct-reading frequency meter was made in NRL Report 3527 entitled 'Portable Precision Frequency Meter.' The most unique but least known feature in the recommendation was the direct-reading four-decade divider which would provide division by any integer, including prime numbers up to 10,999, without becoming frequency sensitive below its upper operating limit. The divider differs from other types of multiple-decade dividers because division by any whole number, including prime numbers, may be selected and continuously obtained, and the actual division ratio may be directly read from the dial settings. A direct-reading four-decade frequency divider, successfully completed at NRL, was developed to provide step-frequency control of a disciplined oscillator as used in a frequency meter. The divider operates for any input frequency from the low audio range up to 450 kc without any form of adjustment except the selection of division ratio. This is a final report on one of the three major phases of the frequency-meter problem; work continues on the other two phases.

DTIC

*Dividers; Frequency Dividers; Reading*

**20070002092** Purdue Univ., West Lafayette, IN USA

**Automatic Detection of Anomalous Behavior in Networks**

Sep 2006; 24 pp.; In English

Contract(s)/Grant(s): F30602-02-2-0217; Proj-7820

Report No.(s): AD-A458332; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Detection; Automatic Control; Anomalies; Communication Networks*

**20070002098** Massachusetts Inst. of Tech., Cambridge, MA USA

**Effectiveness Analysis of C3 Systems**

Bouthonnier, Vincent; Levis, Alexander H; Sep 1982; 10 pp.; In English

Contract(s)/Grant(s): N00014-81-K-0495; N00014-77-C-0532

Report No.(s): AD-A458720; LIDS-P-1238; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458720>; Avail.:

CASI: [A02](#), Hardcopy

A methodology for analyzing and assessing the effectiveness of command, control and communications (C3) systems is developed. The analysis is carried out by characterizing separately both the system and the mission in terms of attributes. These attributes are determined as functions of primitives that describe the system, the mission, and the context within which both operate. Then the system capabilities and the mission requirements are compared in a common attribute space. This comparison leads to the evaluation of partial measures of effectiveness which are then combined to yield a global measure. The methodology is illustrated through the assessment of the effectiveness of a communications network operating in a hostile environment.

DTIC

*Command and Control; Telecommunication*

**20070002099** Unisys Corp., Paoli, PA USA

**Beyond Class A: A Proposal for Automatic Evaluation of Discourse**

Hirschman, Lynette; Dahl, Deborah A; McKay, Donald P; Norton, Lewis M; Linebarger, Marcia C; Jan 1990; 6 pp.; In English

Contract(s)/Grant(s): N000014-89-C0171

Report No.(s): AD-A458704; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458704>; Avail.: CASI: [A02](#),

Hardcopy

The DARPA Spoken Language community has just completed the first trial evaluation of spontaneous query/response pairs in the Air Travel (ATIS) domain. Our goal has been to find a methodology for evaluating correct responses to user queries. To this end, we agreed, for the first trial evaluation, to constrain the problem in several ways: Database Application: Constrain the application to a database query application, to ease the burden of a) constructing the back-end, and b) determining correct responses; Canonical Answer: Constrain answer comparison to a minimal 'canonical answer' that imposes the fewest constraints on the form of system response displayed to a user at each site; Typed Input: Constrain the evaluation to typed input only; Class A: Constrain the test set to single unambiguous intelligible utterances taken without context that have well-defined database answers ('class A' sentences). These were reasonable constraints to impose on the first trial evaluation. However, it is clear that we need to loosen these constraints to obtain a more realistic evaluation of spoken language systems. The purpose of this paper is to suggest how we can move beyond evaluation of class A sentences to an evaluation of connected dialogue, including out-of-domain queries.

DTIC

*Voice Communication; Automatic Control*

**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*.

**20070000019** Brookhaven National Lab., Upton, NY USA

**Future Trends in Microelectronics Impact on Detector Readout**

O'Conner, P.; Apr. 2006; 8 pp.; In English

Report No.(s): DE2006-891913; BNL-76773-2006; No Copyright; Avail.: Department of Energy Information Bridge

Mainstream CMOS is now a well-established detector readout technology. We review technology scaling trends and limits, the implementation of analog circuits in digital CMOS processes, and radiation resistance. Emphasis is placed on the growing importance of power dissipation in ultra-scaled technologies.

NTIS

*Microelectronics; Readout; Analog Circuits; CMOS; Display Devices*

**2007000673** Space and Naval Warfare Systems Center, San Diego, CA USA

**The Influence of Diffusion Fluxes on the Detection Limit of the Jalaite Copper Ion-Selective Electrode**

Zirino, Alberto; Rivera, Ignacio; De Marco, Roland; Pejic, Bobby; Oct 2, 2001; 7 pp.; In English

Report No.(s): AD-A457972; No Copyright; Avail.: CASI: [A02](#), Hardcopy

It has been suggested that electrode dissolution and the concomitant saturation of the electrode's diffusion layer restricts the detection limit of the jalaite Cu ion-selective electrode (ISE) to samples with total Cu levels above  $10(\text{exp}-5)$  mol dm $(\text{exp}-3)$  [1, 2]. This article will use rotating disk electrode (RDE) data for San Diego Bay seawater and Fick's law of diffusion to demonstrate that the static commercial Orion Cu ISE (employing a jalaite membrane) produces a background level of contamination of  $(2.0 \text{ plus or minus } 0.5) \times 10(\text{exp}-8)$  mol dm $(\text{exp}-3)$  total Cu, and the reduced thickness of the Orion Cu ISE's diffusion layer in the presence of hydrodynamic flow [e.g., at an RDE, or in continuous flow analysis (CFA)] lowers the background contamination of Cu to  $\leq 10(\text{exp}-9)$  mol dm $(\text{exp}-3)$ . Furthermore, the RDE Cu ISE employing an electrode fabricated using jalaite precipitated in 80% excess Na<sub>2</sub>S, so as to minimize the presence of occluded and leachable Cu salts and extraneous phases such as silver sulfide [3 - 5], reveals an improvement in the lower limit of detection compared to the commercial Orion Cu ISE.

DTIC

*Copper; Diffusion; Ion Selective Electrodes*

**2007000730** Massachusetts Inst. of Tech., Cambridge, MA USA

**Envelope Detection of Orthogonal Signals with Phase Noise**

Azizoglu, Murat; Humblet, Pierre A; Dec 12, 1990; 53 pp.; In English

Contract(s)/Grant(s): F19628-90-C-0002; 8802991-NCR

Report No.(s): AD-A458093; LIDS-P-2010; No Copyright; Avail.: CASI: [A04](#), Hardcopy

We analyze the performance of receivers which use envelope detection at IF to detect optical signals with orthogonal modulation formats. We obtain exact closed-form expressions for the error probability conditioned on the normalized envelope. The only information necessary for obtaining the unconditional error probability is the set of tilted moments of the envelope. We then provide an approximation to this envelope which is not only accurate to the first order in phase noise strength, but also has the same range as the actual random envelope. We use this approximation to obtain the bit error performance of the three receiver models that we consider. We also provide a tight lower bound in closed-form. Finally we extend the analysis to N-ary FSK to observe the improvement due to increased bandwidth use and transmitter/receiver complexity.

DTIC

*Infrared Detectors; Signal Detection; Transmitter Receivers*

**2007000742** Massachusetts Inst. of Tech., Cambridge, MA USA

**A Signal Processing Framework for the Analysis and Application of Chaotic Systems**

Isabelle, Steven H; May 1995; 162 pp.; In English

Contract(s)/Grant(s): N00014-93-1-0686; AFOSR-91-0034-C

Report No.(s): AD-A458116; RLE-TR-593; No Copyright; Avail.: CASI: [A08](#), Hardcopy

One contribution of chaos theory to the engineering research community is the notion that complex, erratic behavior in physical systems need not be the result of stochastic phenomena-such phenomena may result from deterministic mechanisms. This idea has been used in the analyses of several engineering systems. Perhaps more interesting are the several proposed engineering applications that take advantage of the structure of signals generated by chaotic systems. In order to take full advantage of the unique properties of chaotic signals in future applications, this structure must be well characterized. This thesis explores two aspects of this issue-the statistical structure of chaotic signals and the to linear distortion of chaotic signals. In the first portion of the thesis, we concentrate on the time-average behavior of signals generated by chaotic systems with one state variable. Using an analogy between such signals and stationary stochastic processes, we present a framework for analyzing the statistical properties of these chaotic signals. In particular, we provide readily computable analytic expressions

for a broad class of statistics of a large class of chaotic signals. We also present a technique for approximating the statistics of certain chaotic signals for which exact results are unavailable. As an example of the utility of these results, we use them to determine the power spectra of chaotic signals and to analyze a model of a switching DC-DC power converter operating in a chaotic regime. In the second portion of the thesis, we concentrate on chaotic signals that have been linearly filtered. Such signals may arise, for example, when chaotic phenomena are measured through sensors with linear dynamics. We present results relating certain parameters of the original and distorted signals.

DTIC

*Signal Processing; Stochastic Processes; Voltage Converters (DC to DC)*

**20070000751** Massachusetts Inst. of Tech., Cambridge, MA USA

**Linear Models for Large Signal Control of High Power Factor AC-DC Converters**

Mahabir, K; Verghese, G; Thottuvelil, J; Heyman, A; Nov 1989; 12 pp.; In English

Contract(s)/Grant(s): AFOSR-88-0032

Report No.(s): AD-A458127; LIDS-P-1931; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper shows that the large signal behavior of high power factor ac to dc power conditioners can be analyzed via linear models, by using squared output voltage as the state variable. The state equation for general loads (e.g. constant power plus resistive) is obtained by a simple dynamic power balance. Time invariant or periodically varying controllers, acting at the time scales of the line or switching periods respectively, are then easy to design from the resulting averaged or sampled data models.

DTIC

*Alternating Current; Direct Current; Equations of State; Power Converters*

**20070000753** Sverdrup Technology, Inc., Beavercreek, OH USA

**AIRSAM: A Tool for Assessing Airborne Infrared Countermeasures**

Forrai, David; Maier, James; Jan 2000; 8 pp.; In English

Report No.(s): AD-A458135; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Intelligence data is a key component to command and control (C2) decisions. Often intelligence analysts have to provide commanders with timely data in order for them to execute their missions. The Advanced Infrared Countermeasures Assessment Model (AIRSAM) is a tool used by analysts at the National Air Intelligence Center (NAIC) to predict the most likely infrared countermeasure (IRCM) response from aircraft when engaged by a threat using electro-optic (EO) and infrared (IR) weaponry. The Air Force Research Laboratory (AFRL) develops this tool for NAIC. The goal of this tool is to allow the analyst to perform multiple engagement scenarios involving different geometries and IRCM responses in a relatively short period of time (e.g. one day).

DTIC

*Electro-Optics; Optical Countermeasures*

**20070000766** Massachusetts Inst. of Tech., Cambridge, MA USA

**On the Bit Error Rate of Lightwave Systems with Optical Amplifiers**

Humblet, Pierre A; Azizoglu, Murat; Jun 1991; 24 pp.; In English

Contract(s)/Grant(s): 8802991-NCR; F19628-90-C-0002

Report No.(s): AD-A458154; LIDS-P-2015; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We revisit the problem of evaluating the performances of communications systems with optical amplifiers and a wideband optical filter. We compute the exact probability of error and the optimal threshold and compare them with those predicted by Gaussian approximations for ASK, FSK or DPSK modulations, both for ideal photodetectors and for the case where shot noise is significant.

DTIC

*Bit Error Rate; Light Amplifiers; Optical Filters; Telecommunication*

**20070000804** North Carolina State Univ., Raleigh, NC USA

**Autonomous Self-Propelling Microcircuit Particles**

Velev, Orlin D; Chang, Suk T; Paunov, Vesselin N; Petsev, Dimiter N; Nov 2006; 20 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0398

Report No.(s): AD-A458216; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We show that various types of miniature semiconductor diodes floating in water act as self-propelling particles when

powered by external alternating electric field. The millimeter-sized diodes rectify the voltage induced between their electrodes. The resulting electro-osmotic force propels them in the direction of either the cathode or the anode depending on their surface charge. The motion of these rudimentary self-propelling micromachines can be controlled by internal logic. The semiconductor elements could emit light or respond to light, move at internally controlled speed and could be used as propellers for rotating freely-suspended 'gears' and future autonomous micromachines. Diodes embedded into walls of microfluidic channels provide locally distributed pumping or mixing functions powered by a global external field. The combined application of AC and DC fields in such devices allows decoupling the velocity of the particles and the liquid and could be used for on-chip separations.

DTIC

*Autonomy; Microelectronics*

**20070000816** Optical Sciences Corp., Huntsville, AL USA

**Advancements in the Micromirror Array Projector Technology II**

Beasley, D B; Bender, Matt; Crosby, Jay; McCall, Sean; Messer, Tim; Saylor, Daniel A; Jan 2005; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAH01-00-C-R093; DAAH01-00-D-0012

Report No.(s): AD-A458236; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Micromirror Array Projector System (MAPS) is a state-of-the-art dynamic scene projector developed by Optical Sciences Corporation (OSC) for Hardware-In-the-Loop (HWIL) simulation and sensor test applications. Since the introduction of the first MAPS in 2001, OSC has continued to improve the technology and develop systems for new projection and test applications. The MAPS is based upon the Texas Instruments Digital Micromirror Device (DMD) which has been modified to project high resolution, realistic imagery suitable for testing sensors and seekers operating in the UV, visible, NIR, and IR wavebands. This paper reviews the basic design and describes recent developments and new applications of the MAPS technology. Recent developments for the MAPS include increasing the format of the micromirror array to 1280x1024, increasing the video frame rate to 230 Hz, development of a DMD active cooling system, and development of a high-temperature illumination blackbody.

DTIC

*Arrays; High Resolution; High Temperature; Microelectromechanical Systems; Projectors*

**20070000838** Army Research Lab., Adelphi, MD USA

**The Present State of Amperometric Nanowire Sensors for Chemical and Biological Detection**

Ervin, M H; Kilpatrick, S J; Lombardo, C; Nichols, B M; Perrella, A C; Wickenden, A E; Oct 2006; 48 pp.; In English

Report No.(s): AD-A458282; ARL-TR-3962; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report reviews the research in chemical sensing at the nanometer scale using amperometric detection focusing on publications from January 2004 to September 2005. The devices discussed fall into two categories: chemresistors and chemFETs. In either configuration, the number of carriers available in the channel, and hence the device's transconductance, changes as a function of analyte exposure. Devices based on inorganic nanowires (specifically limited to metal oxides and silicon), conductive organic polymer fibers, and carbon nanotubes are discussed as issues of sensitivity, selectivity, response/refresh times, etc.

DTIC

*Biological Effects; Detection; Electrical Measurement; Nanotechnology; Nanowires*

**20070001128** QSS Group, Inc., Cleveland, OH, USA

**Switching Characteristics of a 4H-SiC Based Bipolar Junction Transistor to 200 C**

Niedra, Janis M.; November 2006; 13 pp.; In English

Contract(s)/Grant(s): NAS3-00145; NAS3-98008; WBS 799.03.01

Report No.(s): NASA/CR-2006-214257; E-15540; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001128>;

Avail.: CASI: [A03](#), Hardcopy

Static curves and resistive load switching characteristics of a 600 V, 4 A rated, SiC-based NPN bipolar power transistor (BJT) were observed at selected temperatures from room to 200 C. All testing was done in a pulse mode at low duty cycle (approx.0.1 percent). Turn-on was driven by an adjustable base current pulse and turn-off was accelerated by a negative base voltage pulse of 7 V. These base drive signals were implemented by 850 V, gated power pulsers, having rise-times of roughly 10 ns, or less. Base charge sweep-out with a 7 V negative pulse did not produce the large reverse base current pulse seen in

a comparably rated Si-based BJT. This may be due to a very low charge storage time. The decay of the collector current was more linear than its exponential-like rise. Switching observations were done at base drive currents ( $I_{(sub B)}$ ) up to 400 mA and collector currents ( $I_{(sub C)}$ ) up to 4 A, using a 100  $\Omega$  non-inductive load. At  $I_{(sub B)} = 400$  mA and  $I_{(sub C)} = 4$  A, turn-on times typically varied from 80 to 94 ns, over temperatures from 23 to 200 C. As expected, lowering the base drive greatly extended the turn-on time. Similarly, decreasing the load current to  $I_{(sub C)} = 1$  A with  $I_{(sub B)} = 400$  mA produced turn-on times as short as 34 ns. Over the 23 to 200 C range, with  $I_{(sub B)} = 400$  mA and  $I_{(sub C)} = 4$  A, turn-off times were in the range of 72 to 84 ns with the 7 V sweep-out.

Author

*Junction Transistors; High Temperature; Bipolar Transistors; Switching; Static Loads; Electric Potential*

**20070001129** QSS Group, Inc., Cleveland, OH, USA

**Junction-to-Case Thermal Resistance of a Silicon Carbide Bipolar Junction Transistor Measured**

Niedra, Janis M.; November 2006; 18 pp.; In English

Contract(s)/Grant(s): NAS3-00145; WBS 799.03.01

Report No.(s): NASA/CR-2006-214258; E-15541; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001129>;

Avail.: CASI: [A03](#), Hardcopy

Junction temperature of a prototype SiC-based bipolar junction transistor (BJT) was estimated by using the base-emitter voltage ( $V_{(sub BE)}$ ) characteristic for thermometry. The  $V_{(sub BE)}$  was measured as a function of the base current ( $I_{(sub B)}$ ) at selected temperatures ( $T$ ), all at a fixed collector current ( $I_{(sub C)}$ ) and under very low duty cycle pulse conditions. Under such conditions, the average temperature of the chip was taken to be the same as that of the temperature-controlled case. At increased duty cycle such as to substantially heat the chip, but same  $I_{(sub C)}$  pulse height, the chip temperature was identified by matching the  $V_{(sub BE)}$  to the thermometry curves. From the measured average power, the chip-to-case thermal resistance could be estimated, giving a reasonable value. A tentative explanation for an observed bunching with increasing temperature of the calibration curves may relate to an increasing dopant atom ionization. A first-cut analysis, however, does not support this.

Author

*Junction Transistors; Temperature Measurement; Bipolar Transistors; Electric Potential; Pulse Amplitude; Thermal Resistance; Silicon Carbides*

**20070001136** QSS Group, Inc., Cleveland, OH, USA

**Fast Turn-Off Times Observed in Experimental 4H SiC Thyristors**

Niedra, Janis M.; November 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS3-00145; NAS3-98008; WBS 799.03.01

Report No.(s): NASA/CR-2006-214259; E-15542; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001136>;

Avail.: CASI: [A03](#), Hardcopy

Room temperature measurements of the turn-off time ( $t_{(sub q)}$ ) are reported for several packaged, npnp developmental power thyristors based on 4H-type SiC and rated 400 V, 2 A. Turn-off is effected by a 50 V pulse of applied reverse voltage, from a state of a steady 1 A forward current. Plots of  $t_{(sub q)}$  against the ramp rate ( $dV_{(sub AK)}/dt$ ) of reapplied forward voltage are presented for preset values of limiting anode-to-cathode voltage ( $V_{(sub AK,max)}$ ). The lowest  $t_{(sub q)}$  measured was about 180 ns. A rapid rise of these  $t_{(sub q)}$  curves was observed for values of  $V_{(sub AK,max)}$  that are only about a fifth of the rated voltage, whereas comparative  $t_{(sub q)}$  plots for a commercial, fast turn-off, Si-based thyristor at a proportionately reduced  $V_{(sub AK,max)}$  showed no such behavior. Hence these SiC thyristors may have problems arising from material defects or surface passivation. The influence the R-C-D gate bypass circuit that was used is briefly discussed.

Author

*Thyristors; Electric Potential; Circuits; Temperature Measurement; Bypasses*

**20070001137** QSS Group, Inc., Cleveland, OH, USA

**A Current Source Method For  $t_{(sub q)}$  Measurement of Fast Switching Thyristors**

Niedra, Janis M.; November 2006; 14 pp.; In English

Contract(s)/Grant(s): NAS3-98008; NAS3-00145; WBS 799.03.01

Report No.(s): NASA/CR-2006-214260; E-15543; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001137>;

Avail.: CASI: [A03](#), Hardcopy

A current source driven circuit has been constructed to measure the turn-off time ( $t_{(sub q)}$ ) of fast-switching SiC

thyristors. This circuit operates from a single power supply and a dual channel pulse generator to provide adjustment of forward current, magnitude and duration of reverse applied voltage, and rate of rise of reapplied forward voltage. Values of  $t(\text{sub } q)$  down to 100 ns can be resolved.

Author

*Pulse Generators; Switching; Thyristors; Circuits*

**20070001148** NAVSYS Corp., Colorado Springs, CO USA

**Indoor Navigation Test Results using an Integrated GPS/TOA/Inertial Navigation System**

Brown, Alison; Lu, Yan; Jan 2006; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458227; No Copyright; Avail.: CASI: [A02](#), Hardcopy

NAVSYS has developed a networked radionavigation approach for operating in urban environments where GPS signals can be significantly attenuated or completely blocked. The networked radionavigation approach is based on a Software Defined Radio (SDR) testbed, which combines Global Positioning System (GPS), wireless communications, and Time-of-Arrival (TOA) 'Pseudolite' technology to provide location indoors for applications such as first responders, warfighters operating in urban terrain, and location-based services. This system has been integrated with a low-cost Micro-Electro-Mechanical System (MEMS) Inertial Measurement Unit (IMU) to provide an integrated GPS/TOA/inertial man-portable navigation system. The system architecture and test results showing its performance for indoor navigation are presented in this paper.

DTIC

*Architecture (Computers); Cities; Global Positioning System; Inertial Navigation; Microelectromechanical Systems; Navigation; Portable Equipment; Telecommunication*

**20070001209** Air Force Research Lab., Rome, NY USA

**Frequency Stabilization of a Waveguide Laser Using Pound-Drever-Hall**

Sep 2006; 11 pp.; In English

Report No.(s): AD-A458445; AFRL-SN-RS-TP-2006-14; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Frequency Stability; Waveguide Lasers*

**20070001447** Army Research Lab., Adelphi, MD USA

**Isotope Generated Electron Density in Silicon Carbide Direct Energy Converters**

Oct 2006; 22 pp.; In English

Report No.(s): AD-A458321; ARL-TR-3964; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Direct Power Generators; Electron Density (Concentration); Isotopes; Silicon Carbides; Power Converters*

**20070001470** NASA Glenn Research Center, Cleveland, OH, USA

**High Power High Efficiency Ka-Band Power Combiners for Solid-State Devices**

Freeman, Jon C.; Wintucky, Edwin G.; Chevalier, Christine T.; November 2006; 29 pp.; In English

Contract(s)/Grant(s): WBS 122272.01.03.0473.01

Report No.(s): NASA/TM-2006-214447; E-15710; Copyright; Avail.: CASI: [A03](#), Hardcopy

Wide-band power combining units for Ka-band are simulated for use as MMIC amplifier applications. Short-slot couplers as well as magic-tees are the basic elements for the combiners. Wide bandwidth (5 GHz) and low insertion (approx.0.2 dB) and high combining efficiencies (approx.90 percent) are obtained.

Author

*Power Efficiency; Bandwidth; Integrated Circuits; Magic Tees; Couplers; Broadband*

**20070001512** Delaware Univ., Newark, DE USA

**Magnetic Meta-Materials for Electromagnetic Applications**

Jun 2006; 67 pp.; In English

Contract(s)/Grant(s): F33615-01-2-2166; Proj-3145

Report No.(s): AD-A458377; PHYS-332116; PHYS-332117; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Magnetic Materials; Electromagnetism*

**20070001555** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Retrieving Storm Electric Fields from Aircraft Field Mill Data: Part II: Applications**

Koshak, William; Mach, D. M.; Christian H. J.; Stewart, M. F.; Bateman M. G.; Journal of Atmospheric and Oceanic Technology; October 04, 2006; 20 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The Lagrange multiplier theory developed in Part I of this study is applied to complete a relative calibration of a Citation aircraft that is instrumented with six field mill sensors. When side constraints related to average fields are used, the Lagrange multiplier method performs well in computer simulations. For mill measurement errors of 1 V m(sup -1) and a 5 V m(sup -1) error in the mean fair-weather field function, the 3D storm electric field is retrieved to within an error of about 12%. A side constraint that involves estimating the detailed structure of the fair-weather field was also tested using computer simulations. For mill measurement errors of 1 V m(sup -1), the method retrieves the 3D storm field to within an error of about 8% if the fair-weather field estimate is typically within 1 V m(sup -1) of the true fair-weather field. Using this type of side constraint and data from fair-weather field maneuvers taken on 29 June 2001, the Citation aircraft was calibrated. Absolute calibration was completed using the pitch down method developed in Part I, and conventional analyses. The resulting calibration matrices were then used to retrieve storm electric fields during a Citation flight on 2 June 2001. The storm field results are encouraging and agree favorably in many respects with results derived from earlier (iterative) techniques of calibration.

Author

*Electric Fields; Storms; Aircraft Maneuvers; Computerized Simulation*

**20070001560** Newcastle-upon-Tyne Univ., Newcastle, UK

**Determining the Specification of a Control System: An Illustrative Example**

Coleman, J. W.; Jun. 2006; 22 pp.; In English

Report No.(s): PB2007-102201; CS-TR-974; Copyright; Avail.: National Technical Information Service (NTIS)

Creating the specification of a system by focusing primarily on the detailed properties of the digital controller can lead to complex descriptions that are nearly incoherent. An argument given by Hayes, Jackson, and Jones provides reasons to focus first on the wider environment in which the system will reside. In their approach are two major ideas: pushing out the specification boundaries, and carefully distinguishing between the requirements of the system and the assumptions about the environment. Pushing out the boundaries of the system specification to include the pragmatic intent of the system being specified allows the specification to be understood relative to the environmental context, rather than remaining a mysterious black box in isolation. Clarifying the distinction between assumptions about the environment and requirements that the specification must meet increases the clarity of the specification, and has the potential to seriously reduce the complexity of the final specification. The example of a gas burner is explored in depth to illustrate this approach to system specification.

NTIS

*Specifications; Control Systems Design; Controllers*

**20070001571** Texas Center for Superconductivity, Houston, TX, USA

**Systematic Evaluation of  $J_c$  Decrease in Thick Film Coated Conductors. (Final Report, October 1, 2003-December 31, 2003)**

Ignatiev, A.; Goyal, A.; May 10, 2006; 14 pp.; In English

Report No.(s): DE2006-885091; No Copyright; Avail.: Department of Energy Information Bridge

We proposed to address both the thickness dependence of  $J_c$ , in thick film YBCO coated conductors through an application of a suite of new measurement techniques to thick film wire samples produced by commercially viable coated conductor technologies. We proposed to fabricate a series of thick film YBCO samples (from 0.5 to 8  $\mu$ m thickness) on oxide and RABiTS substrates by high growth rate photo assisted MOCVD. The oxide substrates, although not commercially viable, will play an important role in helping to better elucidate the  $J_c$  vs. thickness problem by partially eliminating the question of quality of cube texturing of the substrate. The Proposed Objectives were only partially fulfilled due to premature termination of funding of the 3-year program after only the first year.

NTIS

*Coatings; Conductors; Thick Films; Thickness*

**20070001574** Lawrence Livermore National Lab., Livermore, CA USA

**Performance of Low-Rank QR Approximation of the Finite Element Biot-Savart Law**

White, D. A.; Fassenfest, B. J.; Jan. 18, 2006; 8 pp.; In English

Report No.(s): DE2006-885135; UCRL-CONF-218238; No Copyright; Avail.: National Technical Information Service (NTIS)



We are concerned with the computation of magnetic fields from known electric currents in the finite element setting. In finite element eddy current simulations it is necessary to prescribe the magnetic field (or potential, depending upon the formulation) on the conductor boundary. In situations where the magnetic field is due to a distributed current density, the Biot-Savart law can be used, eliminating the need to mesh the nonconducting regions. Computation of the Biot-Savart law can be significantly accelerated using a low-rank QR approximation. We review the low-rank QR method and report performance on selected problems.

NTIS

*Biot-Savart Law; Electric Current; Electromagnetic Fields; Finite Element Method; Magnetic Fields*

**20070001584** National Oceanic and Atmospheric Administration, Boulder, CO, USA

**Review of Reference Radiation Scale Transfer to Broadband Global SW Pyranometers in Use By The NOAA/GMD Solar Radiation Program and Its Predecessors**

Nelson, D.; Sep. 2006; 16 pp.; In English

Report No.(s): PB2007-100060; NOAA/TM-OAR-GMD-16; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report reviews the history of nineteen broadband solar shortwave (2 pi steradian field-of-view) sensors (pyranometers) used for measurements of downwelling short wave solar irradiance by the NOAA/Global Monitoring Division (GMD) and its predecessors, the CMDL (Climate Monitoring and Diagnostics Laboratory) and the GMCC (Geophysical Monitoring for Climate Change), for the period 1977 through 2004, as presented in Dutton et al., 2006. Monitoring locations discussed in Dutton et al., 2006 include the four NOAA baseline observatories; Pt. Barrow Alaska; Mauna Loa Observatory on the island of Hawaii, the Samoa Observatory located in American Samoa on the island of Tutuila, the CAF (Clean Air Facility) at Amundson-Scott Station Antarctica, plus the NOAA/Solar Radiation Facility (SRF) in Boulder, Colorado. For the duration of the time series (1977-2004) each sensor was regularly compared with calibrated standards traceable to a consistent internationally adopted radiometric reference scale, either via side-by-side on-site comparisons with a calibrated traveling standard pyranometer or exchanged with a calibrated sensor and returned to Boulder for recalibration at the NOAA/SRF. A data archive on magnetic media of all historical SRF data collected for calibration purposes at the NOAA/SRF since 1977 was used in the preparation of this report with the intention of documenting the stability and precision of NOAA radiometric reference(s), and verifying the historical radiometric scale transfers to NOAA/GMD pyranometers.

NTIS

*Broadband; Pyranometers; Radiative Transfer; Solar Radiation; Solar Sensors*

**20070001610** Burns (Greer) and Crain, Chicago, IL, USA

**Methods for Test Application and Test Content Generation for AC Faults in Integrated Circuits**

Dey, S.; Bai, X.; Chen, L.; Krstic, A.; 27 Sep 04; 25 pp.; In English

Contract(s)/Grant(s): DARPA-98-DT-660

Patent Info.: Filed Filed 27 Sep 04; US-Patent-Appl-SN-10-951-278

Report No.(s): PB2007-100933; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for generating a software-based self-test in an integrated circuit includes extracting constraints for corresponding instructions for the integrated circuit, modeling the constraints for a plurality of timeframes and performing constrained test pattern generation on the integrated circuit using the models. An automatic test pattern generation method for an AC fault in an integrated circuit includes identifying a current desired condition for triggering the AC fault, determining whether the current desired condition is feasible, and identifying a subsequent desired condition for triggering the AC fault if the current desired condition is not feasible. The method further includes determining whether the subsequent desired condition for triggering the AC fault is feasible, and searches for test vectors for realizing the current desired condition or subsequent desired condition which is determined to be feasible.

NTIS

*Alternating Current; Integrated Circuits; Patent Applications*

**20070001614** California Univ., Santa Cruz, CA USA

**Thermoelectric, Thermionic and Thermophotovoltaic Energy Conversion**

Shakouri, Ali; Jan 2005; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458490; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458490>; Avail.: CASI: [A02](#), Hardcopy

Key characteristics of thermoelectric, ballistic thermionic and quasi diffusive thermionic energy converters are compared.

First, the main assumptions used to derive the linear Boltzmann transport equations for electrons are examined and the possibility that a higher order transport coefficient may become relevant is discussed. In the linear transport regime, there is a fundamental trade off between high Seebeck coefficient and high electrical conductivity for bulk materials and for many multilayer structures due to the interplay between electronic density-of-states (DOS) and electron group velocity and also due to the shape of DOS versus energy curve deep inside a band. While low dimensional structures alter the density-of-states, a similar trade off still exists. If large barrier heights and high doping concentrations could be achieved solid-state thermionic energy converters would be able to alleviate this trade off, thereby achieving a very high thermoelectric power factor. For this to occur, the electron transverse momentum perpendicular to heterostructure barriers must not be conserved. This can be achieved with non-planar structures or with embedded nanostructures. Finally, a comparison between thermoelectric/thermionic devices and thermophotovoltaic energy converters shows a difference in the average energy of the emitted hot carriers due to the difference between electronic and photonic density-of-states in the reservoirs. The use of both electrons and photons from a hot reservoir or the engineering of the reservoir density-of-states may provide additional means to achieve higher efficiency in energy conversion devices and to approach the limit given by the entropy generation more easily.

DTIC

*Energy Conversion; Thermoelectricity; Thermophotovoltaic Conversion*

**20070001619** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Pegasus: An Efficient Intermediate Representation**

Budiu, Mihai; Goldstein, Seth C; Apr 2002; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0659

Report No.(s): AD-A458495; CMU-CS-02-107; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458495>; Avail.:

CASI: **A03**, Hardcopy

This paper presents Pegasus, a compact and expressive intermediate representation for imperative languages. The representation is suitable for target architectures supporting predicated execution and aggressive speculation. In this paper, the authors present Pegasus (Predicated Explicit GAted Simple Uniform SSA), a new intermediate representation (IR) that makes explicit -- in a single representation -- the control flow, the data flow, and the synchronization of operations that interfere through side-effects. More importantly, Pegasus has a clean semantics, independent of the target architecture. This enables its use to bridge the gap between C programs and hardware implementations, enabling the conversion from an imperative, single-threaded model of computation to a highly parallel, asynchronous, explicitly synchronized target. Pegasus combines predicated static single assignment (SSA) representation and gated SSA, making explicit the switching of data values, enabling the compiler to use predication and aggressive speculation for exposing instruction-level parallelism (ILP). In the second section, the authors describe the basic components of Pegasus and how the IR can be constructed starting from an imperative language. The operational semantics of Pegasus is described informally in Section 3, and formally in Appendix A. Section 4 shows that the compactness of Pegasus enables the use of extremely simple and efficient algorithms for many major compiler optimizations; in particular, they exhibit linear-time algorithms for almost all of the scalar optimizations from Muchnick. The versatility of Pegasus is demonstrated in Section 5, where they describe its use in a compiler that translates ANSI C programs into hardware.

DTIC

*C (Programming Language); Compilers; Computers; Optimization; Parallel Processing (Computers)*

**20070001629** California Univ., Santa Cruz, CA USA

**Thin Film ZT Characterization using Transient Harman Technique**

Bian, Zhixi; Yan, Zhang; Schmidt, Holger; Shakouri, Ali; Jan 2005; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458516; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458516>; Avail.:

CASI: **A01**,  
Hardcopy

Thin-film thermoelectric materials offer great potential for improving the thermoelectric figure of merit ZT due to the freedom of tailoring the electron and heat transport. The characterization of these thin films is difficult because of the coexistence of the substrate, non-ideal contact, and asymmetric three-dimensional device structure. We have investigated theoretically and experimentally the transient Harman method for measuring the ZT of a thin film Si/SiGe superlattices on a silicon substrate. 3D electrothermal simulations allow us to identify the contribution of the thin film and the substrate to the transient response. On the measurement side, ringing at short times and noise can be significantly improved by using high-speed packages and electrical impedance matching. The Joule heating contribution to the thermoelectric EMF is

separated from the Peltier one by the bipolar measurement. The parasitic non-ideal effects of contacts and substrate can be removed by variable thickness superlattice method.

DTIC

*Characterization; Thermoelectric Cooling; Thin Films*

**20070001630** Science Applications International Corp., McLean, VA USA

**Novel Coatings for Enhancement of Light-Emitting Diodes (LEDs)**

Smilgys, Russell V; Shatz, Neri; Bortz, John; Oct 28, 2006; 129 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W31P4Q-05-C-R017; ARPA ORDER-T169

Report No.(s): AD-A458518; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458518>; Avail.: CASI: A07, Hardcopy

This report summarizes work performed by Science Applications International Corporation (SMC) in fulfillment of a contract with the Defense Advanced Research Projects Agency. SMC's partner in this work was Lumileds, a major manufacturer of high power LEDs. Since SMC did not have a contractual relationship with Lumileds - which was agreed to by all parties at the beginning - SMC's performance on some tasks was ultimately limited by Lumileds' cooperation. One task was to investigate novel coatings that could protect and improve the performance of light emitting diodes (LEDs). Another task was to investigate methods to improve the stability and performance of a phosphor coating on an LED die. The final task was to develop original designs that could improve the external quantum efficiency of LEDs.

DTIC

*Augmentation; Light Emitting Diodes; Protective Coatings*

**20070001642** Wisconsin Univ., Madison, WI USA

**Microfabricated Traveling Wave Tubes for High Power Millimeter-Wave and THz-regime Sources**

Booske, John H; Weide, Dan van der; Jiang, Hongrui; Limbach, Steve; Sengele, Sean; Marshal, Al; Yang, Ben; Marconnet, Amy; He, Mike; Drezdson, Sam; Oct 31, 2006; 15 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0147

Report No.(s): AD-A458532; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458532>; Avail.: CASI: A03, Hardcopy

The millimeter-wave (MMW) and terahertz (THz)-regime portions of the electromagnetic spectrum have enormous application potential, including high-data-rate communications, remote sensing and threat detection, high resolution radar, biomedical imaging, and spectroscopic analysis. To exploit this potential, new sources of coherent electromagnetic radiation are needed in the frequency range of 100 - 1000 GHz. The ideal sources would provide high power with high efficiency in a compact, lightweight, and low-cost package. Many of the applications require bandwidths of several percent (relative) or greater and both amplifiers and oscillators are needed. Vacuum electronic devices, such as traveling wave tubes (TWTs) meet many of these requirements but are constrained by complex fabrication methods that become impractical at frequencies of 100 GHz and above. This research is investigating new methods for TWT fabrication, derived from semiconductor microfabrication technologies. Various microfabrication techniques are under investigation, to identify those that are optimally suited. One critical piece of research is to measure the passive microwave losses of a 400 GHz waveguide made by these microfabrication methods. The final goal includes a study of the characteristics of a microfabricated TWT using a new electron-beam source designed for MMW and THz-regime vacuum device research

DTIC

*Etching; Microelectromechanical Systems; Millimeter Waves; Reactivity; Traveling Wave Tubes*

**20070001691** Army Tank-Automotive and Armaments Command, Warren, MI USA

**1570V, 14A 4H-SiC Bipolar Darlington with a High Current Gain of Beta<sub>g</sub>462**

Zhao, Jian H; Zhang, Jianhui; Alexandrov, Petre; Burke, Terry; Jan 2003; 4 pp.; In English

Report No.(s): AD-A458623; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458623>; Avail.: CASI: A01, Hardcopy

This paper reports the design, fabrication and characterization of a 4H-SiC bipolar Darlington with both high DC common emitter current gain and high voltage. The driving and output transistors are designed and fabricated on the same chip with a 12μm, 8.5x10<sup>15</sup>cm<sup>-3</sup> doped drift layer and a 1 μm 4.1x10<sup>17</sup>cm<sup>-3</sup> doped p base. The Darlington's drive transistor is capable of 1,600V and 5A with a maximum current gain beta<sub>(sub 1)</sub> over 25 at a collector current density J<sub>(sub C1)</sub>=250A/cm<sup>2</sup> with a specific on-resistance (RSP\_ON) of 12.2mOhmcm<sup>2</sup>. The output transistor can handle over 23A and

a blocking voltage higher than 1600V with a peak current gain  $\beta_{DC}$  at  $J_{C2}=261\text{A/cm}^2$  and an  $R_{SP\_ON}$  of  $13.4\text{m}\Omega\text{cm}^2$ . The Darlington's DC current gain at room temperature is found to increase with the collector current, up to 462 at  $I_{C2}=13.9\text{A}$  ( $232\text{A/cm}^2$ ), limited by the measurement instrument. The Darlington can block voltages up to 1571V, conduct an  $I_{C2}=14\text{A}$  at  $V_{CE}=7.5\text{V}$  and provide a differential  $R_{SP\_ON}$  of  $16.7\text{m}\Omega\text{cm}^2$  at  $J_{C2}$  up to over  $240\text{A/cm}^2$ . Temperature-dependent I-V characteristics will be presented for the driving and output transistors. DC common emitter current gains will also be reported for the driving and output transistors as well as the Darlington.

DTIC

*Bipolar Transistors; Bipolarity; High Current; Transistors*

**20070001860** California Univ., Santa Cruz, CA USA

**High Resolution Non-Contact Thermal Characterization Semiconductor Devices**

Christofferson, James; Vashae, Daryoosh; Shakouri, Ali; Melese, Philip; Baskin, Jack; Jan 2006; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458443; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Non-contact optical methods can be used for sub micron surface thermal characterization of active semiconductor devices. Point measurements were first made, and then real time thermal images were acquired with a specialized PINarray detector. This method of thermal imaging can have spatial resolution better than the diffraction limit of an infrared camera and can work in a wide range of ambient temperatures. The experimentally obtained thermal resolution is on the order of 50mK.

DTIC

*Characterization; High Resolution; Optical Properties; Semiconductor Devices; Thermal Mapping*

**20070001870** University of Southern California, Los Angeles, CA USA

**Semiconductor Device Synthesis**

Levi, A F; Dec 15, 2006; 47 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0029

Report No.(s): AD-A458741; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A systematic approach towards optimal design of optoelectronic semiconductor devices has been developed. The adaptive design of excitonic absorption in broken-symmetry quantum wells has been used as a prototype system with which to explore the device synthesis method. The device model used captured the basic exciton absorption physics but did not include RF design. Electro-absorption modulator designs were investigated experimentally and a modulator with 25 GHz small signal -3 dB response was measured near 1550 nm wavelength. This device has performance comparable to the best commercially available modulator from Oki electric. Further improvements to device performance could be achieved by improving RF design, in particular, incorporation of traveling wave electrodes. To become part of the semiconductor device synthesis procedure the physical model of the device should incorporate these and other aspects of RF design.

DTIC

*Electro-Optics; Semiconductor Devices*

**20070001973** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Retrieving Storm Electric Fields from Aircraft Field Mill Data, Part 1, Theory**

Koshak, W. J.; Journal of Atmospheric and Oceanic Technology; October 2006; Volume 23, pp. 1290-1291; In English; Copyright; Avail.: Other Sources

It is shown that the problem of retrieving storm electric fields from an aircraft instrumented with several electric field mill sensors can be expressed in terms of a standard Lagrange multiplier optimization problem. The method naturally removes aircraft charge from the retrieval process without having to use a high voltage stinger and linearly combined mill data values. It allows a variety of user-supplied physical constraints (the so-called side constraints in the theory of Lagrange multipliers) and also helps improve absolute calibration. Additionally, this paper introduces an alternate way of performing the absolute calibration of an aircraft that has some benefits over conventional analyses. It is accomplished by using the time derivatives of mill and pitch data for a pitch down maneuver performed at high (greater than 1 km) altitude. In Part II of this study, the above methods are tested and then applied to complete a full calibration of a Citation aircraft.

Author

*Electric Fields; Storms; Mathematical Models; Sensors; Aircraft Maneuvers; Calibrating*

**20070001980** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Application of RADSAFE to Model Single Event Upset Response of a 0.25 micron CMOS SRAM**

Warren, Kevin M.; Weller, Robert A.; Sierawski, Brian; Reed, Robert A.; Mendenhall, Marcus H.; Schrimpf, Ronald D.; Massengill, Lloyd; Porter, Mark; Wilkerson, Jeff; LaBel, Kenneth A.; Adams, James; [2006]; 1 pp.; In English; The 2006 Radiation Effects on Components and Systems Workshop, 27-29 Sep. 2006, Athens, Greece; Copyright; Avail.: CASI:

[A01](#), Hardcopy

The RADSAFE simulation framework is described and applied to model Single Event Upsets (SEU) in a 0.25 micron CMOS 4Mbit Static Random Access Memory (SRAM). For this circuit, the RADSAFE approach produces trends similar to those expected from classical models, but more closely represents the physical mechanisms responsible for SEU in the SRAM circuit.

Author

*CMOS; Random Access Memory; Single Event Upsets; Models*

**20070002040** IP Legal Strategies Group P.C., Centerville, MA, USA

**Charge Barrier Flow-Through Capacitor**

Andelman, M. D.; Walker, G. S.; 7 Dec 04; 31 pp.; In English

Contract(s)/Grant(s): DARPA-DAAD-19-99-C-0033

Patent Info.: Filed 7 Dec 04; US-Patent-Appl-SN-11-007-566

Report No.(s): PB2007-100937; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Flow-through capacitors are provided with one or more charge barrier layers. Ions trapped in the pore volume of flow-through capacitors cause inefficiencies as these ions are expelled during the charge cycle into the purification path. A charge barrier layer holds these pore volume ions to one side of a desired flow stream, thereby increasing the efficiency with which the flow-through capacitor purifies or concentrates ions.

NTIS

*Capacitors; Patent Applications*

## 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*.

**20070000669** Network Computing Services, Inc., Minneapolis, MN USA

**Effect of Material Phase Change on Penetration and Shock Waves**

Holmquist, Timothy J; Johnson, Gordon R; Templeton, Douglas W; Jan 2003; 9 pp.; In English

Report No.(s): AD-A457966; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper has presented computed results that investigated the effect a material phase change, and strength, had on penetration and shock waves. Three phase change conditions and three levels of material strength were used. The results showed that penetration was very sensitive to the level of material strength and less sensitive to the phase change pressure. The shock wave response showed more sensitivity to the phase change condition and less sensitivity to the level of strength. More importantly, the results demonstrated that when a volume loss phase change occurs, it produces a softer material response, which reduces the material resistance. The effectiveness of an armor material depends on many of its characteristics. It appears from this work that the presence of a volume loss phase change reduces the ballistic efficiency of the material.

DTIC

*Penetration; Shock Waves*

**20070000720** Iowa Univ., Iowa City, IA USA

**Towing Tank Experiments of Resistance, Sinkage and Trim, Boundary Layer, Wake, and Free Surface Flow Around a Naval Combatant Insean 2340 Model**

Olivieri, A; Pistani, F; Avanzini, A; Stern, F; Penna, R; Sep 2001; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0344

Report No.(s): AD-A458075; IIHR-TR-421; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Results from towing tank experiments regarding resistance, sinkage and trim, far field wave elevation, boundary layer and wake of the INSEAN 2340 model are presented. The resistance and sinkage and trim tests are for Froude numbers between

Fr = 0.05 and Fr = 0.41 and free model conditions. Wave profiles and far field wave elevations have been carried out at two Froude numbers namely Fr = 0.28 and Fr = 0.41. Mean velocity field and total head in the boundary layer and wake have been measured by 5-hole Pitot probe at Fr = 0.28. The test design, measurement system and the uncertainty assessment have been described both for wave elevation and velocity fields. The uncertainty assessment methodology follows the AIAA Standard S-071-1995. The data contributes to the surface-ship resistance and propulsion model-scale database for computational fluid dynamics validation, as part of an international collaborative project between INSEAN, Iowa Institute of Hydraulic Research (IIHR) and David Taylor Model Basin (DTMB) on experimental and computational fluid dynamics and uncertainty assessment for a combatant geometry [1].

DTIC

*Boundary Layers; Computational Fluid Dynamics; Free Flow; Scale Models; Wakes*

**20070000729** Iowa Univ., Iowa City, IA USA

**General-Purpose Parallel Unsteady Rans Ship Hydrodynamics Code: CFDSHIP-Iowa**

Paterson, Eric G; Wilson, Robert V; Stern, Fred; Nov 2003; 115 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A458092; IIHR-432; No Copyright; Avail.: Defense Technical Information Center (DTIC)

CFDSHIP-IOWA is a general-purpose unsteady Reynolds-averaged Navier-Stokes CFD code that has been developed, over the past 10 years, to handle a broad range of ship hydrodynamics problems. Originally designed to support both thesis and project research in the areas of resistance and propulsion, it has been successfully transitioned to Navy and university laboratories and industry, and has recently been extended to unsteady applications such as seakeeping and maneuvering. It was developed following a modern software-development philosophy, which was based upon open source, revision control, modular coding using Fortran 90/95, liberal use of comments, and an easy to understand architecture which enables model development by users.

DTIC

*Hydrodynamics; Ships*

**20070000817** Combustion Research and Flow Technology, Inc., Pipersville, PA USA

**Modeling Approach for Reducing Helmholtz Resonance in Submarine Structures**

Arunajatesan, S; Sinha, N; Jan 2005; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00024-04-C-4165

Report No.(s): AD-A458237; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper discusses CFD technology capable of predicting the occurrence of Helmholtz resonance in surface openings of underwater vehicles. An examination of the numerical issues involved in the prediction is discussed - numerical dissipation, turbulence modeling and their interplay are analyzed through detailed parametric simulations. Further, control of such resonance through the use of passive devices is analyzed. Interesting parallels are observed between resonant flow field behavior in a compressible fluid and the behavior in an incompressible setting with no resonance. This suggests the interesting possibility of controlling resonant flow fields through analysis of corresponding incompressible flow fields.

DTIC

*Cavities; Flow Distribution; Resonance*

**20070000819** Air Force Research Lab., Edwards AFB, CA USA

**Plume Simulation, Contamination, and Microfluidics (Preprint)**

Ketsdever, Andrew; Wysong, Ingrid; Gimelshein, Sergey; Alexeenko, Alina; Young, Marc; Gimselshein, Natalia; Lilley, Taylor; Ngalande, Cedric; Sep 2006; 12 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A458240; AFRL-PR-ED-TP-2006-283; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This research project pursues basic understanding of rarefied gas flows, leading to Air Force tools for plumes, spacecraft, and micro-devices. It develops, applies, and validates kinetic and molecular-level models of improved physical realism for nonequilibrium processes such as collisional interaction of gases, gas-particulate mixtures, and gas surface interaction that arise in high temperature, multi-species, chemically reacting rarefied flowfields such as rocket plumes. These phenomena are not accurately addressed by standard engineering tools and require improved understanding of the basic physics. A number of closely related research issues arise in the area of rarefied flows on the micro length scales, including micropropulsion flows. The key computational tool used in this effort is the direct simulation Monte Carlo (DSMC) method and related kinetic solvers. Recently, a 3D multi-phase DSMC capability has been developed and applied to study the interaction of solid propellant

plumes with rarefied atmosphere. A parallel 3D Monte Carlo numerical tool for modeling radiation in multi-phase flows has been developed; the integration of fluid and radiation tools is planned in the future. New optical micropropulsion concepts have been formulated based on non-resonant interaction of optical lattice and carrier gas. Spacecraft contamination effects have been studied, and efficient numerical models for surface roughness were proposed.

DTIC

*Contaminants; Exhaust Gases; Gas Flow; Plumes; Rarefied Gases; Simulation*

**20070000851** Princeton Univ., NJ USA

**Shock Control and Power Extraction by MHD Processes in Hypersonic Air Flow**

Miles, Richard B; Macheret, Sergey O; Nov 2006; 31 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0028

Report No.(s): AD-A458308; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This project was a theoretical and experimental research effort on the use of MHD body forces and plasmas for boundary layer control and power extraction in supersonic flow, and on the development of new diagnostics for plasmas and for high-speed flows. The first part of this final report addresses MHD processes for control and power extraction. This section includes the constricted DC driven 'snowplow arc' discharge that can potentially be used to accelerate the boundary layer for suppression of separation, volumetric MHD for power extraction, and volumetric MHD for flow control. In order to accomplish volumetric MHD in cold air, a high repetition rate, short pulse sustainer concept is developed and applied for the first demonstration of power extraction from cold supersonic air. The following section addresses non MHD plasma methods of flow control and power extraction, particularly through the use of a dielectric barrier discharge and through a new pulse sustained thermionic power generator embedded into the hot walls of the vehicle engine. Finally, two new diagnostic methods are introduced in the third section: magnetically modulated microwave attenuation for the measurement of electron number density and electron collision frequency, and Radar REMPI for the localized measurement of flow velocity.

DTIC

*Air Flow; Boundary Layer Control; Extraction; Hypersonic Flow; Magnetohydrodynamics; Supersonic Flow*

**20070001135** NASA Glenn Research Center, Cleveland, OH, USA

**Settled Cryogenic Propellant Transfer**

Kutter, Bernard F.; Zegler, Frank; Sakla, Steve; Wall, John; Hopkins, Josh; Saks, Greg; Duffey, Jack; Chato, David J.; November 2006; 16 pp.; In English; 42nd Joint Propulsion Conference and Exhibit, 9-12 Jul. 2006, Sacramento, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): NNC05QA89P; WBS 994.05.01.01.03.02

Report No.(s): NASA/TM-2006-214411; E-15690; AIAA Paper 2006-4436; No Copyright; ONLINE:

<http://hdl.handle.net/2060/20070001135>; Avail.: CASI: [A03](#), Hardcopy

Cryogenic propellant transfer can significantly benefit NASA's space exploration initiative. LMSSC parametric studies indicate that "Topping off" the Earth Departure Stage (EDS) in LEO with approx.20 mT of additional propellant using cryogenic propellant transfer increases the lunar delivered payload by 5 mT. Filling the EDS to capacity in LEO with 78 mT of propellants increases the delivered payload by 20 mT. Cryogenic propellant transfer is directly extensible to Mars exploration in that it provides propellant for the Mars Earth Departure stage and in-situ propellant utilization at Mars. To enable the significant performance increase provided by cryogenic propellant transfer, the reliability and robustness of the transfer process must be guaranteed. By utilizing low vehicle acceleration during the cryogenic transfer the operation is significantly simplified and enables the maximum use of existing, reliable, mature upper stage cryogenic-fluid-management (CFM) techniques. Due to settling, large-scale propellant transfer becomes an engineering effort, and not the technology development endeavor required with zero-gravity propellant transfer. The following key CFM technologies are all currently implemented by settling on both the Centaur and Delta IV upper stages: propellant acquisition, hardware chilldown, pressure control, and mass gauging. The key remaining technology, autonomous rendezvous and docking, is already in use by the Russians, and must be perfected for NASA whether the use of propellant transfer is utilized or not.

Author

*Fluid Management; Cryogenic Fluids; Centaur Launch Vehicle; Propellant Transfer; Cryogenics*

**20070001432** New South Wales Univ., Sydney, Australia  
**A Further Comparison of Solid-State Thermionic and Thermoelectric Refrigeration**

Jan 2005; 5 pp.; In English

Report No.(s): AD-A458438; No Copyright; Avail.: CASI: [A01](#), Hardcopy

No abstract available

*Refrigerating; Solid State; Thermoelectricity*

**20070001457** Aircraft Sustainment Squadron (551st), Tinker AFB, OH USA  
**Comparison of the Tandem Conductivity Tester (TCT) and the Complete Oil Breakdown Rate Analyzer Model 2 (COBRA 2) for Detecting Synthetic Aircraft Oil Degradation**

Nov 29, 2006; 20 pp.; In English

Report No.(s): AD-A458395; MXSS/MXDTAA/MXDTAB-06001; XC-551ASQ; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Oils; Degradation; Detection; Conductivity Meters*

**20070001510** Engineering Research and Consulting, Inc., Edwards AFB, CA USA  
**Supercritical and Transcritical Shear Flows in Microgravity: Experiments and Direct Numerical Simulations**

Aug 2006; 314 pp.; In English

Contract(s)/Grant(s): F04611-99-C-0025; Proj-1011

Report No.(s): AD-A458381; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Shear Flow; Supercritical Flow; Microgravity; Direct Numerical Simulation*

**20070001673** Newcastle-upon-Tyne Univ., Newcastle, UK  
**Reliability-Based Performance Assessment of Damaged Ships**

Lee, Y W; Pu, Y; Chan, H S; Incecik, A; Dow, R S; Khan, I; Das, P K; Hess, P E; Oct 2006; 223 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0757; Proj-05PR08631-00

Report No.(s): AD-A458589; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458589>; Avail.: CASI: [A10](#), Hardcopy

The objective of this research is to develop a reliability-based procedure for the ship operators to make the immediate repair actions by evaluating the effects of the damage on the safety of the ship using residual strength assessment procedure. In this study, a procedure has been developed to assess structural integrity of damaged ships. The procedure consists of four steps: (1) Identify the location and size of the openings; (2) Calculate the still water bending moment and wave-induced loadings including vertical bending moment, horizontal bending moment and torsion; (3) Calculate the ultimate strength of the damaged cross-section considering the interaction of vertical bending moment, horizontal bending moment and torsion; (4) Assess the structural integrity by deterministic and probabilistic approaches. The state of the art of the methods for predicting environmental loads and assessing the structural safety has been reviewed. The developed procedure is applied to a sample vessel, HULL5415, to demonstrate the applicability of the proposed procedure. Overall the developed procedure and the methods are working well.

DTIC

*Bending Moments; Damage Assessment; Reliability; Reliability Analysis; Residual Strength; Safety; Structural Failure*

**20070001695** Science Applications International Corp., Fort Washington, PA USA  
**Navier-Stokes Simulation of Plume/Vertical Launching System Interaction Flowfields**

York, B J; Sinha, N; Dash, S M; Anderson, L; Gominho, L; Jan 9, 1992; 13 pp.; In English

Report No.(s): AD-A458628; AIAA-92-0839; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458628>; Avail.: CASI: [A03](#), Hardcopy

The application of Navier-Stokes methodology to the analysis of Vertical Launching System/missile exhaust plume interactions is discussed. The complex three-dimensional flowfields related to the Vertical Launching System (VLS) are computed utilizing the PARCH/RNP Navier-Stokes code. PARCH/RNP solves the fully-coupled system of fluid, two-equation



turbulence (kE) and chemical species equations via the implicit, approximately factored, Beam-Warming algorithm utilizing a block-tridiagonal inversion procedure.

DTIC

*Flow Distribution; Launching; Navier-Stokes Equation; Plumes; Simulation*

**20070002004** BAE Systems Analytical Solutions, Inc., Huntsville, AL, USA

**Using Magnetic Field Gradients to Simulate Variable Gravity in Fluids and Materials Experiments**

Ramachandran, Narayanan; [2006]; 1 pp.; In English; 57th International Aeronautical Congress, 2-6 Oct. 2006, Valencia, Spain

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail.: Other Sources; Abstract Only

Fluid flow due to a gravitational field is caused by sedimentation, thermal buoyancy, or solutal buoyancy induced convection. During crystal growth, for example, these flows are undesirable and can lead to crystal imperfections. While crystallization in microgravity can approach diffusion limited growth conditions (no convection), terrestrially strong magnetic fields can be used to control fluid flow and sedimentation effects. In this work, a theory is presented on the stability of solutal convection of a magnetized fluid (weakly paramagnetic) in the presence of a magnetic field. The requirements for stability are developed and compared to experiments performed within the bore of a superconducting magnet. The theoretical predictions are in good agreement with the experiments. Extension of the technique can also be applied to study artificial gravity requirements for long duration exploration missions. Discussion of this application with preliminary experiments and application of the technique to crystal growth will be provided.

Author

*Microgravity; Gravitational Fields; Crystallization; Crystal Growth; Crystal Defects; Artificial Gravity; Buoyancy; Magnetic Fields; Fluid Flow*

**20070002082** Air Force Research Lab., Edwards AFB, CA USA

**Mixing Dynamics of Supercritical Droplets and Jets (Revised To Include Appendices)**

Aug 2006; 375 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A458342; No Copyright; Avail.: CASI: [A16](#), Hardcopy

No abstract available

*Drops (Liquids); Supercritical Flow; Dynamics; Fluid Jets*

**20070002104** NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems Analytical Solutions, Inc., Huntsville, AL, USA

**Heat Transfer of Thermocapillary Convection in a Two-Layered Fluid System Under the Influence of Magnetic Field**

Ramachandran, N.; Ludovisis, D.; Cha, S. S.; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail.: Other Sources; Abstract Only

Heat transfer of a two-layer fluid system has been of great importance in a variety of industrial applications. For example, the phenomena of immiscible fluids can be found in materials processing and heat exchangers. Typically in solidification from a melt, the convective motion is the dominant factor that affects the uniformity of material properties. In the layered flow, thermocapillary forces can come into an important play, which was first emphasized by a previous investigator in 1958. Under extraterrestrial environments without gravity, thermocapillary effects can be a more dominant factor, which alters material properties in processing. Control and optimization of heat transfer in an immiscible fluid system need complete understanding of the flow phenomena that can be induced by surface tension at a fluid interface. The present work is focused on understanding of the magnetic field effects on thermocapillary convection, in order to optimize material processing. That is, it involves the study of the complicated phenomena to alter the flow motion in crystal growth. In this effort, the Marangoni convection in a cavity with differentially heated sidewalls is investigated with and without the influence of a magnetic field. As a first step, numerical analyses are performed, by thoroughly investigating influences of all pertinent physical parameters. Experiments are then conducted, with preliminary results, for comparison with the numerical analyses.

Author

*Heat Transfer; Thermocapillary Migration; Capillary Flow; Heat Exchangers; Magnetic Effects; Surface Tension Driven Convection; Working Fluids*

## 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*.

**20070000668** Army Tank-Automotive and Armaments Command, Warren, MI USA

**The Evaluation of Fractal Surfaces for Modeling Radar Backgrounds**

Evans, Roger; Bennett, John G; Jones, Jack; Jan 2000; 27 pp.; In English

Report No.(s): AD-A457965; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We evaluate how well fractals match the radar backscatter of natural backgrounds in terms of dependence on angle of incidence. We discuss the parameters that define the particular surfaces studied. Finally, we compare the radar backscatter from a range of fractals to experimental backscatter data from natural backgrounds, and we discuss the suitability of fractal surfaces as modeling surrogates for the still more complex natural backgrounds.

DTIC

*Backscattering; Fractals*

**20070000678** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Polarization Measurement Errors Due to Spatial and Temporal Misregistration**

Gerhart, Grant R; Matchko, Roy M; Aug 2003; 6 pp.; In English

Report No.(s): AD-A457980; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper focuses on potential false conclusions regarding polarization parameters obtained through the use of a digital camera. It outlines a methodology for calibrating, displaying and visualizing polarization profiles of natural, daylight scenes using a camera (commercial-off-the-shelf) digital camera. It presents cause and effect scenarios related to spatial and temporal misregistration of polarization data and the acquisition of accurate polarization parameters, such as the degree of polarization and the polarization azimuth and ellipticity angles. Trade-offs between precise spatial registration and precise temporal registration are discussed.

DTIC

*Calibrating; Digital Cameras; Errors; Independent Variables*

**20070000684** Washington Univ., Seattle, WA USA

**Concluding Analysis of IR Measurements of Microbreaking and Whitecaps**

Jessup, Andrew T; Branch, Ruth; Sep 30, 2004; 14 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0523

Report No.(s): AD-A457990; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Analysis of existing field and laboratory measurements using infrared techniques to study wave breaking was concluded by accomplishing two tasks. The field data were from the Fluxes, Air-sea Interaction, and Remote Sensing (FAIRS) experiment that took place off Monterey, California, in the fall of 2000. The laboratory data were obtained at the NASA Goddard Wallops Flight Facility in 1998 and 2004. The first task was the use of infrared (IR) imagery to determine the extent to which microbreaking waves are modulated by swell waves. In 1998 and 2004, The authors conducted laboratory measurements using an IR imager of wind-generated waves superimposed on paddle-generated waves. The laboratory results suggested that modulation of the skin temperature observed in the field was due to modulation of microbreaking by swell waves. The second task involved the correlation of microbreaking with radar backscatter. Gravity-capillary waves bound to the forward face of swell waves have been postulated to be the cause of large Doppler shifts in radar backscatter at high incidence angles. To investigate the relationship between these bound scatterers and microbreakers, the authors made simultaneous, collocated IR, video, and radar measurements during FAIRS. Microbreakers were identified as waves that produced a warm wake in the IR imagery, but no visible signature in the video. The large Doppler shift in the radar data associated with these waves supports the idea that microbreaking waves are a source of bound scatterers in radar return from the ocean.

DTIC

*Backscattering; Infrared Signatures; Microwave Signatures; Microwaves; Modulation; Ocean Surface; Surface Temperature; Water Waves; Wind (Meteorology)*

**20070000732** Philadelphia Naval Shipyard, PA USA

**Photogrammetry - Automating the Collection of Shipcheck Data (The National Shipbuilding Research Program)**

Sparacino, Peter L; Arguto, William; Sep 1991; 12 pp.; In English

Report No.(s): AD-A458102; NSRP-0340; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The installation of new or modified systems on board U.S. Naval combatants during overhauls requires advance planning ship checks. One primary purpose of a ship check is to document existing shipboard conditions in order to develop engineering drawings for the installation of these new systems. Gathering and documenting existing shipboard conditions has always been a very labor intensive effort. Also, accuracy of measurements is restricted by congested spaces, dimensions of extensive length, and intricate configurations of systems. Furthermore, the accuracy of the ship check information relates directly to the quality of the production installation. Accurate well-planned ship check information will reduce production interferences, production costs and schedule variance. One objective of a planning department is to reduce man day expenditures required to accomplish a ship check while increasing the accuracy of the data gathered. Automating this ship check using photogrammetry, specifically stereo photogrammetry, can provide a means to achieve these objectives. This paper will explore the use of stereo photogrammetry to gather ship check data for shipboard distributive systems such as piping, ventilation, cable ways, compartment arrangements and structural components.

DTIC

*Data Acquisition; Marine Technology; Photogrammetry; Ships*

**20070001007** NASA Johnson Space Center, Houston, TX, USA

**Measurement Challenges for Carbon Nanotube Material**

Sosa, Edward; Arepalli, Sivaram; Nikolaev, Pasha; Gorelik, Olga; Yowell, Leonard; [2006]; 40 pp.; In English; NIST Workshop on Nanotechnology, 16-19 Oct. 2006, Gaithersburg, MD, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The advances in large scale applications of carbon nanotubes demand a reliable supply of raw and processed materials. It is imperative to have a consistent quality control of these nanomaterials to distinguish material inconsistency from the modifications induced by processing of nanotubes for any application. NASA Johnson Space Center realized this need five years back and started a program to standardize the characterization methods. The JSC team conducted two workshops (2003 and 2005) in collaboration with NIST focusing on purity and dispersion measurement issues of carbon nanotubes [1]. In 2004, the NASA-JSC protocol was developed by combining analytical techniques of SEM, TEM, UV-VIS-NIR absorption, Raman, and TGA [2]. This protocol is routinely used by several researchers across the world as a first step in characterizing raw and purified carbon nanotubes. A suggested practice guide consisting of detailed chapters on TGA, Raman, electron microscopy and NIR absorption is in the final stages and is undergoing revisions with input from the nanotube community [3]. The possible addition of other techniques such as XPS, and ICP to the existing protocol will be presented. Recent activities at ANSI and ISO towards implementing these protocols as nanotube characterization standards will be discussed.

Author

*Carbon Nanotubes; Nanotechnology; Measuring Instruments*

**20070001499** Research and Technology Organization, Neuilly-sur-Seine, France

**Guidelines for Camouflage Assessment Using Observers**

October 2006; 64 pp.; In English; Original contains color illustrations

Report No.(s): RTO-AG-SCI-095; AC/323(SCI-095)TP/96; Copyright; Avail.: CASI: [C01](#), CD-ROM: [A04](#), Hardcopy

Using military observers in the field is the preferred method to evaluate the effectiveness of camouflaged targets. However, it is also a time consuming, labor intensive, logistically difficult and expensive procedure to use. In order to provide a reasonable alternative, the procedures outlined in these guidelines describe an approach to improve the reliability and repeatability of visual trials. The content of these guidelines contains the collective knowledge of SCI-095 gathered over the span of the four years of the task group and provide a framework for the user to conduct an assessment. These guidelines address a typical situation where comparison between different camouflage treatments is desired, as opposed to determination of an absolute range. The statistical analysis procedures presented are a minimal set of descriptive statistics that produce acceptable results. More exhaustive analytical techniques exist and are left to the user to investigate. Based on a comparative digital photosimulation trial conducted by SCI-095 in 2004 and similar trials carried out previously, it can be stated conclusively that following these recommended procedures and paying careful attention to the experimental set-up will produce consistent, reproducible target detection results that can be compared across different observer trials.

Author

*Camouflage; Target Recognition; Statistical Analysis*

**20070001602** Memphis Univ., Memphis, TN USA

**Center for Advanced Sensors, Year One Funding (FY2005)**

Halford, Carl; Patterson, Stacie; Oct 30, 2006; 76 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-05-2-0019

Report No.(s): AD-A458466; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458466>; Avail.: CASI: A05, Hardcopy

The Center for Advanced Sensors presents the research results for the first year of effort. Research is reported on networked sensors, modeling performance for sensors with image processing enhancements, THz imager modeling, mammalian vision, infrared displays, and wavefront sensors. The Annual Program Plan goals and objectives were met. Milestones included: (1) building an ontology-based, knowledge repository of representative sensors, (2) establishing methodology for incorporating image processing techniques into existing performance models, (3) determining sensor performance enhancements offered by anomaly detection ATRs, (4) modifying existing sensor models to account for the improvements offered by image fusion, (5) modeling of advanced architecture systems, (6) establishing the bio-optics for mammalian vision, (7) developing an advanced infrared display, (8) developing a high-speed wavefront sensor.

DTIC

*Detectors; Image Processing; Networks*

**20070001617** Massachusetts Inst. of Tech., Cambridge, MA USA

**Optimum and Suboptimum Array Processing for the Estimation of Superimposed Signals**

Weiss, Anthony J; Willisky, Alan S; Levy, Bernard C; Jul 1987; 52 pp.; In English

Contract(s)/Grant(s): ECS-8312921; DAAG29-84-K-0005

Report No.(s): AD-A458493; LIDS-P-1686; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458493>; Avail.: CASI: A04, Hardcopy

This report addresses the problem of estimating the parameters of superimposed signals observed by an array of sensors. Some of the proposed techniques are equally useful for estimating the frequencies of sinusoids in noise. The methods used are direct iterative maximum likelihood, the EM algorithm, the eigenstructure approach and the polynomial approach. In addition to the traditional estimation of the source locations we also address the estimation of parameters related to the radiation patterns of the sources.

DTIC

*Detectors; Signal Processing*

**20070001666** Massachusetts Inst. of Tech., Cambridge, MA USA

**Multiscale Segmentation of SAR Imagery**

Fosgate, C H; Krim, H; Willisky, A S; Irving, W W; Chaney, R D; Apr 1996; 13 pp.; In English

Contract(s)/Grant(s): F19628-95-C-0002; F49620-93-1-0604

Report No.(s): AD-A458575; LIDS-P-2327; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458575>; Avail.: CASI: A03, Hardcopy

In this paper, we propose an efficient multiscale approach for the segmentation of natural clutter, specifically grass and forest, in synthetic aperture radar (SAR) imagery. This method exploits the coherent nature of SAR sensors. In particular, we exploit the characteristic statistical differences in imagery of different clutter types, as a function of scale, due to radar speckle. We employ a recently introduced class of multiscale stochastic processes that provide a powerful framework for describing random processes and fields that evolve in scale. We build models representative of each category of clutter of interest (i.e. grass and forest), and use these models to segment the imagery into these two clutter classes. The scale-autoregressive nature of the models allows extremely efficient calculation of the relative likelihood of different clutter classifications for windows of SAR imagery, and we use these likelihood as the basis for classifying image pixels and for accurately estimating forest-grass boundaries. We evaluate the performance of the technique by testing it on 0.3 meter SAR data gathered with the Lincoln Laboratory Millimeter-Wave SAR.

DTIC

*Clutter; Radar Imagery; Segments; Synthetic Aperture Radar*

**20070001732** Army Communications-Electronics Command, Fort Belvoir, VA USA

**Handheld Metal Detectors: Nicaraguan Field Test Report**

Reidy, Dennis M; Garcia, Sigberto A; Mejia Ramos, Duvier A; Soares, Eraldo R; Oct 2001; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458679; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458679>; Avail.: CASI: [A03](#), Hardcopy

This final technical report details the results of a joint project between the USA Office of the Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict (OASD-SO/LIC), the US Army Communications and Electronics Command (CECOM) Night Vision and Electronic Sensors Directorate (NVESD), the Organization of American States (OAS) (Organizacion de los Estados Americanos [OEA]), the Assistance Mission for Mine Clearance in Central America (La Mision de Asistencia para la Remocion de Minas en Centroamerica, [MARMINCA]), the Program for Demining in Central America (el Programa de Apoyo al Desminado de Centroamerica, [PADCA]), and the Inter-American-Defense Board (IADB) (Junta Interamericana de Defensa, [JID]). The joint project was an in-country field evaluation of seven commercial off-the-shelf (COTS) handheld metal detectors. It was the result of an earlier Department of Defense (DoD) visit to Nicaragua to provide advice and recommendations on demining equipment as part of DoD's Humanitarian Demining Research and Development (R&D) program. The evaluation took place near Panchito, a high-priority minefield on a former Nicaraguan airbase where the magnetic properties of volcanic soil render conventional mine detectors extremely unreliable. The conduct of the field test was greatly enhanced through the assistance of officers from MARMINCA and experienced Nicaraguan deminers.

DTIC

*Field Tests; Mine Detectors; Nicaragua; Portable Equipment*

**20070001866** Maryland Univ., College Park, MD USA

**Building Mosaics from Video using MPEG Motion Vectors**

Jones, Ryan C; DeMenthon, Daniel; Doermann, David S; Jul 1999; 29 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): MDA904-96-C-1250

Report No.(s): AD-A458737; LAMP-TR-035; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper, we present a novel way of creating mosaics from an MPEG video sequence. Two original aspects of our work are that (1) we explicitly compute camera motion between frames and (2) we deduce the camera motion directly from the motion vectors encoded in the MPEG video stream. This enables us to create mosaics more simply and quickly than with other methods.

DTIC

*Cameras; Mosaics; Motion; Motion Pictures; Sequencing*

**20070001879** Defence Science and Technology Organisation, Edinburgh, Australia

**Coherent Change Detection: Theoretical Description and Experimental Results**

Preiss, Mark; Stacy, Nicholas J S; Aug 2006; 116 pp.; In English

Report No.(s): AD-A458753; DSTO-TR-1851; No Copyright; Avail.: CASI: [A06](#), Hardcopy

This report investigates techniques for detecting fine scale scene changes using repeat pass Synthetic Aperture Radar (SAR) imagery. As SAR is a coherent imaging system two forms of change detection may be considered, namely incoherent and coherent change detection. Incoherent change detection identifies changes in the mean backscatter power of a scene typically via an average intensity ratio change statistic. Coherent change detection on the other hand, identifies changes in both the amplitude and phase of the transduced imagery using the sample coherence change statistic. Coherent change detection thus has the potential to detect very subtle scene changes to the sub-resolution cell scattering structure that may be undetectable using incoherent techniques. The repeat pass SAR imagery however, must be acquired and processed interferometrically. This report examines the processing steps required to form a coherent image pair and describes an interferometric spotlight SAR processor for processing repeat pass collections acquired with DSTO Ingara X-band SAR. The detection performance of the commonly used average intensity ratio and sample coherence change statistics are provided as well as the performance of a recently proposed log likelihood change statistic. The three change statistics are applied to experimental repeat pass SAR data to demonstrate the relative performance of the change statistics.

DTIC

*Change Detection; Synthetic Aperture Radar*

**20070002068** Defence Science and Technology Organisation, Edinburgh, Australia

**Coherent Change Detection: Theoretical Description and Experimental Results**

Preiss, Mark; Stacy, Nicholas J S; Aug 2006; 116 pp.; In English

Report No.(s): AD-A458288; DSTO-TR-1851; No Copyright; Avail.: CASI: [A06](#), Hardcopy

This report investigates techniques for detecting fine scale scene changes using repeat pass Synthetic Aperture Radar (SAR) imagery. As SAR is a coherent imaging system two forms of change detection may be considered, namely incoherent and coherent change detection. Incoherent change detection identifies changes in the mean backscatter power of a scene typically via an average intensity ratio change statistic. Coherent change detection on the other hand, identifies changes in both the amplitude and phase of the transduced imagery using the sample coherence change statistic. Coherent change detection thus has the potential to detect very subtle scene changes to the sub-resolution cell scattering structure that may be undetectable using incoherent techniques. The repeat pass SAR imagery however, must be acquired and processed interferometrically. This report examines the processing steps required to form a coherent image pair and describes an interferometric spotlight SAR processor for processing repeat pass collections acquired with DSTO Ingara X-band SAR. The detection performance of the commonly used average intensity ratio and sample coherence change statistics are provided as well as the performance of a recently proposed log likelihood change statistic. The three change statistics are applied to experimental repeat pass SAR data to demonstrate the relative performance of the change statistics.

DTIC

*Change Detection; Coherent Radar*

**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*.

**20070000814** Army Aviation and Missile Command, Redstone Arsenal, AL USA

**Current Efforts on Developing a HWIL Synthetic Environment for LADAR Sensor Testing at AMRDEC**

Kim, Hajin J; Cornell, Michael C; Naumann, Charles B; Jan 2005; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458233; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Efforts in developing a synthetic environment for testing LADAR sensors in a hardware-in-the-loop simulation are continuing at the Aviation and Missile Research, Engineering, and Development Center (AMRDEC) of the U.S. Army Research, Engineering and Development Command (RDECOM). Current activities have concentrated on developing the optical projection hardware portion of the synthetic environment. These activities range from system level design down to component level testing. Of particular interest have been schemes for generating the optical signals representing the individual pixels of the projection. Several approaches have been investigated and tested with emphasis on operating wavelength, intensity dynamic range and uniformity, and flexibility in pixel waveform generation. This paper will discuss some of the results from these current efforts at RDECOM's Advanced Simulation Center (ASC).

DTIC

*Detectors; Laser Range Finders; Lasers; Modulators; Optical Radar*

**20070001102** Air Force Research Lab., Rome, NY USA

**Injection Characterization of Packaged Bi-Directional Diamond Shaped Ring Laser at 1550 NM**

Sep 2006; 13 pp.; In English

Contract(s)/Grant(s): F30602-03-2-0228; Proj-SEMI

Report No.(s): AD-A458456; AFRL-SN-RS-TP-2006-15; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Diamonds; Injection; Ring Lasers; Characterization*

**20070001504** Air Force Research Lab., Rome, NY USA

**Diamond Shaped Ring Laser Characterization, Package Design and Performance**

Sep 2006; 9 pp.; In English

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

Report No.(s): AD-A458389; AFRL-SN-RS-TP-2006-13; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Characterization; Diamonds; Ring Lasers*

**20070001886** Colorado Univ., Boulder, CO USA

**Nonlinear Wave Propagation**

Ablowitz, Mark J; Aug 31, 2006; 137 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0250

Report No.(s): AD-A458776; UOC-1536810; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The dynamics and properties of mode locked lasers, such as Titanium:sapphire lasers, that produce ultrashort pulses were modeled and compared with experiments carried out. An important characteristic of short pulse lasers is the carrier-envelope phase (CEP) slip which is the phase offset between carrier and envelope from pulse to pulse in the pulse train. Control of the phase slip allows researchers to stabilize trains of ultrashort pulses, which are very useful in applications. Accurate models of the slip were obtained. New asymptotic and computational methods describing observed phenomena in photonic lattices were developed. Research in quadratic optical materials has led to novel asymptotic systems of equations. In certain parameter regimes stable localized pulse solutions are found and in other cases the equations have unstable and singular solutions. The possibility of such solutions indicates situations when extreme damage to the optical crystal can occur. New numerical schemes to compute localized states to a broad class of nonlinear systems have been developed. From 1 July 2003 to 30 June 2006, 8 papers were published or accepted in refereed journals, 2 book chapters were published and 19 invited lectures were given.

DTIC

*Asymptotic Series; Laser Mode Locking; Nonlinear Systems; Nonlinearity; Wave Propagation*

**20070002086** Air Force Research Lab., Kirkland AFB, NM USA

**Studies by a Mesospheric Sodium Guidestar Pumped by Continuous Wave Sum-Frequency Mixing of Two Nd: YAG Laser in Lithium Triborate (Preprint)**

May 16, 2006; 11 pp.; In English

Contract(s)/Grant(s): DF297062; (IN-HOUSE); Proj-5076

Report No.(s): AD-A458339; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Continuous Radiation; Frequencies; Mesosphere; Sodium; YAG Lasers; Lithium Compounds*

**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*.

**20070000489** Environmental Protection Agency, Washington, DC, USA

**Progress Report on EPA's Nonroad Mobile Source Emissions Reduction Strategies**

Sep. 27, 2006; 35 pp.; In English

Report No.(s): PB2007-103008; EPA/2006-P-00039; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Emissions from nonroad mobile sources can present significant health and environmental hazards. The U.S. Environmental Protection Agency (EPA) projects that emissions from these sources will decrease in some categories but increase in others. As such, we examined EPA's efforts to reduce nonroad mobile source emissions, opportunities for additional reductions, and challenges to addressing nonroad emissions problems. Nonroad mobile sources include marine vessels, locomotives, aircraft, farm and construction machinery, lawn and garden equipment, recreational vehicles, and outdoor power equipment. Nonroad mobile sources produce particulate matter and ozone-forming nitrogen oxides and volatile organic compound emissions, as well as toxic air pollutants, which contribute to a host of health and environmental hazards.

NTIS

*Environment Protection; Emission*

**20070000702** Army Engineer Research and Development Center, Vicksburg, MS USA

**Effectiveness of Pocket-Wave Absorbers in Vertical-Wall, Coastal Entrance Structures**

Thompson, Edward F; Bottin, Jr, Robert R; Selegean, James P; Mar 2004; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458026; ERDC/CHL-CHETN-III-69; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This Coastal and Hydraulics Engineering Technical Note (CHETN) provides preliminary information on the effectiveness of pocket wave absorbers (relative to wave conditions) in vertical steel sheet-pile coastal entrance structures. The U.S. Army Corps of Engineers is responsible for dozens of harbor entrances in the Great Lakes constructed with parallel jetties. These jetties, many in operation for more than 100 years, were typically constructed of rock-filled timber cribs. Over time, the wood cribbing has experienced significant deterioration, thus causing the jetty to be rather porous. Many of these structures have been rehabilitated. The typical rehabilitation approach has been to drive steel sheet pile around the existing structure and place a concrete cap on top, thereby encasing the original structure. After completion of the rehabilitation projects, the wave climate between the jetties appears to increase significantly causing navigational difficulties and damage to moored vessels within the harbor. This is apparently due to the fact that the timber crib jetties were rough, porous structures, especially in their deteriorated state, and were much more effective at dampening wave energy than the rehabilitated, sheet-pile encased jetties. The steel sheet-pile structures, being considerably more reflective than the deteriorating timber structures, are largely responsible for the increasingly energetic wave climate. To mitigate for the more energetic wave climate, the Corps has removed short sections of steel sheet piling at selected harbors and replaced them with pocket wave absorbers.

DTIC

*Breakwaters; Coasts; Walls*

**20070000778** Missouri Univ., Rolla, MO USA

**Vibration Testing of Repaired Lead-Tin/Lead-Free Solder Joints (Preprint)**

Perez, Martin G; O'Keefe, Matthew J; Colfax, Richard; Vetter, Steve; Murry, Dale; Smith, James; Kleine, David W; Amick, Patricia; Feb 2006; 9 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2865

Report No.(s): AD-A458169; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Due to growing environmental concerns and recent legislation, tin-lead (Pb-Sn) solders are being phased out by lead-free (LF) solders. The most common Sn-Pb replacement is the tin-silver-copper (Sn-Ag-Cu, SAC) alloys. During the transition phase, it is expected that there will be a period where both Sn-Pb and LF solders will be used side by side, and in conjunction with one another, during assembly processes. Repaired solder joints may also be expected to contain a mixture of Sn-Pb and LF solders, especially in military systems. Tested printed circuit boards were visually inspected for solder cracking and delamination. Metallographic analysis was done on areas where visible cracking or physical damage had occurred. All vibration testing was done at room temperature.

DTIC

*Circuit Boards; Printed Circuits; Soldered Joints; Solders; Tin; Vibration*

**20070000847** Wyoming Univ., Laramie, WY USA

**Reduced Order Modeling for Aero-Elastic Simulations**

Balas, Mark; Jul 2006; 11 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0020

Report No.(s): AD-A458303; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Control of systems described by large-order models typically requires construction and use of reduced order models (ROM's) for the purpose of feedback controller design and implementation. However, controllers based on these ROM's can have deleterious interactions with un-modeled modes, and some sort of stability compensation is needed, such as Residual Mode Filters (RMF's). In this report we summarize our work on exponential closed loop stability using RMF's for Aero-Elastic Simulations. This can be achieved for systems with actuator dynamics, as well as for controllers designed only using a ROM of the actuator. Our applications include the control of fluid-structure interaction in a simple piston model and a three dimensional NACA wing to alleviate aero-elastic flutter.

DTIC

*Actuators; Aeroelasticity; Flutter; Simulation*

**20070000876** Newport News Shipbuilding and Drydock Co., VA USA

**Navy Document Conversion Program Project: Pipe Flanges (The National Shipbuilding Research Program)**

Sharp, George G; May 1, 1990; 30 pp.; In English

Report No.(s): AD-A458440; NSRP-0358; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The prescribed objective of this project is to develop an overall strategy and a specific plan of action for the commercialization of Navy pipe flange patterns to be used in conjunction with on-going commercialization projects for



pumps, valves, strainers, and other flanged piping components. This objective is derived from an understanding of the problem reflected in the SP6 Project abstract, which states as follows: There currently exists in the U. S. Marine industry, two systems of pipe flanges - so called Navy flanges (Mil-Spec) and commercial (ANSI). Both flange systems have general attributes (pipe sizes, pressure ratings, material availability) that are identical to each other. The major difference between them is in their physical dimensions (diameter, thickness, bolt holes) which makes them incompatible with each other. The construction of most Navy ships results in a combination of Navy and commercial flanges being installed, many times in the same piping system. This creates confusion for the designer, procurer, and installer. Ultimately, the confusion is carried over to the ship's operations and logistics in that two flange systems must be provisioned. Also pumps, valves, and other components with otherwise similar attributes are made unique due to their flange types, further complicating the ship's stores. The starting point in this project was to determine the scope of the incompatibility caused by specifying a combination of Navy and commercial standards for flanges in Navy ship specifications. Following a determination of the incompatibilities, an analysis of the standardization efforts necessary to reduce or eliminate them will be made. This result will be looked at in the light of existing industry and Navy practices relating to the utilization of flanges. Following this, an action plan will be developed for achieving the desired objective.

DTIC

*Compatibility; Flanges; Marine Technology; Navy; Pipes (Tubes); Ships*

**20070001106** Amptek, Inc., Bedford, MA USA

**Low Energy Particle Sensor for Medium Earth Orbit**

Jun 15, 2006; 20 pp.; In English

Contract(s)/Grant(s): FA8718-05-C-0014; Proj-5021

Report No.(s): AD-A458455; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Earth Orbits; Sensors; Particles*

**20070001439** Army Cold Regions Research and Engineering Lab., Hanover, NH USA

**Assessing Fog Oil Deposition to Simulated Plant Surfaces During Military Training**

Nov 2006; 66 pp.; In English

Report No.(s): AD-A458324; ERDC/CRREL TR-06-19; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Fog; Oils; Simulation; Deposition; Education; Military Technology; Industrial Plants*

**20070001464** Army Engineer Research and Development Center, Vicksburg, MS USA

**Distribution and Fate of Energetics on DoD Test and Training Ranges: Final Report**

Nov 2006; 165 pp.; In English

Report No.(s): AD-A458391; ERDC-TR-06-13; No Copyright; Avail.: CASI: [A08](#), Hardcopy

No abstract available

*Education; Defense Program; Energetic Particles; Test Ranges*

**20070001471** NASA Johnson Space Center, Houston, TX, USA

**Effects of Laser Peening, and Shot Peening, on Friction Stir Welding**

Hatamleh, Omar; Hackel, Lloyd; Rankin, Jon; Truong, Chanh; Walter, Matt; [2006]; 36 pp.; In English; 2006 USAF Aircraft Structural Integrity Program, 28-30 Nov. 2006, San Antonio, TX, USA; Original contains color illustrations; Copyright;

Avail.: CASI: [A03](#), Hardcopy

A viewgraph presentation describing the effects of laser peening and shot peening on friction stir welding is shown. The topics include: 1) Background; 2) Friction Stir Welding (FSW); 3) Microstructure; 4) Laser & Shot Peening; 5) Residual Stresses; 6) Tensile Behavior; 7) Fatigue Life & Surface Roughness; 8) Crack Growth; and 9) Benefits.

CASI

*Friction Stir Welding; Lasers; Shot Peening*

**20070001473** NASA Stennis Space Center, Stennis Space Center, MS, USA

**Simulations of Transient Phenomena in Liquid Rocket Feed Systems**

Ahuja, V.; Hosangadi, A.; Cavallo, P. A.; Daines, R.; [2006]; 14 pp.; In English; 53rd JANNAF Propulsion Meeting, 5-8 Dec. 2005, Monterey, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNS04AA08C; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001473>; Avail.: CASI: A03, Hardcopy

Valve systems in rocket propulsion systems and testing facilities are constantly subject to dynamic events resulting from the timing of valve motion leading to unsteady fluctuations in pressure and mass flow. Such events can also be accompanied by cavitation, resonance, system vibration leading to catastrophic failure. High-fidelity dynamic computational simulations of valve operation can yield important information of valve response to varying flow conditions. Prediction of transient behavior related to valve motion can serve as guidelines for valve scheduling, which is of crucial importance in engine operation and testing. Feed components operating in cryogenic regimes can also experience cavitation based instabilities leading to large scale shedding of vapor clouds and pressure oscillations. In this paper, we present simulations of the diverse unsteady phenomena related to valve and feed systems that include valve stall, valve timing studies as well as two different forms of cavitation instabilities in components utilized in the test loop.

Author

*Feed Systems; Rocket Engines; Simulation; Control Valves; Liquid Rocket Propellants*

**20070001507**

**Final Testing and Evaluation of a Meter-Class Actively Controlled Membrane Mirror (Preprint)**

Apr 13, 2006; 15 pp.; In English

Contract(s)/Grant(s): F29601-03-C-0040; Proj-3005

Report No.(s): AD-A458386; No Copyright; Avail.: CASI: A03, Hardcopy

No abstract available

*Active Control; Membranes; Mirrors*

**20070001508** Defence Science and Technology Organisation, Edinburgh, Australia

**Corrosion of Hawk Lead-in-Fighter Hydraulic Pipe Work**

Feb 2006; 31 pp.; In English

Report No.(s): AD-A458385; DSTO-TR-1833; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Corrosion; Pipes (Tubes); Hydraulic Equipment; Mechanical Engineering*

**20070001537** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Using the Climbing Drum Peel (CDP) Test to Obtain a G(sub IC) value for Core/Facesheet Bonds**

Nettles, A. T.; Gregory, Elizabeth D.; Jackson, Justin R.; [2006]; 15 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

A method of measuring the Mode I fracture toughness of core/facesheet bonds in sandwich Structures is desired, particularly with the widespread use of models that need this data as input. This study examined if a critical strain energy release rate, G(sub IC), can be obtained from the climbing drum peel (CDP) test. The CDP test is relatively simple to perform and does not rely on measuring small crack lengths such as required by the double cantilever beam (DCB) test. Simple energy methods were used to calculate G(sub IC) from CDP test data on composite facesheets bonded to a honeycomb core. Facesheet thicknesses from 2 to 5 plies were tested to examine the upper and lower bounds on facesheet thickness requirements. Results from the study suggest that the CDP test, with certain provisions, can be used to find the GIG value of a core/facesheet bond.

Author

*Bonding; Fracture Strength; Sandwich Structures; Peeling; Mechanical Properties*

**20070001968** International Trade Commission, Washington, DC USA

**Internal Combustion Industrial Forklift Trucks from Japan. Investigation No. 731-TA-377 (Second Review)**

Dec. 2005; 187 pp.; In English

Report No.(s): PB2007-101226; USITC/PUB-3831; No Copyright; Avail.: CASI: A09, Hardcopy

The U.S. International Trade Commission (ITC) determined that revoking the existing antidumping duty order on internal combustion industrial forklift trucks from Japan would not be likely to lead to continuation or recurrence of material injury

within a reasonably foreseeable time. As a result of the Commission's negative determination, the existing order on imports of these products from Japan will be revoked.

NTIS

*Combustion; International Trade; Japan; Trucks*

**20070001996** Tennessee Technological Univ., Cookeville, TN, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

**A Rotating Plug Model of Friction Stir Welding Heat Transfer**

Raghulapadu J. K.; Peddieson, J.; Buchanan, G. R.; Nunes, A. C.; [2006]; 24 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC8-223; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001996>; Avail.: CASI: A03, Hardcopy

A simplified rotating plug model is employed to study the heat transfer phenomena associated with the friction stir welding process. An approximate analytical solution is obtained based on this idealized model and used both to demonstrate the qualitative influence of process parameters on predictions and to estimate temperatures produced in typical friction stir welding situations.

Author

*Friction Stir Welding; Heat Transfer; Plugs; Mathematical Models; Approximation*

**20070002093** Army Research Lab., Adelphi, MD USA

**Calibration and Verification Procedures at ARL for the Focus Microwaves Load Pull System**

Nov 2006; 28 pp.; In English

Report No.(s): AD-A458331; ARL-TR-3985; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Calibrating; Loads (Forces); Microwaves*

**38**

**QUALITY ASSURANCE AND RELIABILITY**

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

**20070001003** NASA Stennis Space Center, Stennis Space Center, MS, USA

**Valve Health Monitoring System Utilizing Smart Instrumentation**

Jensen, Scott L.; Drouant, George J.; [2006]; 27 pp.; In English; SPIE Conference, 17-21 Apr. 2006, Orlando, FL, USA; Original contains black and white illustrations

Report No.(s): SREP-2290-0002; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001003>; Avail.: CASI: A03, Hardcopy

The valve monitoring system is a stand alone unit with network capabilities for integration into a higher level health management system. The system is designed for aiding in failure predictions of high-g geared ball valves and linearly actuated valves. It performs data tracking and archiving for identifying degraded performance. The data collection types are cryogenic cycles, total cycles, inlet temperature, body temperature torsional strain, linear bonnet strain, preload position, total travel and total directional changes. Events are recorded and time stamped in accordance with the IRIG B True Time. The monitoring system is designed for use in a Class 1 Division II explosive environment. The basic configuration consists of several instrumentation sensor units and a base station. The sensor units are self contained microprocessor controlled and remotely mountable in three by three by two inches. Each unit is potted in a fire retardant substance without any cavities and limited to low operating power for maintaining safe operation in a hydrogen environment. The units are temperature monitored to safeguard against operation outside temperature limitations. Each contains 902-928 MHz band digital transmitters which meet Federal Communication Commission's requirements and are limited to a 35 foot transmission radius for preserving data security. The base-station controller correlates data from the sensor units and generates data event logs on a compact flash memory module for database uploading. The entries are also broadcast over an Ethernet network. Nitrogen purged National Electrical Manufacturers Association (NEMA) Class 4 enclosures are used to house the base-station

Author

*Identifying; Management Systems; Systems Health Monitoring; Component Reliability; Fault Detection; Control Valves; Propulsion System Performance; Valves*

## 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*.

**20070000488** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Failure Analysis of Cracked FS-85 Tubing and ASTAR-811C End Caps**

Petrichek, M. E.; Feb. 09, 2006; 20 pp.; In English

Report No.(s): DE2006-884679; No Copyright; Avail.: Department of Energy Information Bridge

Failure analyses were performed on cracked FS-85 tubing and ASTAR-811C and caps which had been fabricated as components of biaxial creep specimens meant to support materials testing for the NR Space program. During the failure analyses of cracked FS-85 tubing, it was determined that the failure potentially could be due to two effects: possible copper contamination from the EDM (electro-discharge machined) recast layer and/or an insufficient solution anneal. To prevent similar failures in the future, a more formal analysis should be done after each processing step to ensure the quality of the material before further processing. During machining of the ASTAR-811FC rod to form end caps for biaxial creep specimens, linear defects were observed along the center portion of the end caps. These defects were only found in material that was processed from the top portion of the ingot. The linear defects were attributed to a probable residual ingot pipe that was not removed from the ingot. During the subsequent processing of the ingot to rod, the processing temperatures were not high enough to allow self healing of the ingot's residual pipe defect. To prevent this from occurring in the future, it is necessary to ensure that complete removal of the as-melted ingot pipe is verified by suitable non-destructive evaluation (NDE).

NTIS

*Creep Properties; Failure Analysis; Pipes (Tubes)*

**20070000846** Associated Forest Products Consultants, Seattle, WA USA

**Strength Properties of Drydocking Timbers and Blocks (The National Shipbuilding Research Program)**

Bryant, Ben S; England, Rollo F; Gates, Jack G; Haith, Ross L; Ross, Jonathan M; Sep 1991; 16 pp.; In English

Report No.(s): AD-A458299; NSRP-0340; No Copyright; Avail.: CASI: A03, Hardcopy

Knowledge of the strength characteristics of docking block timbers is a key element in safely drydocking ships. Such knowledge has become especially important for the Navy, because of changes in Navy ship design, coupled with heightened safety concerns regarding seismic loading. Although, over the years, timber strength knowledge has evolved to a general level, it has never reached the detailed level required to meet today's needs. This paper describes a study to gain timber strength knowledge at the detailed level by testing actual docking block timbers. The tests were conducted on individual timbers, timbers formed into layers, and timbers within full-sized docking block build-ups. The implication of the test results are discussed.

DTIC

*Drydocks; Marine Technology; Ships*

**20070001654** Army Engineer Research and Development Center, Vicksburg, MS USA

**Periodic Inspections of Coastal Structures with Stone Armor**

Bottin, Jr, Robert R; Mar 2003; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458556; ERDC/CHL-CHETN-III-65; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458556>; Avail.: CASI: A02, Hardcopy

This Coastal and Hydraulics Engineering Technical Note (CHETN) provides information on the long-term structural performance of selected stone-armored navigation structures to their environment. Coastal structures at St. Paul Harbor, AK, and Burns Harbor, IN, are discussed herein. The response of concrete-armored coastal structures to their environment will be presented in a subsequent CHETN.

DTIC

*Armor; Coasts; Inspection*

**20070001876** Texas Univ., Austin, TX USA

**An Overview of Alternate Dispute Resolution Use in the Construction Industry**

Tucker, Matthew P; Aug 2005; 62 pp.; In English

Report No.(s): AD-A458748; No Copyright; Avail.: CASI: A04, Hardcopy

This report provides an overview of alternate dispute resolution and its use in the construction industry. An overview of the U.S. legal system is provided as a basis for dispute resolution. Caseload and litigation trends in U.S. courts are discussed. An overview of the various types of alternate dispute resolution and use by Fortune 1000 companies and the U.S. government is provided. Specific considerations of alternate dispute resolution in the construction industry are discussed. The report concludes with case studies from an actual construction mediation and arbitration.

DTIC

*Construction; Construction Industry; Industries*

**20070002074** Universidad Politecnica de Madrid, Madrid, Spain

**MICROMECHANICS and MICROSTRUCTURE EVOLUTION: Modeling, Simulation and Experiments. Held in Madrid, Spain on 12-16 September 2005**

Oct 30, 2006; 95 pp.; In English

Contract(s)/Grant(s): FA8655-05-1-5027

Report No.(s): AD-A458362; No Copyright; Avail.: CASI: [A05](#), Hardcopy

No abstract available

*Micromechanics; Microstructure; Simulation; Spain*

## 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*.

**20070000543** National Oceanic and Atmospheric Administration, Silver Spring, MD, USA

**Earth System Monitor, Volume 15, No. 2**

Crane, Michael, Editor; Gaines, Mindy, Editor; Pulliam, Marc, Editor; November 2006; ISSN 1068-2678; 12 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This issue of the NOAA newsletter contains the following brief articles: Ecosystems: A NOAA Priority, Letter from the Director, Ecosystem Training Essential for Next Generation of Professionals, Establishing a Corporate Infrastructure for NOAA Education: Interview with Louisa Koch, Director, Hollings Scholar Creates Data Catalog for Science on a Sphere, Regional Ecosystem.

CASI

*Ecosystems; Earth Sciences; Ecology*

## 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*.

**20070000511** Lawrence Livermore National Lab., Livermore, CA USA

**Sharper Image for Surveillance**

Hazi, A.; Feb. 22, 2006; 10 pp.; In English

Report No.(s): DE2006-883743; UCRL-TR-219197; No Copyright; Avail.: Department of Energy Information Bridge

A technique adapted by Livermore scientists to take the twinkle out of stars is now being used to improve the resolution of long-range surveillance systems trained on earthbound objects. The speckle-imaging technique involves taking tens to hundreds of pictures with short-exposure times and reconstructing a single, sharp image using image-processing software. The technique drew the interest of Livermore engineer Carmen Carrano. She developed a prototype remote-surveillance system that can produce a detailed image of a face from a couple of kilometers away. The system also helps identify vehicles tens of kilometers away and improves the viewing of large structures more than 60 kilometers away.

NTIS

*Image Processing; Surveillance; Remote Sensing; Imaging Techniques*

**2007000535** NASA Stennis Space Center, Stennis Space Center, MS, USA

**Can MODIS Data Calibrate and Validate Coastal Sediment Transport Models? Rapid Prototyping Using 250 m Data and the ECOMSED Model for Lake Pontchartrain, LA USA**

Miller, Richard L.; Georgiou, Ioannis; Glorioso, Mark V.; McCorquodale, J. Alex; Crowder, Keely; [2006]; 1 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Field measurements from small boats and sparse arrays of instrumented buoys often do not provide sufficient data to capture the dynamic nature of biogeophysical parameters in many coastal aquatic environments. Several investigators have shown the MODIS 250 m images can provide daily synoptic views of suspended sediment concentration in coastal waters to determine sediment transport and fate. However, the use of MODIS for coastal environments can be limited due to a lack of cloud-free images. Sediment transport models are not constrained by sky conditions but often suffer from a lack of in situ observations for model calibration or validation. We demonstrate here the utility of MODIS 250 m to calibrate (set model parameters), validate output, and set or reset initial conditions of a hydrodynamic and sediment transport model (ECOMSED) developed for Lake Pontchartrain, LA USA. We present our approach in the context of how to quickly assess of 'prototype' an application of NASA data to support environmental managers and decision makers. The combination of daily MODIS imagery and model simulations offer a more robust monitoring and prediction system of suspended sediments than available from either system alone.

Author

*Calibrating; Coastal Water; Hydrology Models; Proving; Sediment Transport; Drainage Patterns; Hydrogeology*

**2007000537** NASA Langley Research Center, Hampton, VA, USA

**Surface Emissivity Effects on Thermodynamic Retrieval of IR Spectral Radiance**

Zhou, Daniel K.; Larar, Allen M.; Smith, William L.; Liu, Xu; [2006]; 8 pp.; In English; SPIE 5th International Symposium on Asia-Pacific Remote Sensing Conference 2006, 13-17 Nov. 2006, Goa, Indonesia; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 622-39-00; Copyright; Avail.: CASI: [A02](#), Hardcopy

The surface emissivity effect on the thermodynamic parameters (e.g., the surface skin temperature, atmospheric temperature, and moisture) retrieved from satellite infrared (IR) spectral radiance is studied. Simulation analysis demonstrates that surface emissivity plays an important role in retrieval of surface skin temperature and terrestrial boundary layer (TBL) moisture. NAST-I ultraspectral data collected during the CLAMS field campaign are used to retrieve thermodynamic properties of the atmosphere and surface. The retrievals are then validated by coincident in-situ measurements, such as sea surface temperature, radiosonde temperature and moisture profiles. Retrieved surface emissivity is also validated by that computed from the observed radiance and calculated emissions based on the retrievals of surface temperature and atmospheric profiles. In addition, retrieved surface skin temperature and emissivity are validated together by radiance comparison between the observation and retrieval-based calculation in the window region where atmospheric contribution is minimized. Both simulation and validation results have led to the conclusion that variable surface emissivity in the inversion process is needed to obtain accurate retrievals from satellite IR spectral radiance measurements. Retrieval examples are presented to reveal that surface emissivity plays a significant role in retrieving accurate surface skin temperature and TBL thermodynamic parameters.

Author

*Atmospheric Temperature; Satellite Observation; Spectral Emission; Spectrum Analysis; Surface Temperature; Temperature Profiles; Remote Sensing; Atmospheric Boundary Layer; Atmospheric Moisture*

**2007000538** NASA Langley Research Center, Hampton, VA, USA

**AIRS Retrieval Validation During the EAQUATE**

Zhou, Daniel K.; Smith, William L.; Cuomo, Vincenzo; Taylor, Jonathan P.; Barnett, Christopher D.; DiGirolamo, Paolo; Pappalardo, Gelsomina; Larar, Allen M.; Liu, Xu; Newman, Stuart M., et al.; [2006]; 12 pp.; In English; SPIE Europe Remote Sensing 2006, 11-14 Sep. 2006, Stockholm, Sweden; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 622-39-00; Copyright; Avail.: CASI: [A03](#), Hardcopy

Atmospheric and surface thermodynamic parameters retrieved with advanced hyperspectral remote sensors of Earth observing satellites are critical for weather prediction and scientific research. The retrieval algorithms and retrieved parameters from satellite sounders must be validated to demonstrate the capability and accuracy of both observation and data processing systems. The European AQUA Thermodynamic Experiment (EAQUATE) was conducted mainly for validation of the Atmospheric InfraRed Sounder (AIRS) on the AQUA satellite, but also for assessment of validation systems of both ground-based and aircraft-based instruments which will be used for other satellite systems such as the Infrared Atmospheric Sounding Interferometer (IASI) on the European MetOp satellite, the Cross-track Infrared Sounder (CrIS) from the NPOESS

Preparatory Project and the following NPOESS series of satellites. Detailed inter-comparisons were conducted and presented using different retrieval methodologies: measurements from airborne ultraspectral Fourier transform spectrometers, aircraft in-situ instruments, dedicated dropsondes and radiosondes, and ground based Raman Lidar, as well as from the European Center for Medium range Weather Forecasting (ECMWF) modeled thermal structures. The results of this study not only illustrate the quality of the measurements and retrieval products but also demonstrate the capability of these validation systems which are put in place to validate current and future hyperspectral sounding instruments and their scientific products.

Author

*Atmospheric Sounding; Meteorological Parameters; Temperature Distribution; Weather Forecasting; Proving; Intercalibration; Multisensor Applications; Satellite-Borne Instruments*

**2007000744** Massachusetts Inst. of Tech., Cambridge, MA USA

**A Layer-Stripping Solution of the Inverse Problem for a One-Dimensional Elastic Medium**

Yagle, Andrew E; Levy, Bernard C; Sep 1984; 32 pp.; In English

Contract(s)/Grant(s): AFOSR-82-0135A

Report No.(s): AD-A458118; LIDS-P-1329-REV; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A fast algorithm for recovering profiles of density and Lamé parameters as functions of depth for the inverse seismic problem in an elastic medium is obtained. The medium is probed with planar impulsive P and SV waves at oblique incidence, and the medium velocity components are measured at the surface. The interconversion of P and SV waves defines reflection coefficients from which the medium parameter profiles are obtained recursively. The algorithm works on a layer-stripping principle, and is specified in both differential and recursive forms. A physical interpretation of this procedure is given in terms of a lattice filter, where the first reflections of the downgoing waves in each layer yield the various reflection coefficients for that layer. A computer run of the algorithm on the synthetic impulsive plane wave responses of a twenty-layer medium shows that the algorithm-works satisfactorily.

DTIC

*Algorithms; Elastic Media; Seismic Waves; Stratigraphy*

**2007000875** Naval Research Lab., Stennis Space Center, MS USA

**Spatial Data Methods and Vague Regions: A Rough Set Approach**

Beaubouef, Theresa; Petry, Frederick E; Ladner, Roy; Jul 9, 2003; 30 pp.; In English

Report No.(s): AD-A458392; NRL/JA/7440--03-1010; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Uncertainty management has been considered essential for real world applications, and spatial data and geographic information systems in particular require some means for managing uncertainty and vagueness. Rough sets have been shown to be an effective tool for data mining and uncertainty management in databases. The 9-intersection, region connection calculus (RCC), and egg-yolk methods have proven useful for modeling topological relations in spatial data. In this paper, we apply rough set definitions for topological relationships based on the 9-intersection, RCC, and egg-yolk models for objects with broad boundaries. We show that rough sets can be used to express and improve on topological relationships and concepts defined with these models.

DTIC

*Data Management; Geographic Information Systems; Mathematical Models; Spatial Distribution; Topology*

**20070001123** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

**Stennis Space Center Verification & Validation Capabilities**

Pagnutti, Mary; Ryan, Robert E.; Holekamp, Kara; O'Neal, Duane; Knowlton, Kelly; Ross, Kenton; Blonski, Slawomir; [2005]; 3 pp.; In English; 2005 CALCON Technical Conference on Characterization and Radiometric Calibration for Remote Sensing, 22-25 Aug. 2005, Logan, UT, USA; Original contains color illustrations

Contract(s)/Grant(s): NNS04AB54T; SWR-C15C-JC15-00

Report No.(s): SSTI-2220-0044; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001123>; Avail.: CASI: [A01](#), Hardcopy

Scientists within NASA's Applied Sciences Directorate have developed a well-characterized remote sensing Verification & Validation (V&V) site at the John C. Stennis Space Center (SSC). This site enables the in-flight characterization of satellite and airborne high spatial and moderate resolution remote sensing systems and their products. The smaller scale of the newer high resolution remote sensing systems allows scientists to characterize geometric, spatial, and radiometric data properties using a single V&V site. The targets and techniques used to characterize data from these newer systems can differ significantly

from the techniques used to characterize data from the earlier, coarser spatial resolution systems. Scientists are also using the SSC V&V site to characterize thermal infrared systems and active lidar systems. SSC employs geodetic targets, edge targets, radiometric tarps, atmospheric monitoring equipment, and thermal calibration ponds to characterize remote sensing data products. The SSC Instrument Validation Lab is a key component of the V&V capability and is used to calibrate field instrumentation and to provide National Institute of Standards and Technology traceability. This poster presents a description of the SSC characterization capabilities and examples of calibration data.

Author

*Remote Sensing; Proving; Characterization; Environmental Monitoring; Radiometers; Satellite Observation; Geodesy*

**20070001500** NASA Stennis Space Center, Stennis Space Center, MS, USA

**Techniques for Producing Coastal Land Water Masks from Landsat and Other Multispectral Satellite Data**

Spruce, Joe; Hall, Callie; July 8, 2005; 3 pp.; In English; Twenty-Fifth Annual ESRI International User Conference, 25-29 Jul. 2005, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0048; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001500>; Avail.: CASI: A01, Hardcopy

Coastal erosion and land loss continue to threaten many areas in the USA. Landsat data has been used to monitor regional coastal change since the 1970's. Many techniques can be used to produce coastal land water masks, including image classification and density slicing of individual bands or of band ratios. Band ratios used in land water detection include several variations of the Normalized Difference Water Index (NDWI). This poster discusses a study that compares land water masks computed from unsupervised Landsat image classification with masks from density-sliced band ratios and from the Landsat TM band 5. The greater New Orleans area is employed in this study, due to its abundance of coastal habitats and its vulnerability to coastal land loss. Image classification produced the best results based on visual comparison to higher resolution satellite and aerial image displays. However, density-sliced NDWI imagery from either near infrared (NIR) and blue bands or from NIR and green bands also produced more effective land water masks than imagery from the density-sliced Landsat TM band 5. NDWI based on NIR and green bands is noteworthy because it allows land water masks to be generated from multispectral satellite sensors without a blue band (e.g., ASTER and Landsat MSS). NDWI techniques also have potential for producing land water masks from coarser scaled satellite data, such as MODIS.

Author

*Coasts; Landsat Satellites; Satellite Imagery; Remote Sensing; Water Erosion*

**20070001505** Army Construction Engineering Research Lab., Champaign, IL USA

**A Characterization of Land Use Trends Around the Perimeter of Military Ranges**

Sep 2006; 173 pp.; In English

Report No.(s): AD-A458388; ERDC/CERL-TR-06-26; No Copyright; Avail.: CASI: A08, Hardcopy

No abstract available

*Land Use; Trends; Ranges (Facilities); Characterization; Military Technology*

**20070001538** NASA Marshall Space Flight Center, Huntsville, AL, USA

**CIV Vacuum Ultraviolet Fabry-Perot Interferometers for Transition-Region Magnetography**

Gary, G. Allen; West, Edward A.; Rees, David; Zukic, Maumer; Herman, Peter; Li, Jianzhao; [2006]; 2 pp.; In English; Astronomical Society of the Pacific: Conference Proceedings, 19-23 Sep. 2005, Boulder, CO, USA; Copyright; Avail.:

Other Sources; Abstract Only

The vacuum ultraviolet region allows remote sensing of the upper levels of the solar atmosphere where the magnetic field dominates the physics. Obtaining an imaging interferometer that observes the transition region is the goal of this program. This paper gives a summary of our instrument development program (1998-2005) for a high-spectral-resolution, piezoelectric tunable Vacuum Ultraviolet Fabry-Perot Interferometer (VUV FPI) for obtaining narrow-passband images, magnetograms, and Dopplergrams of the transition region emission line of CN (155nm). A VUV interferometer will allow us to observe the magnetic field, flows, and heating events in the mid-transition region. The MSFC VUV FPI has measured values of FWHM approx. 9pm, FSR approx. 62pm, finesse approx. 5.3 and transmittance approx. 50% at 157nm. For the measurements, the University of Toronto's F2 eximer laser was used as an appropriate proxy for CIV 155nm. This has provided the first tunable interferometer with a FWHM compatible to VUV filter magnetograph.

Author

*Fabry-Perot Interferometers; Magnetic Signatures; Remote Sensing; Transition; Emission Spectra*



**20070001595** Army Engineer Research and Development Center, Vicksburg, MS USA  
**Characterization of Post-Hurricane Katrina Floodwater Pumping on Marsh Infauna**

Ray, Gary L; Oct 2006; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458459; ERDC/EL-TN-06-4; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458459>;  
Avail.: CASI: **A03**, Hardcopy

The Interagency Performance Evaluation Task Force (IPET) was created to study the performance of hurricane protection and damage reduction systems and consequences of structural failures, including potential impacts on biological resources, following Hurricane Katrina. This technical note describes the results of an IPET study funded to examine the impact of floodwater pumping on benthic invertebrate assemblages near Chalmette and Violet, Louisiana.

DTIC

*Floods; Hurricanes; Marshlands*

**20070001655** Massachusetts Inst. of Tech., Cambridge, MA USA

**Application of Statistical Learning Theory to Plankton Image Analysis**

Hu, Qiao; Jun 2006; 168 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): OCE-9820099; OCE-0000580

Report No.(s): AD-A458557; MIT/WHOI-2006-08; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458557>;

Avail.: CASI: **A08**, Hardcopy

A fundamental problem in limnology and oceanography is the inability to quickly identify and map distributions of plankton. This thesis addresses the problem by applying statistical machine learning to video images collected by an optical sampler, the Video Plankton Recorder (VPR). The research is focused on development of a real-time automatic plankton recognition system to estimate plankton abundance. The system includes four major components: pattern representation/feature measurement, feature extraction/selection, classification, and abundance estimation. After an extensive study on a traditional learning vector quantization (LVQ) neural network (NN) classifier built on shape-based features and different pattern representation methods, I developed a classification system combined multi-scale co-occurrence matrices feature with support vector machine classifier. This new method outperforms the traditional shape-based-NN classifier method by 12% in classification accuracy. Subsequent plankton abundance estimates are improved in the regions of low relative abundance by more than 50%. Both the NN and SVM classifiers have no rejection metrics. In this thesis, two rejection metrics were developed. One was based on the Euclidean distance in the feature space for NN classifier. The other used dual classifier (NN and SVM) voting as output. Using the dual-classification method alone yields almost as good abundance estimation as human labeling on a test-bed of real world data. However, the distance rejection metric for NN classifier might be more useful when the training samples are not 'good' ie, representative of the field data.

DTIC

*Image Analysis; Learning Theory; Limnology; Machine Learning; Neural Nets; Oceanography; Plankton; Statistical Analysis; Statistics; Video Signals*

**20070001697** Naval Research Lab., Bay Saint Louis, MS USA

**Creation and Modification of 1/8 degree and 1/16 degree Subtropical Gyre Atlantic Topographies**

McManus, Ashley P; Townsend, Tamara L; Metzger, E J; May 30, 1997; 26 pp.; In English

Report No.(s): AD-A458630; NRL/FR/7323--95-9626; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458630>;

Avail.: CASI: **A03**, Hardcopy

This report describes the development of the 1/16 deg Subtropical Gyre (STG) Atlantic topography used in the Naval Research Laboratory (NRL) Layered Ocean Model (NLOM). This topography is a version of the Earth Topography 5-minute (ETOP05) dataset that has been modified using maps from the National Imagery and Mapping Agency (NIMA), the Times (London) Atlas, and personal contacts. Comparisons are made between the pure ETOP05 dataset and the modified 1/8 deg and 1/16 deg versions of the STG Atlantic topographies. Actual and model coastlines (i.e., the 200-m isobath) from the final topography are more representative of this region, especially in the passages of the Lesser Antilles. Close examination of the coastlines at 1/16 deg resolution highlighted areas at 1/8 deg resolution that needed improvements. These were retrofitted into existing 1/8 deg topographies.

DTIC

*Coasts; Forecasting; Gyres; Ocean Models; Oceans; Topography*

**20070002094** Army Engineer Research and Development Center, Vicksburg, MS USA

**Monitoring Completed Navigation Projects Program**

Bottin, Jr , Robert R; Sep 2001; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458031; ERDC/CHL-CHETN-IX-5; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This Coastal and Hydraulics Engineering Technical Note (CHETN) describes the U.S. Army Corps of Engineers Monitoring Completed Navigation Projects (MCNP) Program. The program was formerly known as the Monitoring Completed Coastal Projects Program, but was modified in the late 1990s to include all navigation projects, inland as well as coastal. The MCNP Program evaluates the performance of completed civil works navigation projects. Its objective is to obtain information for verifying, or improving, navigation project performance. Monitoring is conducted to (a) determine if the project is functioning as designed, (b) improve design procedures, (c) improve construction methods, and (d) improve operations and maintenance techniques. Shallow- and deep-draft navigation projects located in rivers, reservoirs, lakes, estuaries, and the coastal zone may be considered for monitoring in the MCNP Program. Monitoring may be conducted as either a comprehensive detailed survey to verify postconstruction conditions on a one-time basis, or a continuous (repetitive) collection of prototype data over an extended period. The MCNP Program can only fund monitoring for completed projects operated and/or maintained by the Corps. Projects must be related to navigation, or mitigation for navigation, to be monitored by the program.

DTIC

*Coasts; Navigation*

**20070002096** SRI International Corp., Menlo Park, CA USA

**Reimplementation of the Stanford Stereo System. Integration Experiments with the SRI Baseline Stereo System**

Baker, H H; Feb 1989; 14 pp.; In English

Contract(s)/Grant(s): MDA903-83-C-0027; DACA76-85-C-0004

Report No.(s): AD-A457985; TN-431; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We describe experiments in stereo matching using a Lisp Machine implementation of the Baker stereo system developed at Stanford University. The processing is one of edge matching in a hierarchy of long to short image contours, finishing with interedge intensity correlation to yield a dense map of scene disparities. An experiment and the results obtained in coupling this with the SRI STEREO SYS mapping system are presented.

DTIC

*Stereophotography; Mapping*

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*.

**20070000492** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Supporting Photovoltaics in Market-Rate Residential New Construction: A Summary of Programmatic Experience to Date and Lessons Learned**

Barbose, G.; Wiser, R.; Bolinger, M.; Feb. 2006; 34 pp.; In English

Report No.(s): DE2006-883792; No Copyright; Avail.: Department of Energy Information Bridge

As a market segment for solar photovoltaic (PV) adoption, new homes have a number of attractive attributes. Homebuyers can easily roll the cost of the PV system into their tax-deductible home mortgage and, with rebates and other financial incentives, potentially achieve an immediate net-positive cash flow from the investment. New homes are amenable to building-integrated photovoltaics (BIPV), which are less susceptible to aesthetic concerns than traditional, rack-mounted systems. The performance of PV systems can be optimized on new homes by taking roof orientation and shading into account when designing the home. Perhaps most importantly, subdivisions with PV systems installed on a large number of homes offer potential cost savings from volume purchases of modules and inverters and from scale economies in system design and installation. Finally, the ability of builders to install PV as a standard feature on multiple homes in new subdivisions offers

an opportunity to circumvent the high transaction costs and information-related market barriers typically confronted when each individual homeowner must make a decision about installing PV.

NTIS

*Incentives; Photovoltaic Conversion; Roofs*

**2007000687** Rock Island Arsenal, IL USA

**Energy Program At Rock Island Arsenal**

Mullins, Mike G; Feb 26, 2004; 58 pp.; In English; Original contains color illustrations

Report No.(s): AD-A457996; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A briefing on the Energy program at the Rock Island Arsenal, covering both energy and water use and conservation. Briefing outline: Arsenal history; Manufacturing history; Energy plan; Energy projects; Industrial buildings - Energy opportunities

DTIC

*Energy Policy; Industrial Plants; Rocks; Water Management*

**2007000775** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Compact, Lightweight, Superconducting Power Generators (Postprint)**

Barnes, Paul N; Rhoads, Gregory L; Tolliver, Justin C; Sumption, Michael D; Schmaeman, Kevin W; Jan 2005; 8 pp.; In English

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

Report No.(s): AD-A458166; AFRL-PR-WP-TP-2006-216; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many future military systems will depend heavily on high electrical power input ranging from hundreds of kilowatts up to the multimewatt level. These weapon systems include electromagnetic launch applications as well as electrically driven directed energy weapons (DEW), such as high-power microwaves and solid-state lasers. These power generation subsystems must often be packaged using limited space and strict weight limits on either ground mobile or airborne platforms. Superconducting generators made of high-temperature superconductors (HTS) will enable megawatt-class airborne power systems that are lightweight and compact. Also discussed briefly are new advances in HTS conductors and refrigeration systems furthering the development of HTS power systems.

DTIC

*Electric Generators; High Temperature Superconductors; Superconductivity*

**20070001127** NASA Glenn Research Center, Cleveland, OH, USA

**Status of NASA's Advanced Radioisotope Power Conversion Technology Research and Development**

Wong, Wayne A.; Anderson, David J.; Tuttle, Karen L.; Tew, Roy C.; November 2006; 15 pp.; In English; Space Technology and Applications International Forum (STAIF-2006), 12-16 Feb. 2006, Albuquerque, NM, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 494.04.01.01

Report No.(s): NASA/TM-2006-214243; E-15486; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001127>;

Avail.: CASI: [A03](#), Hardcopy

NASA's Advanced Radioisotope Power Systems (RPS) development program is funding the advancement of next generation power conversion technologies that will enable future missions that have requirements that can not be met by either the ubiquitous photovoltaic systems or by current Radioisotope Power Systems (RPS). Requirements of advanced radioisotope power systems include high efficiency and high specific power (watts/kilogram) in order to meet mission requirements with less radioisotope fuel and lower mass. Other Advanced RPS development goals include long-life, reliability, and scalability so that these systems can meet requirements for a variety of future space applications including continual operation surface missions, outer-planetary missions, and solar probe. This paper provides an update on the Radioisotope Power Conversion Technology Project which awarded ten Phase I contracts for research and development of a variety of power conversion technologies consisting of Brayton, Stirling, thermoelectrics, and thermophotovoltaics. Three of the contracts continue during the current Phase II in the areas of thermoelectric and Stirling power conversion. The accomplishments to date of the contractors, project plans, and status will be summarized.

Author

*Thermoelectric Power Generation; Stirling Cycle; Brayton Cycle; Systems Engineering*

**20070001620** Ada Systems LLC, Carol Stream, IL USA

**Advanced Energy Saving Through the Use of Evaporative Cooling and Energy Recovery in Hybrid HVAC Systems**

Shapiro, Leon E; Feb 25, 2004; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458497; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458497>; Avail.: Defense Technical Information Center (DTIC)

Evaporative Cooling: There are external forces affecting the method and manner in which institutions and businesses provide ventilation, heating and cooling for their provide their facilities. If you could, would you provide your clients/customers with an HVAC system that: \* Supplies 100% fresh outdoor air instead of stale recirculated air \* Uses significantly less energy to operate than current recirculation systems \* Can be installed on a first cost basis equal to or less than a standard mechanical system \* Can be retrofitted to their existing systems (in most cases) \* Is user-friendly for maintenance personnel to operate and maintain

DTIC

*Air Conditioning; Air Conditioning Equipment; Energy Conservation; Evaporation; Evaporative Cooling; Heating; Space Heating (Buildings); Ventilation*

**20070001903** California Univ., Santa Cruz, CA USA

**Design of Heterostructures for High Efficiency Thermionic Emission**

Bian, Zhixi; Shakouri, Ali; Nov 2005; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458803; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We use two heterostructure designs to improve the energy conversion efficiency of solid-state thermionic devices. The first method is to use a non-planar heterostructure with roughness in order of electron mean free path. This has some combined benefits of increased effective interface area, and reduced total internal reflection for the electron trajectories arriving at the interface. Monte Carlo simulations of various geometries show that the electrical conductivity and thermoelectric figure of merit can be improved for non-planar barrier compared to the planar counterpart. The second method is to use planar high barrier heterostructures with different effective masses for charge carriers in emitter and barrier regions. When an electron passes from a lower effective mass emitter and arrives at a barrier with higher effective mass, since both the lateral momentum and total energy are conserved, part of the lateral energy is coupled to the vertical direction and the electron gains momentum in the direction perpendicular to the interface to enter the barrier region. For high potential barriers, the improvement of thermionic current is about the same as the ratio of the effective masses of the two materials, which can be a factor of 5-10 for typical heterostructure material systems.

DTIC

*Energy Conversion; Thermionic Emission; Thermoelectric Power Generation*

## 45

### ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

**20070000007** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Natural and Industrial Analogues for Release of CO(sub 2) from Storage Reservoirs: Identification of Features, Events, and Processes and Lessons Learned**

Lewicki, J. L.; Birkholzer, J.; Tsang, C. F.; Feb. 2006; 62 pp.; In English

Report No.(s): DE2006-891824; No Copyright; Avail.: National Technical Information Service (NTIS)

The injection and storage of anthropogenic CO(sub 2) in deep geologic formations is a potentially feasible strategy to reduce CO(sub 2) emissions and atmospheric concentrations. While the purpose of geologic carbon storage is to trap CO(sub 2) underground, CO(sub 2) could migrate away from the storage site into the shallow subsurface and atmosphere if permeable pathways such as well bores or faults are present. Large-magnitude releases of CO(sub 2) have occurred naturally from geologic reservoirs in numerous volcanic, geothermal, and sedimentary basin settings. Carbon dioxide and natural gas have also been released from geologic CO(sub 2) reservoirs and natural gas storage facilities, respectively, due to influences such as well defects and injection/withdrawal processes. These systems serve as natural and industrial analogues for the potential release of CO(sub 2) from geologic storage reservoirs and provide important information about the key features, events, and

processes (FEPs) that are associated with releases, as well as the health, safety, and environmental consequences of releases and mitigation efforts that can be applied.

NTIS

*Analogs; Carbon Dioxide; Reservoirs; Underground Storage*

**2007000009** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Mitigating Carbon Emissions: the Potential of Improving Efficiency of Household Appliances in China**

Lin, J.; Jul. 2006; 44 pp.; In English

Report No.(s): DE2006-891826; LBNL-60973; No Copyright; Avail.: National Technical Information Service (NTIS)

China is already the second largest energy consumer and emitter of the greenhouse gases (GHG) in the world after the USA, and its demand for energy is expected to continue to grow rapidly in the foreseeable future, due to its fast economic growth and its low level of energy use per capita. It is widely expected that China is likely to overtake the U.S. in energy consumption and GHG emissions during the first half of the 21st century. Therefore, there is considerable interest in the international community in searching for options that may help China slow down its growth in energy consumption and GHG emissions through energy efficiency improvement and adopting more environmentally friendly fuel supplies such as renewable energy.

NTIS

*Carbon Dioxide; China; Energy Conservation; Forecasting; Energy Consumption*

**2007000021** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Health, Safety, and Environmental Screening and Ranking Framework for Geologic CO2 Storage Site Selection**

Oldenburg, C. M.; Sep. 20, 2005; 34 pp.; In English

Report No.(s): DE2006-885235; LBNL-58873; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes a screening and ranking framework (SRF) developed to evaluate potential geologic carbon dioxide (CO<sub>2</sub>) storage sites on the basis of health, safety, and environmental (HSE) risk arising from possible CO<sub>2</sub> leakage. The approach is based on the assumption that HSE risk due to CO<sub>2</sub> leakage is dependent on three basic characteristics of a geologic CO<sub>2</sub> storage site: (1) the potential for primary containment by the target formation; (2) the potential for secondary containment if the primary formation leaks; and (3) the potential for attenuation and dispersion of leaking CO<sub>2</sub> if the primary formation leaks and secondary containment fails. The framework is implemented in a spreadsheet in which users enter numerical scores representing expert opinions or general information available from published materials along with estimates of uncertainty to evaluate the three basic characteristics in order to screen and rank candidate sites. Application of the framework to the Rio Vista Gas Field, Ventura Oil Field, and Mammoth Mountain demonstrates the approach. Refinements and extensions are possible through the use of more detailed data or model results in place of property proxies. Revisions and extensions to improve the approach are anticipated in the near future as it is used and tested by colleagues and collaborators.

NTIS

*Carbon Dioxide; Health; Ranking; Safety; Site Selection; Structural Properties (Geology); Containment*

**20070000477** Environmental Protection Agency, Washington, DC, USA

**EPA Can Improve Emissions Factors Development and Management**

Mar. 22, 2006; 42 pp.; In English

Report No.(s): PB2007-103010; EPA/2006-P-00017; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We sought to determine whether the air emissions factors used by the Environmental Protection Agency (EPA) are of acceptable quality for making key environmental decisions, and whether EPA's process for developing, improving, and rating emissions factors is sufficient to meet users' needs.

NTIS

*Environment Protection; Emission*

**20070000479** Environmental Protection Agency, Washington, DC, USA

**Progress Made in Monitoring Ambient Air Toxics, But Further Improvements Can Increase Effectiveness**

Mar. 02, 2005; 74 pp.; In English

Report No.(s): PB2007-103012; EPA/2005-P-00008; No Copyright; Avail.: National Technical Information Service (NTIS)

We performed this review to evaluate EPA's progress in establishing a national network and determine the status of ambient air toxics monitoring nationwide. A viable ambient monitoring program to detect areas of unhealthy air toxics

concentrations and to measure national and local trends in those concentrations is key to assessing progress in reducing air toxics-related health risks.

NTIS

*Environment Protection; Toxic Hazards; Air Pollution; Environmental Monitoring*

**20070000491** Environmental Protection Agency, Washington, DC, USA

**Monitoring Needed to Assess Impact of EPA's Clean Air Mercury Rule on Potential Hotspots**

May 15, 2006; 33 pp.; In English

Report No.(s): PB2007-103009; EPA/2006-P-00025; No Copyright; Avail.: National Technical Information Service (NTIS)

In support of its Clean Air Mercury Rule (CAMR), the Environmental Protection Agency (EPA) conducted a detailed analysis of mercury emissions and deposition. EPA concluded that 'utility attributable' hotspots would not occur after implementation of CAMR's mercury trading program. This evaluation assesses the basis for EPA's conclusion.

NTIS

*Air Quality; Environment Protection; Mercury (Metal)*

**20070000709** General Accounting Office, Washington, DC USA

**Drinking Water. Experts' Views on How Federal Funding Can Best Be Spent to Improve Security**

Sep 30, 2004; 23 pp.; In English

Report No.(s): AD-A458048; No Copyright; Avail.: CASI: [A03](#), Hardcopy

GAO's expert panel cited distribution systems as among the most vulnerable physical components of a drinking water utility, a conclusion also reached by key research organizations. Also cited were the computer systems that manage critical utility functions; treatment chemicals stored on-site; and source water supplies. Experts further identified two key factors that constitute overarching vulnerabilities: (1) a lack of the information individual utilities need to identify their most serious threats and (2) a lack of redundancy in vital system components, which increases the likelihood an attack could render an entire utility inoperable. According to over 90 percent of the experts, utilities serving high-density areas deserve at least a high priority for federal funding. Also warranting priority are utilities serving critical assets, such as military bases, national icons, and key academic institutions. Direct federal grants were clearly the most preferred funding mechanism, with over half the experts indicating that such grants would be very effective in distributing funds to recipients. Substantially fewer recommended using the Drinking Water State Revolving Fund for security upgrades.

DTIC

*Federal Budgets; Potable Water; Security*

**20070001567** Istituto Superiore di Sanita, Rome, Italy

**Scientific Symposium: Air Pollution and Human Exposure Complexity. SCOPE Open Executive Committee Meeting (52nd). Held in Rome, Italy on October 2-3, 2006 (Simposio Scientifico: Inquinamento Atmosferico e Complessita Dell'Esposizione Umana. SCOPE Open Executive Committee Meeting (52nd), Roma, Italia, Ottobre 2-3, 2006)**

Carere, A.; Minardi, V.; di Domenico, A.; January 2006; 36 pp.; In English; Scientific Symposium: Air Pollution and Human Exposure Complexity. SCOPE Open Executive Committee Meeting (52nd)., October 2 - 3, 2006, Rome, Italy

Report No.(s): PB2007-103476; ISTISAN-C-06/C7; Copyright; Avail.: National Technical Information Service (NTIS)

The SCOPE (Scientific Committee on Problems of the Environment) 52nd Open Executive Meeting opens with a scientific symposium is structured into two sessions: Session 1 on 'Air pollution' and Session 2 on 'Human exposure complexity: implications for risk assessment'. Both themes are internationally recognized of great relevance for the human health and the environment. International experts at international level will present some of the most important problems associated with air pollution, including regional and global issues, as well as problems related to human exposure complexity, with examples of case studies of complex mixtures, with their implications for risk assessment.

NTIS

*Air Pollution; Exposure; Italy*

**20070001572** Environmental Protection Agency, Sacramento, CA, USA

**Atmospheric Acidity Protection Program: Final Assessment**

Oct. 2000; 37 pp.; In English

Report No.(s): PB2007-103031; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Scientific evidence in other parts of the world has shown that atmospheric deposition of sulfur and nitrogen compounds

can cause harm to the environment and, thus, may present a threat to California's ecosystems and the health of its citizens. To adequately address this serious concern, the causes and effects of acid deposition in California were studied in two comprehensive State-funded research programs. These studies examined the atmospheric processes associated with acid deposition and its effects on human health, aquatic ecosystems, forest ecosystems, agricultural crops, and man-made materials. Statewide networks to monitor pollutant concentrations in wet and dry deposition were established to measure conditions in both urban and rural areas.

NTIS

*Acid Rain; Acidity; Air Pollution; Ecosystems; Forests; Protection; Public Health*

**20070001575** Desert Research Inst., Reno, NV, USA

**Summary of EPA's Particulate Matter Supersites Program: Results That Can Be Used to Prepare and Evaluate State Implementation Plans (SIPS)**

Solomon, P. A.; Sep. 2006; 58 pp.; In English

Contract(s)/Grant(s): CR8280257-01; CR8280258-01-0

Report No.(s): PB2007-103430; EPA/600/R-06/154; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This report is a synopsis of the main scientific findings from EPA's Particulate Matter Supersites Program. Its purpose is to facilitate communication of these findings to key stakeholders in government, the private sector, and to scientists interested in developing approaches to reducing ambient particulate matter (PM) to levels below the National Ambient Air Quality Standards for PM, and thus, protect public health and welfare.

NTIS

*Particulates; Environment Protection*

**20070001661** Istituto Superiore di Sanita, Rome, Italy

**Stazione di Rilevamento Dell'Istituto Superiore di Sanita per lo Studio della Qualita Dell'Aria: Anni 2003 e 2004 (Study of Air Quality as Recorded by the Monitoring Station at the Istituto Superiore di Sanita in 2003-2004)**

Cattani, G.; Viviano, G.; January 2006; 87 pp.; In Italian

Report No.(s): PB2007-103498; ISTISAN-06/13; Copyright; Avail.: National Technical Information Service (NTIS)

Since 1978 a monitoring station of air pollutants has been working at the Istituto Superiore di Sanita. Concentrations of health concern pollutants are measured both continuously (by direct reading instruments) and offline (by collection of air samples followed by chemical characterization). In this report the results obtained in the period 2003-2004 are presented for the following pollutants: carbon monoxide, nitrogen oxides, ozone, volatile organic compounds (VOC) (aliphatic, aromatic, and carbonic compounds), particulate matter (PM10, PM2.5, particles number), metals (cadmium, nickel, lead), semi-metals (arsenicum), and polycyclic aromatic hydrocarbons (PAH). For each pollutant, the report gives the general characteristics, its health effects, the regulations currently adopted in Italy and in the European Union, the results and their evaluation also in relation to the World Health Organization (WHO) guidelines.

NTIS

*Air Pollution; Air Quality; Pollution Monitoring*

**20070001749** Industrial and Environmental Analysts, Inc., Research Triangle Park, NC USA

**Determination of Particulate & Dust Concentration During Shipyard Drydock Sandblasting Operations**

Poore, Everett; Slater, Patrick; Sep 1992; 99 pp.; In English

Report No.(s): AD-A458726; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458726>; Avail.: CASI: [A05](#), Hardcopy

Testing was performed to determine the concentrations of total suspended particulate (TSP) and particulate matter smaller than 10 microns (PM10) during a typical sandblasting operation. Testing was conducted at the Norfolk Shipbuilding and Drydock Corporation (Norshipco) located in Norfolk, Virginia, on July 14-15, 1992 under the direction of Thomas Beacham of Norshipco. Sampling was conducted by Patrick Slater and Everett Poore of Industrial & Environmental Analysts, Inc. (IEA) Research Triangle Park, North Carolina. Testing was observed by Ms. Lural Driver and Mr. Roy Huntley of the U.S. Environmental Protection Agency (EPA). Gravimetric analysis was performed by Clean Air Engineering (CAE) Analytical Services. Polarized Light Microscopy (PLM) and Scanning Electron Microscopy with Energy Dispersive X-Ray Spectroscopy (SEM-EDX) analyses were performed by IEA, Inc., North Billerica, Massachusetts. A discussion of the project and sandblasting process is presented in Section 2. A summary and discussion of sampling results is included in Section 3. Sampling and analytical procedures are discussed in Section 4. Quality assurance/quality control (QA/QC) procedures are

presented in Section 5. All field data, chain-of-custody forms, laboratory data, field logs, and equipment calibrations are included in the appendices.

DTIC

*Abrasives; Drydocks; Dust; Particulates; Shipyards*

## 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*.

**2007000803** Spectral Sciences, Inc., Burlington, MA USA

#### **Radiation Transport Effects and the Interpretation of Infrared Images of Gravity Waves and Turbulence**

Gruninger, John; Duff, James W; Brown, James H; Blumberg, William A; Jan 1998; 15 pp.; In English

Contract(s)/Grant(s): F19628-91-C-0083

Report No.(s): AD-A458214; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Radiation transport modulates the spatial frequencies of atmospheric structures, acting as a low pass filter, which causes the power spectra of the accumulated radiance to have different power spectral slopes than the underlying atmospheric structure. Additional effects arise because of the non-stationarity of the atmosphere. The SHARC atmospheric radiance code is used to model both equilibrium and non-equilibrium radiance and radiance fluctuation statistics. It predicts two dimensional radiance spatial covariance functions and power spectral densities, PSDs. Radiance power spectral slopes for paths through isotropic Kolmogorov turbulence are predicted to vary from  $5/3$  to  $8/3$  depending on the length of the path through the turbulence. The input gravity wave 3-D covariances and PSDs of atmospheric temperature are consistent with current gravity wave theory, having vertical and horizontal power spectral indices of  $-3$  and  $5/3$ , respectively. Altitude profiles of variances and correlation lengths account for the non-stationary of the gravity wave structure in the atmosphere. The radiance covariance and PSD power spectral slopes differ from the atmospheric gravity wave temperature model values of  $-3$  and  $5/3$ . These modulations depend on LOS orientations, and scale lengths of the sampled altitudes along the LOS.

DTIC

*Atmospheric Circulation; Atmospheric Turbulence; Gravitational Effects; Gravity Waves; Infrared Imagery; Radiation Transport; Radiative Transfer; Turbulence*

**20070002065** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Are Ring Current Ions Lost in Electromagnetic Ion Cyclotron Wave Dispersion Relation?**

Khazanov, G. V.; Gamayunov, K. V.; [2006]; 3 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Electromagnetic ion cyclotron (EMIC) waves are widely observed in the inner and outer magnetosphere, at geostationary orbit, at high latitudes along the plasmapause, and at the ionospheric altitudes. Interaction of the Ring Current (RC) ions and EMIC waves causes ion scattering into the loss cone and leads to decay of the RC, especially during the main phase of storms when the RC decay times of about one hour or less are observed. The oblique EMIC waves damp due to Landau resonance with the thermal plasmaspheric electrons, and subsequent transport of the dissipating wave energy into the ionosphere below causes an ionosphere temperature enhancement. Induced scattering of these waves by the plasmaspheric thermal ions leads to ion temperature enhancement, and forms a so-called hot zone near the plasmapause where the temperature of core plasma ions can reach tens of thousands of degrees. Relativistic electrons in the outer radiation belt also interact well with the EMIC waves, and during the main and/or recovery phases of the storms these electrons can easily be scattered into the loss cone over a time scale from several hours to a day. The plasma density distribution in the magnetosphere and the ion content play a critical role in EMIC wave generation and propagation, but the wave dispersion relation in the known RC-EMIC wave interaction models is assumed to be determined by the thermal plasma distribution only. In these models, the modification of the EMIC wave dispersion relation caused by the RC ions is not taken into account, and the RC ions are only treated as a source of free energy in order to generate EMIC waves. At the same time, the RC ions can dominate the thermal magnetospheric content in the night MLT sector at great L shells during the main and/or recovery storm phase. In this study, using our self-consistent RC-EMIC wave model [Khazanov et al., 2006], we simulate the May 1998 storm in order to quantify the global EMIC wave redistribution caused by taking into account the RC ions in the EMIC wave dispersion relation. The dramatic wave pattern redistribution is observed in the postdusk-predawn MLT sector (night sector) for L greater than 5. We found the intense EMIC waves (about a few nT) there during the main and early recovery phases of the storm. The observed wave generation in this sector is caused by taking into account the EMIC wave dispersion change due to the RC ions. There



are no waves at these locations in our model if the RC ions are taken into account in the wave growth rate only, and the wave dispersion relation is only governed by the thermal plasmaspheric model.

Author

*Electromagnetic Radiation; Ions; Ring Currents; Wave Dispersion; Mathematical Models*

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### METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

**2007000024** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

#### **Atmospheric Dispersion Capability for T2VOC**

Oldenburg, C. M.; Aug. 04, 2005; 38 pp.; In English

Report No.(s): DE2006-885233; LBNL-58870; No Copyright; Avail.: Department of Energy Information Bridge

Atmospheric transport by variable-K theory dispersion has been added to T2VOC. The new code, T2VOCA, models flow and transport in the subsurface identically to T2VOC, but includes also the capability for modeling passive multicomponent variable-K theory dispersion in an atmospheric region assumed to be flat, horizontal, and with a logarithmic wind profile. The specification of the logarithmic wind profile in the T2VOC input file is automated through the use of a build code called ATMDISPV. The new capability is demonstrated on 2-D and 3-D example problems described in this report.

NTIS

*Meteorology; Atmospheric Circulation; Horizontal Distribution; Atmospheric Models; Atmospheric Diffusion*

**20070000473** Geological Survey, Reston, VA USA

#### **Land-Cover Trends in the Mojave Basin and Range Ecoregion**

Sleeter, B. M.; Raumann, C. G.; January 2006; 18 pp.; In English

Report No.(s): PB2007-102714; USGS-SIR-2006/5098; No Copyright; Avail.: National Technical Information Service (NTIS)

The U.S. Geological Survey's Land-Cover Trends Project aims to estimate the rates of contemporary land-cover change within the conterminous USA between 1972 and 2000. A random sampling approach was used to select a representative sample of 10-km by 10-km sample blocks and to estimate change within +/-1 percent at an 85-percent confidence interval. Landsat Multispectral Scanner, Thematic Mapper, and Enhanced Thematic Mapper Plus data were used, and each 60-m pixel was assigned to one of 11 distinct land-cover classes based upon a modified Anderson classification system. Upon completion of land-cover change mapping for five dates, land-cover change statistics were generated and analyzed. This paper presents estimates for the Mojave Basin and Range ecoregion located in the southwestern USA. Our research suggests land-cover change within the Mojave to be relatively rare and highly localized. The primary shift in land cover is unidirectional, with natural desert grass/shrubland being converted to development. We estimate that more than 1,300 km<sup>2</sup> have been converted since 1973 and that the conversion is being largely driven by economic and recreational opportunities provided by the Mojave ecoregion. The time interval with the highest rate of change was 1986 to 1992, in which the rate was 0.21 percent (321.9 km<sup>2</sup>) per year total change.

NTIS

*Change Detection; Land Use; Trends*

**20070000510** Colorado Univ., Boulder, CO USA

#### **Coordinated Effort to Improve Parameterization of High-Latitude Cloud and Radiation Processes**

Pinto, J. O.; Lynch, A. H.; Dec. 2004; 10 pp.; In English

Report No.(s): DE2006-877105; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of this project is the development and evaluation of improved parameterization of arctic cloud and radiation processes and implementation of the parameterizations into a climate model. Our research focuses specifically on the following issues: continued development and evaluation of cloud microphysical parameterizations, focusing on issues of particular relevance for mixed phase clouds, and evaluation of the mesoscale simulation of arctic cloud system life cycles.

NTIS

*Cloud Cover; Cloud Physics; Parameterization; Polar Regions; Solar Radiation*

**20070000704** Naval Research Lab., Washington, DC USA

**NRL Tropical Exposure Facilities**

Leonard, John M; Apr 1947; 12 pp.; In English

Report No.(s): AD-A458033; NRL-C-3073; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In the recent war the problem of protecting material from climatic deterioration was accentuated due to the rapid failure of much of the initial equipment consigned to tropical areas. During the war a great deal of effort was directed toward the solution of this problem. In addition to the numerous endeavors made by individual laboratories throughout the country it was deemed necessary to predict actual performance on the ability of tropical equipment or material to withstand attack in actual tropical environment. Under the auspices of the National Defense Research Committee a tropical testing station was established on Barro Colorado Island in the Canal Zone. In the early part of 1946 this station was moved to the Fort Sherman Military Reservation and its administration subsequently assumed by the Naval Research Laboratory. This report describes the history of this station, the scope of its activities and planning for its widest possible use in the future. Facilities are described, which are adaptable to the study of numerous problems in tropical deterioration. These facilities are available to governmental agencies concerned with such problems. An outline is presented of the services which it can provide.

DTIC

*Deterioration; Exposure; Military Technology; Tropical Regions*

**20070000731** Army Research Lab., White Sands Missile Range, NM USA

**The Integrated Weather Effects Decision Aid: A Common Software Tool to Assist in Command and Control Decision Making**

Sauter, David; Torres, Mario; Brandt, Jim; McGee, Steve; Jan 1999; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A458099; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Military operations and weapon systems are adversely affected to some extent by the environment, even those advertised as 'all weather capable'. However, presenting this information to the command and control decision maker has been somewhat nebulous, incomplete, and time consuming. As a result, the Army Research Laboratory has developed an automated software decision aid (the Integrated Weather Effects Decision Aid - IWEDA) to assist the commander in making intelligent command and control decisions regarding the allocation or use of weapon systems and in mission planning. IWEDA produces detailed graphic and text information regarding the what, when, why, and where of pertinent environmental impacts on 70 weapon systems (including 16 threat systems). Impacts are displayed graphically in terms of a Weather Effects Matrix (WEM) which color codes the impacts on the system(s) of interest with green (favorable), amber (marginal), and red (unfavorable) cells over time. Map overlays allow a detailed inspection of the spatial distribution of the impacts. Efforts associated with integrating physics based model output (e.g., target acquisition routines, heat stress algorithms, etc.) have either been completed or are ongoing. Additional weapon system miles (to include Air Force and Navy systems) are being collected for incorporation into a tri-service IWEDA.

DTIC

*Command and Control; Decision Making; Decision Support Systems; Meteorology*

**20070000746** Iowa Univ., Iowa City, IA USA

**Stream-Flow Measurements at Selected Gaging Stations in the Iowa and Des Moines River Basins**

Nakato, Tatsuaki; Houser, Doug; Nov 2003; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458122; IIHR-TR0433; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Two sets of field velocity measurements were taken at fifteen stream gaging sites within the Iowa River and Des Moines River basins during the period from 10 July 2003 to 27 August 2003. These additional data confirmed the validity of the log-linear stage- discharge relationships and the rating tables developed previously in July 2003 for each station by IIHR.

DTIC

*Flow Measurement; Iowa; Measuring Instruments; River Basins; Rivers; Streams*

**20070000855** Library of Congress, Washington, DC USA

**Hurricane Katrina: DOD Disaster Response. CRS Report for Congress**

Bowman, Steve; Kapp, Lawrence; Belasco, Amy; Sep 19, 2005; 20 pp.; In English

Report No.(s): AD-A458318; ORDER-CODE-RL33095; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The issue that has received the most attention in post-Katrina discussions is the speed of rescue and relief operations. The Department of Defense's (DOD's) Northern Command began its alert and coordination procedures before Katrina's landfall;

however, many deployments did not reach the affected area until days later. An examination of the timeline of DOD's response and the decision points along that timeline could provide insight into whether the response could have been accelerated given the intensity of the storm and the extent of the destruction. Both the National Response Plan and DOD's own Homeland Security Doctrine lay out extensive procedures and specific decision points in an attempt to ensure an organized response to catastrophic incidents. It may now be necessary to examine those procedures and the actions of responsible authorities to determine whether procedural obstacles, administrative failures, or both delayed the arrival of needed resources in the affected area. The traditional assumption that the Department of Defense is the resource of last resort may also require re-examination.

DTIC

*Disasters; Hurricanes; Responses*

**20070000996** Meteorological Satellite Center, Kiyose, Japan

**Monthly Report of the Meteorological Satellite Center: September 2006**

September 2006; In English; Copyright; Avail.: Other Sources

The CD-ROM concerning the August 2006 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

*Atmospheric Sounding; Japan; Satellite Observation; Satellite Sounding; Meteorological Parameters; Satellite Imagery*

**20070001480** Navy Personnel Research Studies and Technology, Millington, TN USA

**Results of the 2004 Marine Corps Climate Surveys (MCCS): Management Report**

Nov 2006; 166 pp.; In English

Report No.(s): AD-A458369; NPRST-AB-07-1; No Copyright; Avail.: CASI: [A08](#), Hardcopy

No abstract available

*Climate; Surveys; Military Technology*

**20070001544** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Performance Assessment of the Optical Transient Detector and Lightning Imaging Sensor, Part 2, Clustering Algorithm**

Mach, Douglas M.; Christian, Hugh J.; Blakeslee, Richard; Boccippio, Dennis J.; Goodman, Steve J.; Boeck, William; [2006]; 50 pp.; In English; Copyright; Avail.: CASI: [A03](#), Hardcopy

We describe the clustering algorithm used by the Lightning Imaging Sensor (LIS) and the Optical Transient Detector (OTD) for combining the lightning pulse data into events, groups, flashes, and areas. Events are single pixels that exceed the LIS/OTD background level during a single frame (2 ms). Groups are clusters of events that occur within the same frame and in adjacent pixels. Flashes are clusters of groups that occur within 330 ms and either 5.5 km (for LIS) or 16.5 km (for OTD) of each other. Areas are clusters of flashes that occur within 16.5 km of each other. Many investigators are utilizing the LIS/OTD flash data; therefore, we test how variations in the algorithms for the event group and group-flash clustering affect the flash count for a subset of the LIS data. We divided the subset into areas with low (1-3), medium (4-15), high (16-63), and very high (64+) flashes to see how changes in the clustering parameters affect the flash rates in these different sizes of areas. We found that as long as the cluster parameters are within about a factor of two of the current values, the flash counts do not change by more than about 20%. Therefore, the flash clustering algorithm used by the LIS and OTD sensors create flash rates that are relatively insensitive to reasonable variations in the clustering algorithms.

Author

*Algorithms; Cluster Analysis; Imaging Techniques; Sensors; Lightning; Optical Materials*

## 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*.

**20070000663** Naval Submarine Medical Research Lab., Groton, CT USA

**CpG Oligodeoxynucleotide and Montanide ISA 51 Adjuvant Combination Enhanced the Protective Efficacy of a Subunit Malaria Vaccine**

Kumar, Sanjai; Jones, Trevor R; Oakley, Miranda S; Zheng, Hong; Kuppusamy, Shanmuga P; Taye, Alem; Krieg, Arthur M; Stowers, Anthony W; Kaslow, David C; Hoffman, Stephen L; Feb 2004; 10 pp.; In English

Report No.(s): AD-A457927; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Unmethylated CpG dinucleotide motifs present in bacterial genomes or synthetic oligodeoxynucleotides (ODNs) serve as strong immunostimulatory agents in mice, monkeys and humans. We determined the adjuvant effect of murine CpG ODN 1826 on the immunogenicity and protective efficacy of the *Saccharomyces cerevisiae*-expressed 19-kDa C-terminal region of merozoite surface protein 1 (yMSP1(sub19)) of the murine malaria parasite *Plasmodium yoelii*. We found that in C57BL/6 mice, following sporozoite challenge, the degree of protective immunity against malaria induced by yMSP1(sub19) in a formulation of Montanide ISA 51 (ISA) plus CpG ODN 1826 was similar or superior to that conferred by yMSP1(sub19) emulsified in complete Freund's adjuvant (CFA/incomplete Freund's adjuvant). In total, among mice immunized with yMSP1(sub19), 22 of 32 (68.7%) with ISA plus CpG 1826, 0 of 4 (0%) with CFA/incomplete Freund's adjuvant, 0 of 4 (0%) with CpG 1826 mixed with ISA (no yMSP1(sub19)), and 0 of 11 (0%) with CpG 1826 alone were completely protected against development of erythrocytic stage infection after sporozoite challenge. The adjuvant effect of CpG ODN 1826 was manifested as both significantly improved complete protection from malaria (defined as the absence of detectable erythrocytic form parasites) ( $P < 0.007$ , chi square) and reduced parasite burden in infected mice. In vivo depletions of interleukin-12 and gamma interferon cytokines and CD4 and CD8 T cells in vaccinated mice had no significant effect on immunity. On the other hand, immunoglobulin G (IgG) isotype levels appeared to correlate with protection. .

DTIC

*Bacteria; Infectious Diseases; Nucleotides; Oligomers; Parasites; Parasitic Diseases; Vaccines*

**20070000676** Eastern Virginia Medical School, Norfolk, VA USA

**The National Center for Collaboration in Medical Modeling and Simulation**

Combs, C D; Nov 2006; 232 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0697; Proj-04PR11854-00

Report No.(s): AD-A457977; 211421; No Copyright; Avail.: CASI: [A11](#), Hardcopy

This project demonstrates the objective value of medical simulations as training tools for use by military medical personnel in training for tasks that are relevant to the effective and efficient medical care of military personnel in combat settings as well as in CON US hospitals and clinics operated by the military. In addition, the project pursues an integration effort to provide a coherent set of medical simulations and the related medical education/training curricula in which these simulations will be used. Finally, the project provides an overview of the development of a high performance skill medical simulator.

DTIC

*Clinical Medicine; Education; Medical Services; Military Operations; Simulation*

**20070000691** Naval Medical Research Center, Bethesda, MD USA

**Collected Database of Non-Saturation Porcine Dives (Air and Mixed-Gas)**

Toner, C B; Caplan, B; Temple, D J; Buttolph, T B; Dromsky, D M; Apr 1999; 48 pp.; In English

Contract(s)/Grant(s): Proj-M0099

Report No.(s): AD-A458003; NMRC99-03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Animal models of decompression sickness (DCS) have been developed in various species. The Naval Medical Research Institute (NMRI) developed a porcine model of DCS through the course of more than 300 dives, encompassing widely diverse dive profiles on air and mixed-gas. Some of these profiles include decompression stops, some do not; some profiles include post-dive treatments and others do not. This report provides the collected database of non-saturation porcine dives undertaken

to develop the NMRI porcine DCS model. It correlates the dive profiles with summaries of the various observed outcome measures.

DTIC

*Data Bases; Decompression Sickness; Diving (Underwater); Gas Mixtures*

**20070000706** Naval Health Research Center, San Diego, CA USA

**Assessing the Potential Health Impact of the 1991 Gulf War on Saudi Arabian National Guard Soldiers**

Gackstetter, Gary D; Al Qahtani, Mohammed S; Smith, Tyler C; Memish, Ziad A; Schlangen, Karen M; Cruess, David F; Barrett, Drue H; Gray, Gregory C; Ryan, Margaret A; Hooper, Tomoko I; Mar 10, 2004; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458037; NHRC-04-14; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Background: There has been considerable publicity that the 1991 Gulf War may have caused a wide array of health problems in military personnel. Although postwar health outcomes have been studied in US, British, Canadian, and other deployed troops, this issue has not been previously evaluated in coalition forces native to the Gulf region. Methods: A collaborative team of US and Saudi health researchers was assembled, data sources evaluated, and hospitalizations among Saudi Arabian National Guard (SANG) soldiers between 1991 and 1999 analyzed. Multivariate modeling was used to evaluate differences between 8342 soldiers exposed to combat at Al Khafji and a comparison group of 7270 soldiers in the Riyadh area. Results: Among 15 612 SANG soldiers we identified 148 with at least one hospitalization over the 9 years following the war. The adjusted rate of hospitalization was higher in the combat-exposed group (risk ratio 1.80, 95% confidence interval, 1.25-2.59). No unusual patterns of diagnoses were found and, because the overall number of hospitalizations was low, the absolute difference in risk was found to be very small. Conclusions: This is the first reported epidemiological investigation of postwar hospitalization among coalition forces native to the Gulf region that participated in the 1991 Gulf War. A very small increase in hospitalizations was identified in SANG soldiers exposed to combat at Al Khafji. However, because of data limitations, the clinical relevance of this finding should be interpreted with caution. Future collaborative studies to better understand the health effects of deployment should be encouraged.

DTIC

*Armed Forces (United States); Gulfs; Health; Military Personnel; Saudi Arabia; Warfare*

**20070000716** Naval Health Research Center, San Diego, CA USA

**Prevalence of Circumcision and its Association With HIV and Sexually Transmitted Infections in a Male US Navy Population**

Thomas, Anne G; Bakhireva, Ludmila N; Brodine, Stephanie K; Shaffer, Richard A; Jul 2004; 26 pp.; In English

Report No.(s): AD-A458066; NHRC-04-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Objectives: To determine circumcision prevalence and its association with HIV and STI in a male USA military population. Design: Case-control study of HIV-infected U.S. military personnel (n = 232) from 7 military medical centers and male U.S. Navy controls (n = 516) from an aircraft carrier. Methods: Cases and controls completed HIV risk surveys. Case circumcision status was abstracted from medical charts while control status was reported by survey. Multiple logistic regressions were constructed evaluating the role of circumcision in the acquisition of HIV and STI. Results: Cases (84.9%) and controls (81.8%) reported similar proportions of circumcision. Prevalence of circumcision among U.S.-born men was higher (85.0%) than those born elsewhere (58.1%). After adjustment for demographic and behavioral risk factors lack of circumcision was not found to be a risk factor for HIV (odds ratio [OR] = 0.9; 95% confidence interval [CI], 0.51-1.7) or ST (OR = 1.08; 95% CI, 0.52-2.26). Conclusions: Although known HIV risk factors were found to be associated with HIV in this military population, there was no significant association with male circumcision. Randomized clinical trials currently underway should shed more light on this pressing topic.

DTIC

*Infectious Diseases; Males; Military Personnel; Navy; Populations; Viruses*

**20070000738** McGill Univ., Montreal, Quebec Canada

**Quantum-Dot-Based Automated Screen of Sentinel Lymph Nodes for Metastatic Breast Cancer**

Presley, John F; Oct 2004; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0726

Report No.(s): AD-A458110; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We are developing an automated technique for scanning lymph nodes for small numbers of breast cancer cells using a

mouse model. This technique involves the use of standard primary antibodies for tumor specific antigens and quantum-dot conjugates in place of chemical fluorophores combined with exhaustive confocal z-sectioning and computer analysis. We have verified that the quantum dot conjugates using antibodies to Brst and cytokeratin are functional in frozen sections from actual tissue but will have to do additional work to reliably identify cancer cells in an automated way. The primary problems to still be solved involve reducing antibody background. Once these have been solved, we expect to be able to test our automated approach for sensitivity against standard histological methods for detecting breast cancer cells in lymph nodes.

DTIC

*Antibodies; Breast; Cancer; Conjugates; Lymphatic System; Mammary Glands; Metastasis; Quantum Dots; Sentinel System*

**20070000781** Johns Hopkins Univ., Baltimore, MD USA

**Bone Sialoproteins and Breast Cancer Detection**

Fedarko, Neal S; Jul 2006; 75 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0684

Report No.(s): AD-A458172; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have been studying a family of proteins that we have termed SIBLINGs for Small Integrin Binding Ligand N-linked Glycoproteins that share similar structural domains human chromosomal location normal synthesis by skeletal tissue and abnormal expression by neoplasms. The goal of our research is to test whether SIBLINGs might be informative markers for breast cancer detection. To accomplish this goal we have developed competitive enzyme-linked immunosorbent assays (ELISAs) for the SIBLINGs bone sialoprotein (BSP) osteopontin (OPN) dentin matrix protein-1 (DMP1) dentin sialophosphoprotein (DSPP) and matrix extracellular phosphoglycoprotein (MEPE). Sandwich-based ELISA assays have also been developed. When the competitive ELISAs were used to screen SIBLING protein levels BSP and OPN exhibited the highest degree of sensitivity and specificity for the detection of breast cancer. Microarray analysis of normal and breast cancer-derived mRNA samples found a similar elevated levels of elevated SIBLING expression. The levels of certain SIBLINGs in serum were found to be correlated with cancer stage. These results suggest that SIBLINGs may have utility as serum-based markers for breast cancer detection.

DTIC

*Bones; Breast; Cancer; Detection; Mammary Glands; Proteins*

**20070000783** Michigan Univ., Ann Arbor, MI USA

**Significance of Pathways Leading to RhoC Overexpression in Breast Cancer**

Hensley-Alford, Sharon; Apr 2006; 46 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0395

Report No.(s): AD-A458174; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Tumor biology is a recognized determinant of tumor behavior, including growth rate, motility and metastatic potential, and therapeutic resistance. This project was funded to investigate the regulation and expression of an excellent marker for aggressive breast tumors: RhoC-GTPase. When overactive, RhoC transforms mammary epithelial cells into a highly motile and invasive phenotype. We hypothesize that RhoC overexpression may be regulated by the transcription factor NF-kappa B and that at the same time RhoC is overexpressed the tumor also acquires therapy resistance. The objective of this study is to utilize existing breast cancer cohorts with tumor tissue and treatment response data available to assess the correlation between NF-kappa B and RhoC, individually and in combination, to treatment response. The specific aims of the project are to determine 1) if RhoC and NF-kappa B are correlated; 2) if RhoC and NF-kappa B are associated, individually and in combination, with aggressive breast cancer; and 3) if NF-kappa B and RhoC are associated with therapy resistance.

DTIC

*Breast; Cancer; Mammary Glands; Therapy*

**20070000784** City of Hope Medical Center, Duarte, CA USA

**Do Structural Missense Variants in the ATM Gene Found in Women With Breast Cancer Cause Breast Cancer in 'Knock-in' Mouse Strains?**

Sommer, Steven S; Apr 2006; 38 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0282

Report No.(s): AD-A458176; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The central hypothesis is that knock-in mice lines are made for two human cohort-specific missense mutations will develop breast cancer with dominant inheritance in a subset of animals. It also is hypothesized that other cancers will be more

frequent as well. If correct it follows that the ATM gene is the first known example of a 'sup-oncogene' i.e., a tumor suppressor gene for lymphoma Leukemia and an oncogene for breast cancer. More generally, it is hypothesized that an increased risk for breast cancer due to ATM mutations most commonly derives from cohort-specific missense mutation, that do not cause A-T in a homozygous state and occasionally from a subset of A-T carriers that have non-truncating mutations. Two in human cohort-specific missense variants from our previous case-control analysis will be generated in mice using mouse knock-in technology. The rate and time course of cancer incidence will be determined in these mice in comparison to wild type littermates and an A-T- causing non-truncating structural variant. Since the mouse *Atm* gene is extremely close to the human gene in structure and function, mouse models with only a single alteration in the gene can be used to assess the effects of this alteration on tumor formation, especially mammary tumors, in mice. If a variety of uncommon missense variants are shown to predispose to breast cancer, there are important diagnostic, preventive, and therapeutic implications for women at risk for breast cancer.

DTIC

*Breast; Cancer; Females; Mammary Glands; Mice; Mutations*

**20070000796** Stottler Henke Associates, Inc., San Mateo, CA USA

**Developing an Adaptive ADL Solution for Training Medical Teams**

Ramachandran, Sowmya; Cramer, Michael; Harville, Donald L; Ashworth, Alan; Jan 2003; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458200; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Training military medical personnel to maintain readiness for medical emergencies and combat-related operations is a critical problem. Distance learning solutions are required for providing effective training while minimizing time away from the important peacetime duty of providing quality medical care to military personnel. We are developing an Intelligent Tutoring System (ITS), called ADAPT-MD, for military medical teams in combat and emergency procedures. Using a scenario-based approach, this system provides adaptive instruction that is customized to individual teams and their members. Team training poses challenges beyond individual training and few ITSs address this problem. Issues like student modeling, team performance evaluation, tailoring the challenge level of scenarios to student expertise, etc. take on added complexity. ADAPT-MD addresses these issues by using a compositional approach to scenario generation and student model representation. A student model of a team comprises of a model of the team as a whole and models of each of the individual members. In addition to representing each members own state of expertise, the student model also represents his knowledge of the other team members tasks and abilities. ADAPT-MD has facilities for creating scenarios that are adapted to individual team members expertise levels. Simulations can include simulated intelligent entities to take the place of team members. The ADAPT-MD framework includes an authoring tool for specifying presentation content, domain knowledge, training scenarios, and instructional strategies. This framework is currently being applied to create an ITS for training hyperbaric treatment teams. It is, however, domain-independent and can be used to create ITSs for other medical domains.

DTIC

*Distributed Interactive Simulation; Education; Medical Personnel; Medical Services; Military Operations; Teams*

**20070000799** TRUE Research Foundation, San Antonio, TX USA

**Development and Evaluation of New Products for the Far-Forward Care of Combat Casualties with Acute Lung Injury**

Cancio, Leopoldo C; Hattler, Brack; Batchinsky, Andriy I; Feb 1, 2006; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-2-0016

Report No.(s): AD-A458205; No Copyright; Avail.: CASI: [A03](#), Hardcopy

**OBJECTIVE:** To evaluate the Intravenous Membrane Oxygenator or Hattler Catheter (IMO) in an ovine model of lung injury due to inhalation of chlorine gas. **HYPOTHESIS:** IMO will improve the PaO<sub>2</sub>-to-FiO<sub>2</sub> (PFR) ratio in injured sheep. **METHODS:** Thirteen ewes (sham + IMO, n=1; injury + IMO, n=7; injury without IMO, n=5,) were used. Anesthetized sheep were ventilated with 300 L of 100 ppm chlorine (mixed in 100% O<sub>2</sub>). When animals reached ARDS (PFR<h200), IMO was inserted in the injury + IMO group. ICU care, deep sedation, and mechanical ventilation were continued for up to 96 h. **RESULTS:** IMO was safely inserted in all cases. Gas exchange of the IMO was consistent at rates (normalized to a PCO<sub>2</sub> of 50 mmHg) of 300-350 ml/min/m<sup>2</sup>. The IMO exerted a beneficial effect on PFR up to hour 18 and on PaCO<sub>2</sub> up to hour 30. IMO use was associated with hemolysis, manifested by increased levels of plasma free hemoglobin. In order to reduce the anticipated impact of the HC on cardiac preload an aggressive approach to fluid management was employed, which likely

worsened pulmonary edema and oxygenation. Thus, future studies employing the IMO will involve a fluid-sparing approach to management.

DTIC

*Casualties; Catheterization; Chlorine; Combat; Injuries; Intravenous Procedures; Lungs; Medical Equipment; Membranes; Oxygen; Product Development; Respiration; Signs and Symptoms*

**2007000807** Mount Sinai School of Medicine, New York, NY USA

**Immune Surveillance, Cytokines and Breast Cancer Risk: Genetic and Psychological Influences in African American Women**

Bovbjerg, Dana H; Aug 2006; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0501

Report No.(s): AD-A458220; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Breast cancer cells are known to bear determinants that would allow tumor specific immune responses. However, initiation and amplification of such immune responses are critically dependent upon the balance in TH1 and TH2 cytokine profiles. This molecular epidemiological study evaluates the impact that variability in cytokine profiles, (inferred from functional polymorphisms in cytokine genes), may have on breast cancer risk among urban African-American women. In the first phase of the study, DNA collected and approved for additional study as part of a previously funded Case-Control investigation (n=1600) will be assessed for cytokine polymorphisms. Because cytokine profiles are also known to be affected by environmental factors, particularly levels of stress, this study also evaluates the relative contribution of genotype and stress influences using data collected for that purpose from a sub-sample of healthy Controls (n=400) recruited from the graduates of the larger study. Results will allow evaluation of the possibility that deficits in cytokine responses due to genetic or environmental factors may contribute to breast cancer risk. Based on these findings, women at risk for breast cancer because of polymorphisms in genes important to effective immune surveillance could be targeted for innovative prevention strategies including stress reduction and immune modulators.

DTIC

*Africa; Breast; Cancer; Females; Genetics; Mammary Glands; Surveillance*

**2007000808** Michigan Univ., Ann Arbor, MI USA

**Chemo Resistance of Breast Cancer Stem Cells**

Wicha, Max S; May 2006; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0471

Report No.(s): AD-A458223; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This past year was the second year of the DOD award. Over this year we have made substantial progress in achieving the goals outlined in the proposal. In addition, we have found that the enzyme aldehyde dehydrogenase 1 is an excellent marker for cancer stem cells which can be readily detected in fixed histological sections. Development of this new tool will greatly facilitate future studies. Preliminary results both in xenograft models as well as in neoadjuvant trial are providing strong support for our hypothesis for resistance of cancer cells to chemotherapy. We have also made excellent progress at elucidating the pathways which regulate the cells including Hedgehog signaling and Bmi-1. Together these studies provide a rationale for the combination compounds which inhibit stem cell renewal pathways such as Hedgehog with chemotherapeutic agents.

DTIC

*Breast; Cancer; Chemotherapy; Mammary Glands; Stem Cells*

**2007000810** Pennsylvania Univ., Philadelphia, PA USA

**Assessment of Lymphedema Risk Following Lymph Node Dissection and Radiation Therapy for Primary Breast Cancer**

Cheville, Andrea L; Sep 2005; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0622

Report No.(s): AD-A458225; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Lymphedema is a common complication of primary breast cancer therapy. It is a chronic, insidiously progressive, and potentially devastating condition. Radiation increases patients' lymphedema risk since conventional fields encompass residual functioning lymphatics. Imaging technologies may identify these lymphatics and allow the construction of radiation fields that minimize their radiation exposure while preserving loco-regional tumor control. This study uses SPECT scanning to



anatomically localize lymphatics critical for arm drainage after surgical removal of axillary lymph nodes. The study will determine the feasibility of fusing SPECT images with CT scans used in radiation planning to quantify radiation dosimetry. The study tests the hypothesis that changes in arm volume will correlate with radiation doses delivered to lymphatic critical for arm drainage. The fact that higher doses of radiation and larger radiation ports are associated with an increased incidence of lymphedema (volume up arrow  $\geq$  150ml.), particularly severe lymphedema (volume up arrow  $\geq$  400ml.), supports this hypothesis. The proposed study realizes the BCRP goals by elucidating a novel means of refining breast cancer treatment to minimize patients' risk of developing the most prevalent and dreaded complication of conventional primary therapy, lymphedema.

DTIC

*Biometrics; Breast; Cancer; Clinical Medicine; Dissection; Lymphatic System; Mammary Glands; Radiation Therapy; Risk*

**20070000811** Mount Sinai School of Medicine, New York, NY USA

**ATM Mutations and the Development of Severe Radiation-Induced Morbidity Following Radiotherapy for Breast Cancer**

Rosenstein, Barry S; Jul 2006; 51 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0503

Report No.(s): AD-A458226; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The hypothesis being tested in this project is that a greater proportion of patients who develop radiation-induced subcutaneous late tissue morbidity possess a variant allele in the ATM gene compared with patients who do not suffer these complications. An additional objective is to determine the functional impact upon the protein encoded by the ATM gene for each genetic alteration identified and subsequent cellular radiosensitivity. The specific aims of this project are to (1) screen 50 breast cancer patients for ATM genetic alterations who developed radiation induced late subcutaneous tissue morbidity (2) establish a control group and screen 100 patients without evidence of this late radiation reaction and (3) perform functional studies using cells from patients identified as ATM carriers to determine to what extent each ATM variant identified affects radiosensitivity and normal activity of the protein produced by the ATM gene.

DTIC

*Breast; Cancer; Mammary Glands; Mutations; Radiation Therapy*

**20070000813** Mount Sinai School of Medicine, New York, NY USA

**Screening for ATM Mutations in an African-American Population to Identify a Predictor of Breast Cancer Susceptibility**

Rosenstein, Barry S; Jul 2006; 12 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0502

Report No.(s): AD-A458231; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The hypothesis being tested in this project is that a greater proportion of African-Americans with breast cancer harbor a specific germline genetic alteration in the ATM gene or possess a particular ATM haplotype compared to African-American women without breast cancer. An additional objective is to determine the functional impact upon the protein encoded by the ATM gene for each mutation identified. Specific Aims: The specific aims of this project are to (1) screen 100 African-American breast cancer patients and 100 African-American women without breast cancer and (2) perform functional studies using cells from patients identified as ATM carriers to determine whether each ATM genetic variant identified affects radiosensitivity and levels of the protein encoded by the ATM gene for each mutation examined.

DTIC

*Africa; Breast; Cancer; Mammary Glands; Mutations; Populations*

**20070000815** Duke Univ., Durham, NC USA

**Treatment Related Cardiac Toxicity in Patients Treated for Breast Cancer**

Marks, Lawrence B; Jun 2006; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0374

Report No.(s): AD-A458235; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Purpose: To determine the incidence dose/time-dependence and functional significance of regional cardiac perfusion abnormalities in patients with left-sided breast cancer treated with radiation therapy (RT) with and without doxorubicin. Methods: 160 patients underwent pre-RT single photon emission computed tomography (SPECT) cardiac perfusion imaging. Post-RT images were obtained in 125, 95, 56, 43, 24, 28, 21 and 2 patients at 6, 12, 18, 24, 36, 48, 60 and 72 months post-RT.

SPECT perfusion images were registered onto 3-dimensional (3D) RT dose distributions. The volume of heart in the RT field was quantified and the regional RT dose was calculated. Changes in regional and global cardiac function were assessed. Results: The incidence of new perfusion defects 6 12 16 24 36 46 and 60 months post RT was 38% 35% 38% 42% 52% 71% and 67% respectively. In the 44 patients who have longer follow-up beyond 2 years 30/44 (68%) exhibit perfusion defects. New defects occurred in approximately 0-80% and 30-80% of patients with 5% and 5% of their left ventricle included within the RT fields respectively. Perfusion defects were associated with changes in regional wall motion 8-26% of the time and possibly with the development of chest-pain. Patients with extensive perfusion defects may have subtle reductions in ejection fractions. Conclusions: RT causes volume-dependent perfusion defects in approximately 42% of patients within two years of RT. These perfusion defects largely persist beyond 2 years and are associated with corresponding wall motion abnormalities and possibly reductions in ejection fraction.

DTIC

*Breast; Cancer; Diffusion; Dosage; Heart; Heart Diseases; Patients; Radiation Therapy; Time Dependence; Toxicity*

**20070000823** California Univ., Berkeley, CA USA

#### **Self-Defense Mechanisms of Normal Breast Cells**

Larabell, Carolyn A; Sep 2005; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0637

Report No.(s): AD-A458247; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Human mammary epithelial cells grown in a 3D matrix form polarized acini that closely resemble the cellular environment encountered in breast tissue. Consequently, acini are an excellent system for studying morphogenesis, and for modeling the role of cell-cell interactions in processes such as apoptosis, tumorigenesis and carcinogenesis. In this project, we studied the interaction of an aggressive mammary epithelial tumor cell line with the MCF-10A acini. We found that MCF-10A acini have the ability to induce apoptosis in tumor cells, whereas non-polarized MCF-10A cells (those in monolayers rather than acini) show no such mechanism. We also showed that tumor cell apoptosis induced by contact with MCF-10A acini is mediated by the extrinsic Fas death signaling pathway. We believe this is an example of tissue homeostasis, in which the normal mammary epithelial cells regulate the growth of aberrant epithelial cells. This model system can be used to study the ways in which tumor cells evade this early control mechanism enabling their uncontrolled growth and proliferation.

DTIC

*Breast; Cancer; Mammary Glands*

**20070000824** Pittsburgh Univ., Pittsburgh, PA USA

#### **The Impact of Exercise on the Vulnerability of Dopamine Neurons to Cell Death in Animal Models of Parkinson's Disease**

Zigmond, Michael J; Smith, Amanda; Liou, Anthony; Jul 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0479

Report No.(s): AD-A458249; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Parkinson's disease results in part from the loss of dopamine neurons. We hypothesize that exercise reduces the vulnerability of dopamine neurons to neurotoxin exposure, whereas stress increases vulnerability. We have outlined experiments to test this hypothesis in rats treated with one of several neurotoxins, beginning with 6-hydroxydopamine. Over the past year, we increased the size and training of our research team and made a number of observations of direct relevance to our hypothesis. We also have received permission to expand our original Statement of Work to include critical studies on the mechanism of the actions of exercise, using both in vivo and in vitro approaches. Our focus continues to be on the effects of stress and exercise on the vulnerability of DA neurons, and the role played in these phenomena by trophic factors and intracellular signaling cascades.

DTIC

*Death; Diseases; Dopamine; Neurons; Physical Exercise; Veterinary Medicine; Vulnerability*

**20070000826** Lankenau Inst. of Medical Research, Wynnewood, PA USA

#### **Suppression of Prostate Tumor Progression by Bin 1**

Prendergast, George C; Feb 2006; 15 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0177

Report No.(s): AD-A458252; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This project investigated the role of Bin 1, a gene encoding a Myc-interacting adapter protein with features of a tumor

suppressor on the normal development or neoplastic transformation of the mouse prostate. In Aim 1 we determined the effect of deleting Bin 1 on normal prostate development and tumorigenesis (tumor suppressor model). In Aim 2 we determined the effect of Bin 1 deletion on neoplastic progression of lesions initiated by a prostate-specific c-Myc gene (negative modifier model). In Year 1 we showed that deletion of the conditional 'floxed' allele of Bin 1 phenocopied deletion of the wild-type allele as anticipated. However, to overcome difficulties that arose in Year 2 with generating prostate-specific deletions we created mosaic animals for the study. Although studies are as yet incomplete, results collected to date in Year 3 suggest that Bin 1 loss does not increase prostate cancer incidence nor does it drive progression of Myc-initiated cancers. Ongoing experiments test whether (I.) Bin 1 loss limits castration-induced apoptosis in normal prostate cells and/or (II.) Bin 1 loss phenocopies Myc activation during progression of Ras-driven cancers based on findings about the effects of Bin 1 on Myc stability emerging from other projects in Year 3.

DTIC

*Cancer; Prostate Gland; Tumors*

**20070000827** Mount Sinai School of Medicine, New York, NY USA

**One-Carbon Metabolism and Breast Cancer Survival in a Population-Based Study**

Chen, Jia; Jun 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0514

Report No.(s): AD-A458254; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The 5-year survival rate for BC among US women has increased from 75% during 1974-76 to 85% during 1989-95. Despite such marked improvement, BC is still the leading cause of cancer mortality among women 20-59 years of age and the second leading cause of cancer mortality among all women. Disease-free survival after BC treatment is likely predicted by both tumor characteristics and host factors. The clinical and pathologic parameters that have been shown to influence disease prognosis include tumor size, nodal involvement, tumor state, grade, hormone receptor status, mitotic index, expression of multi-drug resistance proteins, p53 status, and HER-2/neu status. Meanwhile, only a few host factors have been identified that impact disease-free or overall survival, particularly those that a patient may engage in to modify or help clinicians to tailor effective and efficient treatment strategy. This proposed study focuses on one-carbon metabolism, a key process for DNA methylation and DNA synthesis. One-carbon metabolism is crucial of BC prognosis because it not only provides methyl group for regulating expression of genes that have prognostic values (e.g. ER, PR, BRCA1, etc.) but also is a primary target for treatment of the disease (e.g. 5-FU, methotrexate, etc.). We propose to utilize the resources of the Long Island Breast Cancer Study Project, a large population-based study consisting of -1500 BC cases and -1500 controls. We will examine the dietary intake of one-carbon-related micronutrients/compounds (e.g. folate, methionine, choline, B vitamins, alcohol, etc) in relation to disease-free and overall survival of BC via the mechanism of promoter hypermethylation (presumably silencing) of the ER, PR, and BRCA1 genes. We will also examine whether functional polymorphisms in one-carbon metabolism may influence survival of BC, either through modifying the efficacy of chemotherapeutic drugs or influencing methylation of prognosis related genes.

DTIC

*Breast; Cancer; Carbon; Genes; Mammary Glands; Metabolism; Methylation; Polymorphism; Populations; Survival*

**20070000828** Assistant Secretary of Defense (Health Affairs), Washington, DC USA

**DoD Military Injury Prevention Priorities Working Group: Leading Injuries, Causes and Mitigation Recommendations**

Ruscio, Bruce; Smith, Jack; Amoroso, Paul; Anslinger, Jerry; Bullock, Steve; Burnham, Bruce; Campbell, John; Chervak, Michelle; Garbow, Kurt; Garver, Richard; Feb 2006; 88 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458257; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The past decade has witnessed growing recognition that injuries are a leading cause of morbidity and mortality for the U.S. Military, eroding combat readiness more than any other single disease or health condition in this generally healthy and physically active population, which is relatively free of competing causes of death and severe illness. In the 1990s, medical and safety data revealed that across the Services accidental injuries caused (Atlas of Injuries in U.S. Armed Forces, Military Medicine, 1999): \* 47% (Air Force) to 57% (Marine Corps) of all deaths; \* 22% (Air Force) to 63% (Navy and Marine Corps) of all disabilities; and \* 22% (Air Force) to 31% (Marine Corps) of all hospitalizations. Further, Service member injuries cost hundreds of millions of dollars annually, consuming Services resources and challenging operational effectiveness. To address the magnitude of the injury problem of the U.S. Military, in 2003 the Secretary of Defense mandated that rates of accidents and injuries must be significantly reduced and established the Defense Safety Oversight Council (DSOC) to provide governance on DoD-wide efforts to reduce preventable mishaps. Subsequently, the DSOC requested the establishment of the

DoD Military Injury Prevention Priorities Working Group (DMIPPWG) (Appendix A) to outline a systematic, coordinated approach to injury prevention similar to the public health approach outlined in the Atlas of Injuries (Military Medicine, 1999). This white paper describes the DMIPPWG's process for establishing an evidence-based ranking of DoD prevention priorities, presents a DoD-wide process for analysis, and provides recommendations for intervention initiatives.

DTIC

*Injuries; Military Personnel; Prevention; Priorities*

**2007000830** State Univ. of New York, Stony Brook, NY USA

**Identification and Isolation of Human Alarm Pheromones**

Mujica-Parodi, Lilianne R; Strey, Helmut; Apr 30, 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0341

Report No.(s): AD-A458261; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This Progress Report for Phase O of this project reported on four different tasks. Task I, Optimization of Sample Collection, focused on the collection of the putative alarm pheromone via axillary sweat samples obtained during reference (physical exercise) and arousal (skydive) conditions. The researchers chose cotton gauze sponges and developed their own method of sterilizing them and attaching them to the body so that neither contamination nor evaporation could occur. Task II, Development of the Extraction Protocol, focused on a method to extract the target substances from the sweat pads into progressively more hydrophobic solvents (water to primary extraction solvent to secondary extraction solvent) while concentrating them. Ethanol was selected as a primary extraction solvent and a secondary extraction procedure was developed that relies on solvent partitioning. Task III focused on the Preliminary Identification of Steroids of Interest in Human Fear Sweat Using the Skydiving Protocol. The authors collected sweat, urine, blood, saliva, ECG, respiration, and self-report measures in 20 subjects (n=11 males and n=9 females) before, during, and immediately following their first-time tandem skydive, as well as before, during, and immediately following their running on a treadmill for the same period of time. Measurements between the test (skydive) and control (exercise) conditions were made on consecutive days, each experiment precisely matched to the minute between subjects and between conditions to prevent diurnal confounds. Emotional states were monitored using brief standardized questionnaires. For most of the observed compounds, men showed an increase in the compound emission during acute emotional stress, while women showed either no change or a decrease in emission of the compound. Task IV, Olfactometry, sought to determine whether the putative alarm pheromones trigger arousal in other humans using neural (MRI) and autonomic measurements.

DTIC

*Chemical Composition; Fear; Isolation; Perspiration; Steroids; Warning Systems*

**2007000836** Georgetown Univ., Washington, DC USA

**DNA Repair and Ethnic Differences in Prostate Cancer Risk**

Goldman, Radoslav; Mar 2006; 105 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0294

Report No.(s): AD-A458279; No Copyright; Avail.: CASI: [A06](#), Hardcopy

Prostate cancer is the most common lethal tumor among US males and is particularly high in African Americans. This study evaluates DNA repair in a study of 240 prostate cancer patients and 240 healthy controls matched on age and race in a 50% African American population. Low DNA repair correlates with increased risk of certain cancers but prostate cancer was not yet examined. We hypothesize that low DNA repair, especially in African American men, contributes to increased risk of having prostate cancer. To evaluate this hypothesis, we quantify DNA repair capacity in blood cells using comet assay and evaluate how this repair capacity is related to genetic variants in OGG1 and XRCC1 DNA repair genes. Genetic variants of OGG1 and XRCC1 with a decreased DNA repair capacity were previously identified. This means that a portion of the general population carrying the 'at risk' variant might be at higher risk of developing prostate cancer. This pilot study is expected to fill important gaps in our understanding of prostate cancer etiology, produce new hypotheses which can be tested in an expanded prostate cancer study, focus prostate cancer prevention in a new direction, and help design better cancer prevention and treatment strategies.

DTIC

*Africa; Cancer; Deoxyribonucleic Acid; Epidemiology; Ethnic Factors; Maintenance; Prostate Gland; Races (Anthropology); Risk*

**20070000837** University Health Network, Toronto, Ontario Canada

**Detecting and Targeting Oncogenic Myc in Breast Cancer**

Penn, Linda Z; Jun 2006; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0571

Report No.(s): AD-A458281; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our 'idea' is that in addition to the target genes regulated by Myc in nontransformed cells, constitutively activated and overexpressed Myc protein in tumor cells will directly bind and regulate a unique set of target genes that directly contribute to the carcinogenic process. For example, at high levels of expression, Myc may bind low affinity sites and regulate a distinct cohort of targets by a unique mechanism of action. By identifying this transformation specific subset of Myc target genes we aim to develop a diagnostic tool to identify oncogenic Myc activity in breast tumor cells. We also aim to develop a unique anti-cancer therapeutic that will potentially target this unique transforming activity of Myc. The TRRAP cofactor has been shown to be essential for Myc to drive transformation. This suggests blocking Myc:TRRAP interaction will inhibit the carcinogenic program directed by oncogenic Myc. By conducting the experiments outlined in this proposal we will test a unique hypothesis and will make significant contributions to the molecular diagnosis and treatment of breast cancer that can be applied to the clinic in a timely manner. Specific Aims: 1) Identify tumor-specific, directly-regulated Myc target genes in transformed HMECs and develop a definitive diagnostic tool to detect oncogenic Myc activity in breast cancer. 2) Isolate small molecular weight inhibitors that can disrupt Myc:TRRAP interaction in vivo and identify Myc:TRRAP co-bound target genes in breast cancer.

DTIC

*Breast; Cancer; Carcinogens; Detection; Genes; Mammary Glands; Oncogenes; Tumors*

**20070000839** Creighton Univ., Omaha, NE USA

**Effect of Reminder Telephone Calls on Mammography Compliance in High Risk**

Snyder, Carrie; Jun 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0465

Report No.(s): AD-A458283; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Even though mammography has been proven to be effective in reducing breast cancer mortality this simple screening measure is underutilized by women who are at an inordinately high risk for developing breast cancer. The effect of a reminder telephone call intervention has not been studied in this high-risk population where the need for compliance is crucial. The hypothesis for this study is that a simple reminder telephone call will significantly increase mammography frequency in high-risk women compared to a control group. Four-hundred and twenty-eight women have consented to participate in the study. Interestingly, 332 (76%) reported obtaining annual mammography for at least the past two years. Therefore, only subjects who were non-compliant by self-report (n=32) were randomized to the intervention or control group. Reminder and follow-up telephone calls have been completed on 30 (94%) of the women randomized to the study. A preliminary statistical analysis was conducted. A statistical difference (p=0.0027) was seen between the two groups. In conclusion, these findings support the hypothesis that mammography compliance in high risk women can be increased if an intervention such as a simple reminder call is implemented thereby leading to an early diagnosis and potential cure.

DTIC

*Females; Risk; Telephones*

**20070000841** Texas Univ., Dallas, TX USA

**Prediction of Breast Cancer Risk by Aberrant Methylation in Mammary Duct Lavage**

Euhus, David; Jul 2006; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0421

Report No.(s): AD-A458287; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Assessment of breast epithelial cells obtained by nipple duct lavage (NDL) may have value for breast cancer risk stratification. NDL was performed in 150 women: 67 with an incident breast cancer and 83 unaffected women. Promoter region methylation of Cyclin D2, APC, HIN1, RASSF1A, and RAR 2 was measured in NDL samples by quantitative methylation-specific real time PCR. Methylation of one or more of these genes was detected in 31/35 (88.6%) of primary tumors. NDL ipsilateral to these cancers retrieved atypical cells with methylation profiles that were similar to the cancer in only 9%. Unsupervised clustering revealed three distinct methylation clusters. 15.2% of ducts contralateral to a breast cancer or from unaffected high risk women belonged to one of these clusters as compared to only 7.8% of ducts from lower risk women (RR 1.95, P = 0.12). Identification of marked atypia OR TSG methylation provided the best discrimination between

high and lower risk breasts (P (0.01). Assessment of TSG methylation in benign breast cells may contribute to risk stratification.

DTIC

*Aberration; Abnormalities; Breast; Cancer; Ducts; Mammary Glands; Methylation; Risk*

**20070000842** Albany Medical Coll., NY USA

**Exploiting for Breast Cancer Control a Proposed Unified Mechanism for Reduction of Human Breast Cancer Risk by the Hormones of Pregnancy**

Jackson, Herbert; Andersen, Thomas T; Bennett, James A; May 2006; 20 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): W81XWH-04-1-0486

Report No.(s): AD-A458293; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In Year 1 we showed that administration of pregnancy-associated hormones to carcinogen-exposed rats not only reduced the appearance of mammary cancers (as does pregnancy) but also led to generation of AFP in serum at near pregnancy levels in support of our hypothesis. The Year 2 plan was designed to confirm that AFP (not the hormones of pregnancy) is the proximal inhibitor of breast cancer. We planned to perform similar studies in rodents that would be passively immunized against AFP in which inhibition should fail. However due to the cost of those experiments we first employed an in vitro pseudo-human model for passive immunization. We challenged cultures of HepG2 human liver cancer cells with hormones of pregnancy and demonstrated elevated secretion of AFP into the culture media. When these media were added to cultures of T47D human breast cancer cells cell proliferation was inhibited. However preventing inhibition by adding anti-AFP antibodies was not achieved failing with three different antibodies. Investigation disclosed that the antibodies employed failed to deplete the AFP content of the media. We are now investigating a large panel of antibodies as well as their use in higher concentrations before beginning studies using the in vivo model. Achievement of a strategy that effectively neutralizes AFP is critical to completing the work that was proposed to evaluate whether AFP is the proximal breast cancer inhibitor elicited by the hormones of pregnancy.

DTIC

*Breast; Cancer; Hormones; Mammary Glands; Pregnancy; Risk*

**20070000843** State Univ. of New York, Albany, NY USA

**SAPHIRE: A New Flat-Panel Digital Mammography Detector With Avalanche Photoconductor and High-Resolution Field Emitter Readout**

Zhao, Wei; Jun 2006; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0554

Report No.(s): AD-A458294; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A new concept of flat-panel imager (FPI) with avalanche gain and high resolution (with 50 micron pixel size) is being investigated for improving the imaging performance of digital mammography at low dose and high spatial frequencies, which are critical for the detection of subtle breast abnormalities and the development of digital tomosynthesis. The detector employs an avalanche photoconductor - amorphous selenium (a-Se), called HARP, to detect and amplify the optical signal generated by a structured scintillator - cesium iodide (CsI), and form a charge image that is read out by a high-resolution field emitter array (FEA). We call the proposed detector SAPHIRE (Scintillator-Avalanche Photoconductor with High Resolution Emitter Readout). Our investigation showed that the avalanche gain of SAPHIRE permits the use of high resolution (HR) type CsI, which has not been used in existing FPI due to its low light output. HR Cs can provide better imaging performance at high spatial frequencies than existing digital mammography detectors. We also investigated the factors affecting the resolution and image lag of the FEA readout method. Our results showed that adding electrostatic focusing at the FEA substrate can significantly improve the image resolution and lag of the detector. Dividing the signal electrode into multiple (e.g. 32) strips will improve both the electronic noise and the readout speed of the detector.

DTIC

*Avalanches; Breast; Cancer; Detectors; Digital Systems; Emitters; Flat Panel Displays; High Resolution; Mammary Glands; Photoconductors; Readout; Scintillation*

**20070000848** Mount Sinai School of Medicine, New York, NY USA

**Genetic Influence on Toxicity and Prognosis in Women Treated with Breast Conserving Surgery and Radiation Therapy**

Ambrosone, Christine B; Chang-Claude, Jenny; Jul 2006; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0500

Report No.(s): AD-A458304; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Women with earlier stage breast cancer who receive breast conserving surgery and radiation therapy have a generally good prognosis. However, among 15-20% of these women, breast cancer recurs, and a similar proportion of women also experience severe toxicity with radiation therapy. It is possible that inter-individual differences in capabilities of both tumor and normal cells to protect themselves from radiation-induced damage, and to repair that damage if it does occur, will influence recurrence and toxicity. This variability results from common genetic polymorphisms. This study is conducted in a well-characterized cohort of women who had breast-conserving surgery followed by radiation therapy, and in whom skin reactions were measured and noted. We have extracted DNA from blood to determine genetic polymorphisms in a number of genes that may be important in response to treatment. By conducting follow-up on the women in the study, we will be able to determine how variability in genes that protect cells from damage and in those that repair DNA damage will affect both breast cancer recurrence and toxicity experienced. Follow-up through clinic visits, letters, and home visits has been completed. We evaluated and identified effects of certain genetic polymorphisms on the occurrence of acute toxicity and in the next year, we will correlate genotyping results with late toxicity.

DTIC

*Breast; Cancer; Conservation; Females; Genetics; Mammary Glands; Prognosis; Radiation Therapy; Surgery; Toxicity*

**2007000849** Fox Chase Cancer Center, Philadelphia, PA USA

**BRCC36, A Novel Subunit of a BRCA1 E3 Ubiquitin Ligase Complex, Candidates for BRCA3**

Chen, Xiaowei; Jun 2006; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0573

Report No.(s): AD-A458306; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancer is a genetically heterogeneous disease, and multiple genes remain to be identified among nonBRCA1 and BRCA2 breast cancer-prone families. This statement is supported by the evidences that BRCA1 and BRCA2 mutations are associated with between 20 to 60% of hereditary breast cancer families, which is less than originally estimated, especially in population-based studies. We have taken the approach that the next BRCA genes will be those that encode for proteins whose functions are linked to important cell regulatory pathways. We have recently found one such candidate BRCA3 protein, referred to as BRCC36. We have reported a profound increase in BRCC36 expression in breast tumors. Furthermore, our studies have defined BRCC36 as a direct regulator of BRCA1 activation and nuclear foci formation in response to IR in a number of breast cancer cell lines. Our results suggest that down-regulation of BRCC36 expression impairs the DNA repair pathway activated in response to IR and appears to sensitize breast cancer cells to IR-induced apoptosis. Therefore, it is intriguing to speculate that targeting BRCC36 may aid in the treatment of radiation resistant breast tumors,

DTIC

*Breast; Cancer; Enzymes; Genes; Ionizing Radiation; Mammary Glands; Proteins*

**2007000852** University of Southern California, Los Angeles, CA USA

**Maintaining Genome Stability: The Role of Helicases and Deaminases**

Chen, Xiaojiang; Jul 2006; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0391

Report No.(s): AD-A458311; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The Brief Description of The Four Aims For The Grant: (Aim 1). Study the in vitro functions of MCM proteins from archaea and yeast cells using the genetically engineered protein constructs. In this aim, we will also extend our prior success in the X-ray structural studies of an N-terminal fragment of an archaea MCM by attempting to crystallize MCM proteins from yeast. (Aim 2). Examine in vivo effects of helicase function and in particular MCM roles in maintaining genome integrity in response to damage. This aim will use existing and newly generated mutants, which can be achieved through genetic screening and site-directed mutagenesis based on the 3-dimensional structure of MCM, to investigate how MCMs contribution to genome stability during chemical damage. (Aim 3). Express, purify and crystallize the proteins of deaminases. We will focus on AID and APOBEC3G to obtain purified deaminase proteins for the in vitro biochemical, functional, and structural studies. (Aim 4). Examine the functions and substrate specificity of AID and identify other factors required for the coupling of deamination with other processes of DNA synthesis and RNA transcription. The experiments will be carried out in a cell free assay system, using already purified DNA replication/repair and RNA transcription proteins in our labs.

DTIC

*Biosynthesis; Deoxyribonucleic Acid; Genetics; Genome; Proteins; Stability*

**20070000857** Pittsburgh Univ., Pittsburgh, PA USA

**An Organotypic Liver System for Tumor Progression**

Wells, Alan; Apr 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0480

Report No.(s): AD-A458336; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Our overall objective is to understand which tumor cell behaviors contribute to invasion and metastasis. This would allow rationale approaches to limit these aspects of tumor progression. While great strides have defined critical molecular determinants, the current experimental models of tumor invasion limit the dissection of complex cellular responses. In vitro assays do not capture tumor/host relations or relevant tissue architecture and physiology. In vivo model systems provide the relevant organism contexts but cannot readily be manipulated. Quantal advances would be enabled by combining the best attributes direct manipulation of tumor and host, long-term visualization, and tissue relevant architecture. Our central premise is that an ex vivo organotypic liver tissue system can provide an environment to study tumor cell invasion and metastasis. Our objective is to utilize a physiologically relevant microreactor that has proved suitable for organotypic liver culture to investigate metastatic seeding. The sub-millimeter scale of this liver allows for real-time imaging over weeks in culture. We established this system to determine what step is rate-limiting for tumor progression. We have now established an organotypic liver tissue culture that supports metastatic establishment and growth. This will be used to probe the molecular steps that are key to this progression.

DTIC

*Liver; Neoplasms; Tumors*

**20070000858** Minnesota Univ., Minneapolis, MN USA

**Dietary Fat, Eicosanoids and Breast Cancer Risk**

Raatz, Susan; Apr 2006; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0448

Report No.(s): AD-A458337; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Epidemiological and animal studies associate high levels of dietary fat with increased risk of sex hormone mediated cancer, such as breast cancer. A high intake of total fat and omega-6 fatty acids increases risk while omega-3 (n3) fatty acids are associated with risk reduction. Our proposal is testing the effect of dietary fat and fatty acids on sex hormone concentrations in post-menopausal women. The objectives are to evaluate 1) the effects of total fat and n3 intake on plasma and urinary sex hormone levels, 2) the relationship between plasma fatty acids and plasma and urinary sex hormones, and 3) the effects of total fat and n3 on the association between sex hormone concentrations and urinary prostaglandin E2 (PGE2). We are performing a randomized, Latin square-designed controlled feeding study testing High Fat, Low Fat, and Low Fat + n3 diets, each of 8 week duration. In order to determine the estrogenic effects of the diets, sex hormone endpoints will be measured reflecting availability, metabolism, and action. Plasma fatty acids fractions and urinary PGE2 will be measured to evaluate mechanistic effects. At present 48 women have been screened by telephone, 16 have been screened in the clinic and 12 are currently enrolled in the trial. Eight subjects have completed all aspects of the trial. Initial data analysis is being started this summer of the sex hormone samples. No data has yet been generated.

DTIC

*Breast; Cancer; Diets; Fats; Mammary Glands; Risk*

**20070000868** Alion Science and Technology Corp., Dayton, OH USA

**In Vitro Toxicity of Nanoparticles in Mouse Keratinocytes and Endothelial Cells**

Rooney, Aubrey D; Jones, Rochelle L; Mattie, David R; Schlager, John J; Hussain, Saber M; Jun 2004; 26 pp.; In English

Contract(s)/Grant(s): F33615-00-C-6060; Proj-1710

Report No.(s): AD-A458356; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This study was undertaken to assess the potential toxicity of nanomaterials in mouse keratinocytes (HEL-30) and endothelial cells (bEnd.3). The nanoparticles tested were aluminum (Al - 30 nm), silver (Ag - 15 nm hydrocarbon coated, 100 nm uncoated), and molybdenum trioxide (MoO<sub>3</sub> -30 nm). For toxicity evaluations, mitochondrial function (MU assay), lysosomal membrane integrity (NR assay) and cellular morphology were assessed under control and exposed (10-250 mg/ml) conditions for an exposure period of 24 hours. In the MN assay, the 15 nm Ag particles were found to be highly toxic in HEL-30 cells when compared to Al-30 nm and MoO<sub>3</sub>-30 nm particles, which produced no toxicity at the tested concentrations. The 100 nm Ag particles also did not produce significant toxicity in HEL-30 cells. However, Ag-100 nm particles did induce toxicity in bEnd.3 cells. bEnd.3 cells were also three times more sensitive to Ag-IS as compared to HEL-30 cells. Like HEL-30 cells, the bEnd.3 cell line displayed no toxicity in the presence of Al-30 nm or MoO<sub>3</sub>-30 nm particles. NR uptake data in



HEL-30 cells also confirmed that Ag-IS nm particles were highly toxic compared to Al and MoO<sub>3</sub> nanoparticles. Observation using a phase contrast inverted microscope indicated that increased concentration of Ag-IS led to a change in cell morphology. Cells affected by nanoparticle exposure showed a decrease in cellular volume and a change in cell shape. Further comparisons of other nanomaterials are planned using in vitro cells originatin from pulmonary ,liver and skin tissues.

DTIC

*Cells (Biology); Endothelium; Epidermis; In Vitro Methods and Tests; Mice; Nanoparticles; Toxicity*

**20070001099** Case Western Reserve Univ., Cleveland, OH USA

**Novel Molecular Imaging Agents to Detect Biomarkers of Metastatic Breast Cancer**

Jan 2006; 46 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0731

Report No.(s): AD-A458457; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Breast; Cancer; Imaging Techniques; Metastasis; Biomarkers; Detection*

**20070001139** L-3 Communications Corp., San Diego, CA USA

**Mathematical Modeling in Support of Military Operational Medicine**

Jul 2006; 76 pp.; In English

Contract(s)/Grant(s): DAMD17-00-C-0031

Report No.(s): AD-A458419; No Copyright; Avail.: CASI: [A05](#), Hardcopy

No abstract available

*Mathematical Models; Military Operations; Clinical Medicine*

**20070001207** Massachusetts General Hospital, Boston, MA USA

**Protease Mediated Anti-Cancer Therapy**

Aug 2006; 24 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0515

Report No.(s): AD-A458446; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Cancer; Protease; Therapy*

**20070001211** Wisconsin Univ., Madison, WI USA

**Enhancing the Anti-Tumor Activity of ErbB Blockers with Histone Deacetylase (HDAC) Inhibition in Prostate Cancer Cell Lines**

Nov 2005; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0040

Report No.(s): AD-A458444; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Cancer; Prostate Gland; Tumors*

**20070001342** Texas Univ., San Antonio, TX USA

**Cell Motility and Invasiveness of Neurofibromin-Deficient Neural Crest Cells and Malignant Triton Tumor Lines. Addendum**

Jun 2006; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9499

Report No.(s): AD-A458421; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Locomotion; Tumors; Neurons; Cultured Cells*

**20070001411** Arkansas Univ., Little Rock, AR USA  
**Non-Invasive Phosphorus-31 Magnetic Resonance Spectral Characterization of Breast Tissue Anomalies Using Pattern Recognition and Artificial Intelligence**

Aug 2006; 15 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0491

Report No.(s): AD-A458441; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Breast; Pattern Recognition; Magnetic Resonance; Anomalies; Phosphorus Isotopes; Artificial Intelligence*

**20070001422** Massachusetts Inst. of Tech., Cambridge, MA USA

**New Models for Healthcare 2 Symposium**

Oct 2006; 51 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0297

Report No.(s): AD-A458439; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Health; Clinical Medicine*

**20070001444** Army Engineer Research and Development Center, Vicksburg, MS USA

**Selective Control of Eurasian Watermilfoil and Curlyleaf Pondweed Using Low Doses of Endothall Combined With 2,4-D**

Oct 2006; 16 pp.; In English

Report No.(s): AD-A458322; ERDC/TN-APCRP-CC-05; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Dosage; Europe; Asia; Leaves; Ponds*

**20070001452** Michigan Univ., Ann Arbor, MI USA

**Development of a Computer-Aided Diagnosis System for Early Detection of Masses Using Retrospectively Detected Cancers on Prior Mammograms**

Jun 2006; 93 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0475

Report No.(s): AD-A458398; No Copyright; Avail.: CASI: [A05](#), Hardcopy

No abstract available

*Computer Aided Design; Cancer; Detection; Diagnosis; Mammary Glands*

**20070001456** Scripps Research Inst., La Jolla, CA USA

**Suppression of Breast Cancer Progression by Tissue Factor**

Jun 2006; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0385

Report No.(s): AD-A458396; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Breast; Cancer; Tissue Engineering; Cells (Biology); Tissues (Biology)*

**20070001458** Indiana Univ., Indianapolis, IN USA

**Center of Excellence for Individualization of Therapy for Breast Cancer**

Apr 1, 2006; 38 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0468

Report No.(s): AD-A458394; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Breast; Therapy; Cancer*

**20070001479** Defense Advanced Research Projects Agency, Arlington, VA USA

**Chemical and Biological Sensor Standards Study**

Jan 2005; 34 pp.; In English

Report No.(s): AD-A458370; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Chemicals; Standards; Bioinstrumentation*

**20070001494** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Maintaining Endurance Performance at High Altitude (4300 m) Despite Severe Energy Intake Deficit**

Nov 2006; 21 pp.; In English

Report No.(s): AD-A458390; USARIEM-TR-T07-01; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*High Altitude; Endurance; Human Performance*

**20070001511** Tufts Univ., Boston, MA USA

**Do Perturbed Epithelial-Mesenchymal Interactions Drive Early Stages of Carcinogenesis**

Sonnenschein, Carlos; Apr 2006; 41 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0595

Report No.(s): AD-A458380; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This research project had three specific aims. The first was to determine which tissue in the rat mammary gland was the target of the chemical carcinogen N-nitrosomethylurea. This aim was fulfilled. The second aim included screening and counting lesions and performing morphometric data analysis of whole mounts (branching pattern relative abundance of the different ductal and alveolar structures). These studies aimed at identifying the changes occurring between the time of exposure and the appearance of neoplasias. This aim was also fulfilled. Finally as described for Aim #3 during years two and three we explored the specific roles of hyaluronan and emmprin two molecules that are enriched in tumors and involved in tumor-stromal cell interactions as mediators of neoplastic initiation and progression.

DTIC

*Carcinogens; Epithelium; Cells (Biology)*

**20070001518** Texas Univ. Health Science Center, San Antonio, TX USA

**Feasibility Study and Demonstration Project for Joint Military/Civilian Trauma Institute with a Burn Center**

Jun 2006; 39 pp.; In English

Contract(s)/Grant(s): DAMD17-03-C-0071

Report No.(s): AD-A458420; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Feasibility; Military Technology; Burns (Injuries)*

**20070001521** Colorado Univ., Aurora, CO USA

**Co-Operation Between FADD and Bin1 in Prostate Cancer Apoptosis**

Apr 2006; 26 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0049

Report No.(s): AD-A458416; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Apoptosis; Cancer; Prostate Gland*

**20070001523** Titan Corp., San Diego, CA USA

**Overuse Injury Assessment Model**

Mar 2005; 75 pp.; In English

Contract(s)/Grant(s): DAMD17-02-C-0073

Report No.(s): AD-A458415; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Injuries; Models; Technology Assessment*

**20070001525** Parkinson's Inst., Sunnyvale, CA USA  
**Large Scale Single Nucleotide Polymorphism Study of PD Susceptibility**  
Mar 2006; 16 pp.; In English  
Contract(s)/Grant(s): W81XWH-04-1-0404  
Report No.(s): AD-A458414; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
No abstract available  
*Nucleotides; Polymorphism*

**20070001527** Boston Medical Center Corp., Boston, MA USA  
**The Role of DN-GSK3beta in Mammary Tumorigenesis**  
Jul 2006; 22 pp.; In English  
Contract(s)/Grant(s): W81XWH-04-1-0375  
Report No.(s): AD-A458412; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
No abstract available  
*Mammary Glands; Tumors*

**20070001528** Delaware Univ., Newark, DE USA  
**Biomechanical Factors in the Etiology of Tibial Stress Fractures**  
Aug 2006; 157 pp.; In English  
Contract(s)/Grant(s): DAMD17-00-1-0515  
Report No.(s): AD-A458411; No Copyright; Avail.: CASI: [A08](#), Hardcopy  
No abstract available  
*Biodynamics; Etiology; Fractures (Materials); Tibia*

**20070001529** Yale Univ., New Haven, CT USA  
**Interdisciplinary Research Training in Breast Cancer**  
Jul 2006; 13 pp.; In English  
Contract(s)/Grant(s): DAMD17-00-1-0509  
Report No.(s): AD-A458410; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
No abstract available  
*Breast; Cancer; Education; Research*

**20070001531** Fox Chase Cancer Center, Philadelphia, PA USA  
**Evaluation of Feasibility for a Case-Control Study of Pituitary-Ovarian Function in Premenopausal Women With Breast Cancer**  
Jul 2006; 13 pp.; In English  
Contract(s)/Grant(s): DAMD17-01-1-0236  
Report No.(s): AD-A458407; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
No abstract available  
*Breast; Cancer; Feasibility; Females; Pituitary Gland; Ovaries*

**20070001532** Mycobacteria Identification System, Inc., Newark, DE USA  
**BioTerNet Networking and Strain Tracking**  
Jul 2006; 39 pp.; In English  
Contract(s)/Grant(s): W81XWH-05-1-0397  
Report No.(s): AD-A458406; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
No abstract available  
*Life Sciences; Tracking (Position); Internets*

**20070001533** Texas Univ., Dallas, TX USA

**Breast Cancer Gene Therapy: Development of Novel Non-Invasive Magnetic Resonance Assay to Optimize Efficacy**

May 2006; 40 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0343

Report No.(s): AD-A458405; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Assaying; Breast; Cancer; Magnetic Resonance; Genes; Therapy*

**20070001534** Group Health Cooperative of Puget Sound, Seattle, WA USA

**A Population-Based Randomized Trial to Assess the Effects of Short-Term Cessation of HRT on Mammography Assessments and Breast Density**

Jun 2006; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0447

Report No.(s): AD-A458404; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Breast; Populations; Density Measurement*

**20070001589** Magee Womens Health Corp., Pittsburgh, PA USA

**Identification of Stem Cells in a Novel Human Mammary Epithelial Culture (HMEC) System that Reproducibly Demonstrates Ductal Organotypic Architecture in 3 Weeks**

Oct 2006; 55 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0685

Report No.(s): AD-A458403; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Mammary Glands; Stem Cells*

**20070001590** Army Communications-Electronics Command, Fort Belvoir, VA USA

**The Effectiveness of Different Personal Protective Ensembles in Preventing Blast Injury to the Thorax**

Jan 2006; 12 pp.; In English

Report No.(s): AD-A458402; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Injuries; Thorax*

**20070001591** Jackson (Henry M.) Foundation, Rockville, MD USA

**Carcinogenicity and Immunotoxicity of Embedded Depleted Uranium and Heavy-Metal Tungsten Alloy in Rodents**

Oct 2006; 73 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0821

Report No.(s): AD-A458401; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Carcinogens; Tungsten Alloys; Uranium; Heavy Metals; Embedding; Rodents*

**20070001594** Tufts New England Medical Center, Boston, MA USA

**Pepducin Based Intervention of Breast Cancer Invasion**

Covic, Lidija; Nguyen, Nga; Kuliopulos, Athan; Graham, Roger A; Aug 2006; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0454

Report No.(s): AD-A458458; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458458>; Avail.: CASI: [A03](#),

Hardcopy

Matrix metalloproteases (MMPs) play a central role in remodeling the tumor-stromal microenvironment. We recently determined that stromal derived MMP-1 also acts as a signaling molecule by cleaving protease-activated receptor 1 (PAR1) to cause breast cancer cell migration and invasion. Here, we show that ectopic PAR1 expression induces expression of the angiogenic factor Cyr61(CCN1) in breast cancer cells. The tumor-derived Cyr61 acts as an invasogenic signaling molecule that induces MMP-1 expression in adjacent stromal fibroblasts. Gene silencing of Cyr61 in breast cancer cells suppresses

MMP-1 induction in stromal fibroblasts resulting in a major loss immigration of the cancer cells towards the fibroblasts. Cyr61-dependent loss of migration was complemented by exogenous MMP-1 and required the presence of the functional PAR1 receptor on the breast cancer cells. These results suggest that interrupting tumor-stromal cell communication by targeting Cyr61 may provide an alternative therapeutic approach for the treatment of invasive breast cancer.

DTIC

*Breast; Cancer; Fibroblasts; Mammary Glands; Tumors*

**20070001596** Cold Spring Harbor Lab., New York, NY USA

**Scanning the Human Genome for Novel Therapeutic Targets for Breast Cancer**

Hannon, Greg J; Apr 2006; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0346

Report No.(s): AD-A458460; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458460>; Avail.: CASI: A03,

Hardcopy

The broad goal of this project was to develop genome-wide RNAi approaches in mammals and to apply these to the discovery of new therapeutic targets for cancer. Specifically, we have generated and continue to build a library of short hairpin RNA expression constructs (shRNA) that will ultimately correspond to every gene in the human and mouse genomes. These are presently available as a public resource and used internally to screen for genes that are essential to the survival of breast cancer cells but which are dispensable for the survival of normal cells. A subset of these might prove suitable as therapeutic targets for breast cancer therapy. During the course of funding, two things have become clear. First, although they were not in place at the time of submitting this application, we have largely developed the technologies necessary to pursue the above goal. Second, funding in the Innovator award fell far short of that necessary to achieve the goal. Relevant to the last point, we have been able to leverage the Innovator award with several other funding sources to create a program, which was more suited to meeting the proposed goals.

DTIC

*Apoptosis; Breast; Cancer; Genome; Human Beings; Mammary Glands; Ribonucleic Acids; Targets; Therapy*

**20070001597** Magee Womens Health Corp., Pittsburgh, PA USA

**Identification of Stem Cells in a Novel Human Mammary Epithelial Culture (HMEC) System that Reproducibly Demonstrates Ductal Organotypic Architecture in 3 Weeks**

Latimer, Jean J; Oct 2005; 55 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0685

Report No.(s): AD-A458461; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458461>; Avail.: CASI: A04,

Hardcopy

Our laboratory has published a novel culture system for Human Mammary Epithelial Cells (HMEC), both normal and malignant. This system allows for unusually long-term (3 months or longer) establishment of normal primary cultures that begin as three-dimensional 'mammospheres,' which are structures made up of 40-100 epithelial cells. These mammospheres subsequently differentiate into complex organotypic branching ducts and lobules that demonstrate Epithelial Specific Antibody (ESA) staining, lumen, polarized nuclei, desmosomes along the lateral surfaces of the cells, and microvilli on the apical surfaces. We hypothesize that since we have demonstrated de novo formation of multicellular organotypic epithelial ductal and lobular structures, that our cultures must contain multipotent stem cells, possibly because of the use of our novel tissue culture medium and the use of matrigel. We will identify the stem cell component of our HME cultures and determine the percentage of cells that have this profile. We will isolate these putative stem cells and reintroduce them after labeling, into our culture system to determine their ability to contribute to multiple lineages under the juxtacrine and paracrine influences of the other cells present. We will identify and isolate putative mammary stem cells using Hoechst exclusion from our primary cultures before they have actually differentiated ductal structures (pre-14 days in culture). Determine whether these flow sorted cells match

DTIC

*Epithelium; Mammary Glands; Organic Phosphorus Compounds; Stem Cells; Tissue Culturing*

**20070001598** California Univ., Berkeley, CA USA

**The Role of Src in Mammary Epithelial Tumorigenesis**

Kusdra, Leonard; May 2006; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0371

Report No.(s): AD-A458462; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458462>; Avail.: CASI: A03,

Hardcopy

Src kinases represent a family of non-receptor tyrosine kinases that mediate a number of signaling pathways and cell processes that become deregulated during the tumorigenic process such as cell proliferation, growth, motility, and survival. Since its discovery about 35 years ago as the first known oncogene, the scientific literature has focused on the mutant, oncogenic form of c-Src (v-Src) and its effects in the transformation of fibroblast cells. While these studies have gained insight into several aspects of Src signaling and biology, the role of endogenous c-Src in mammary epithelial cells remains unclear. This proposal aims to use various mammary carcinoma cell lines to examine the role of endogenous Src in two aspects of breast cancer biology, namely, the early event of the loss of proper cell polarity and acini architecture and the later event of increased migration and invasion capabilities. In addition, the proposal will examine the role of Src in more physiologically relevant three-dimensional cultures by employing the commercially available Matrigel<sup>®</sup> which contains components of extracellular matrix proteins to supply mammary tumor cells with proper polarity cues. Using Src-specific pharmacological inhibitors, our laboratory has found that T4-2 cells polarized and formed acinus-like structures in 3-D cultures accompanied by a concomitant downregulation of AKT and ERK phosphorylation. Inhibition of Src in the more invasive MDA-MB-231 mammary carcinoma cells prevents the formation of invadopodia in 3-D cultures. Using the dominant-negative mutant of Src in MDA-MB-231 cells, we have confirmed that Src signaling is required for invadopodia formation. Biochemical and cell biological studies will be aimed at delineating the important downstream effectors of Src involved in loss of acini architecture and gain of invasive capabilities of mammary tumor cells.

DTIC

*Breast; Cancer; Epithelium; Fibroblasts; Mammary Glands; Phosphorylation; Tumors*

**20070001599** Cincinnati Univ., OH USA

**A Molecular Connection Between Cancer Proliferation and Metastasis Mediated by Akt Kinase**

Weber, Georg F; Aug 2006; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0510

Report No.(s): AD-A458463; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458463>; Avail.: CASI: A03,

Hardcopy

Death from cancer is most frequently caused by metastases. While research of the past 25 years has identified genes whose malfunction causes cancer to grow, it has not been clear why these defects also induce the ability to metastasize. We have defined molecules that form a connection between signals that make cancer cells grow and signals that cause them to metastasize. In breast cancer cells, a molecule called Akt kinase bridges these two functions. Here we study the exact mechanism by which Akt kinase connects mechanisms of growth with mechanisms of cancer spread. The identification of a single defined defect as responsible for growth and metastasis enhances our molecular insights into cancer and it defines candidate targets for therapeutic intervention.

DTIC

*Breast; Cancer; Mammary Glands; Metastasis*

**20070001600** John Wayne Inst. for Cancer Treatment and Research, Santa Monica, CA USA

**A Dual-Action Approach to Multidrug-Resistant Breast Cancer: Prophylaxis to Ensure Therapeutic Effect**

Cabot, Myles C; Aug 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0528

Report No.(s): AD-A458464; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458464>; Avail.: CASI: A02,

Hardcopy

The development of drug resistance represents a formidable barrier to the successful treatment of breast cancer. Although some cancers such as melanoma can be intrinsically resistant, many cancers acquire resistance through selection pressure in the face of adversity, e.g., chemotherapy. One of the most consistent features of drug resistance is overexpression of P-glycoprotein (P-gp). This protein functions as a pump to reduce the intracellular concentration of anticancer drugs. Clinical use of P-gp antagonists to inhibit drug efflux has been disappointing. Here we propose silencing the multidrug resistance (MDR1) phenotype by retarding glycolipid metabolism via inhibition of glucosylceramide synthase (GCS), a lipogenic enzyme associated with MDR1. We will determine whether inhibitors of GCS affect MDR1/P-gp expression and chemotherapy sensitivity in drug-resistant breast cancer cells and determine whether GCS inhibitors forestall acquired resistance to chemotherapy in wild-type breast cancer cells. This is the first study to attack drug resistance in breast cancer by manipulating GCS and glycolipids, and as such, it represents a major shift in the research paradigm for drug resistance. This is also the first study to propose an approach that might have prophylactic as well as therapeutic value.

DTIC

*Breast; Cancer; Drugs; Enzymes; Health; Lipids; Mammary Glands; Prophylaxis; Proteins; Therapy*

**20070001601** New Mexico Univ., Albuquerque, NM USA

**Evaluation of Genomic Instability as an Early Event in the Progression of Breast Cancer**

Heaphy, Christopher M; Griffith, Jeffrey K; Apr 2006; 98 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0273

Report No.(s): AD-A458465; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458465>; Avail.: CASI: A05,

Hardcopy

We have shown in retrospective studies that loss of telomere content (TC) has potential value in predicting clinical outcome in breast cancer. However, an alternative marker for TC, which could be assessed in samples with small numbers of cells, such as fine needle aspirates, with commonly used methods is desirable. The aim of this study is to demonstrate that measurement of allelic imbalance (AI), which could be easily adapted to the clinical laboratory setting, can serve as a surrogate for TC, discriminating between women in need of more aggressive treatment and those for whom aggressive protocols are unnecessary. The candidate has developed a robust assay to determine the extent of AI that discriminates between normal and tumor specimens with 67% sensitivity and 99% specificity. Currently, the candidate is assessing the potential prognostic capabilities of the assay in node negative breast tumors. Additionally, the candidate has shown that increased AI and altered TC are present in both tumors and surrounding histologically normal breast tissues at distances at least one 1cm from the visible tumor margins and decrease as a function of distance. In addition to evaluating a potential biomarker of breast cancer progression, the proposed investigation has provided the candidate opportunities to interact with pathologists and oncologists to learn normal and abnormal breast morphology, the strengths and limitations of currently used breast cancer biomarkers and the scientific rationale for ongoing clinical trials. To date, all tasks, as outlined in the Statement of Work, are on schedule.

DTIC

*Breast; Cancer; Clinical Medicine; Genome; Mammary Glands; Telomeres*

**20070001603** McMaster Univ., Hamilton, Ontario Canada

**The Role of the POZ-ZF Transcription Factor Kaiso in Breast Cell Proliferation and Tumorigenesis**

Otchere, Abena; Mar 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0263

Report No.(s): AD-A458467; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458467>; Avail.: CASI: A03,

Hardcopy

Kaiso is a new member of the POZ-ZF transcription factor family, which was first identified as a binding partner for the cell adhesion co-factor p120ctn. Preliminary work from our lab indicated that Kaiso is misexpressed in ~40% of human breast tumors and identified cyclin D1 as a putative Kaiso target gene. The purpose of this project is to elucidate the mechanisms by which Kaiso's transcriptional regulation of cyclin D1 affects breast cell proliferation and contributes to breast tumorigenesis. Using such techniques as artificial promoter assays and semi-quantitative RT-PCR, we sought to determine how Kaiso regulates cyclin D1 promoter binding and expression. Our work to date demonstrates that Kaiso is a transcriptional repressor of the cyclin D1 gene and implicates Kaiso and p120ctn activity in modulating canonical Wnt signaling.

DTIC

*Breast; Cancer; Cells (Biology); Mammary Glands; Metastasis; Regeneration (Physiology)*

**20070001605** Fox Chase Cancer Center, Philadelphia, PA USA

**Evaluation of Feasibility for a Case-Control Study of Adrenal Androgen Production in Postmenopausal Women With Breast Cancer**

Dorgan, Joanne F; Jul 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0237

Report No.(s): AD-A458470; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458470>; Avail.: CASI: A03,

Hardcopy

Postmenopausal women with elevated serum estrogens and androgens are at an increased risk of breast cancer [1]. Dehydroepiandrosterone sulfate (DHEAS) is secreted only by the adrenals, and elevated serum DHEAS levels in postmenopausal women who develop breast cancer suggest increased adrenal androgen production. The objective of this pilot study was to evaluate variation in responsiveness of adrenal hormones to ACTH stimulation in healthy postmenopausal women. We also evaluated variation in natural killer cell cytotoxicity in response to ACTH. ACTH stimulation was accomplished by infusing a physiologic dose of synthetic ACTH over one hour following overnight adrenal suppression with dexamethasone. Results indicate considerable variation in response of serum progesterone, cortisol, DHEA, and androstenedione following ACTH stimulation. Other hormones measured and natural killer cell cytotoxicity did not change



significantly after ACTH. Future analyses will attempt to identify determinants of variation in response of progesterone, cortisol and adrenal androgens to ACTH stimulation.

DTIC

*Adrenal Gland; Adrenocorticotropin (ACTH); Breast; Cancer; Estrogens; Feasibility; Females; Hormones; Males; Mammary Glands*

**20070001606** Texas Univ., Dallas, TX USA

**The Functions of BRCA2 in Homologous Recombinational Repair**

Chen, David J; Jul 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0439

Report No.(s): AD-A458474; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458474>; Avail.: CASI: [A03](#),  
Hardcopy

We demonstrated that the BRCA2-Rad51 interaction is crucial for HR repair and multiple regions of BRCA2 protein are involved in regulating HR repair. Using biochemical approaches, we found that BRCA2 forms a multiprotein complex with Rad51, Rad51B and Rad51C DNA repair proteins involving a strong interaction between BRCA2 and Rad51, and between Rad51B and Rad51C. We successfully expressed three BRC fragments using baculovirus expression system. However, the purification of these proteins was found to be difficult because these proteins were extremely unstable and tended to be degraded during the purification process. The investigation regarding whether the BRC1-4, BRC5-8 or BRC1-8 proteins affects the Rad51 activities are underway. We found that, upon replication stresses, DNA-PKcs is phosphorylated and phosphorylated DNA-PKcs co-localizes with Brca1. The possible interaction between DNA-PKcs and Brca1 was confirmed in the co-immunoprecipitation (co-IP) analysis showing that DNA-PKcs could be co-precipitated with the -Brca1 antibody. Furthermore, GST-Brca1 fusion proteins covering different region of Brca1 were mixed with HeLa nuclear extract followed by co-IP with -DNA-PKcs antibody and western against -GST antibody. The result showed that Brca1 fragment #5 may potentially interact directly with DNA-PKcs.

DTIC

*Breast; Cancer; Mammary Glands*

**20070001607** Case Western Reserve Univ., Cleveland, OH USA

**Multimodality CT/SPECT Evaluation of Micelle Drug Carriers for Treatment of Breast Tumors**

Weinberg, Brent; Gao, Jinming; Jul 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0258

Report No.(s): AD-A458476; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458476>; Avail.: CASI: [A02](#),  
Hardcopy

Polymer micelles are a nanoparticle drug delivery system that has the potential to improve breast tumor treatment with chemotherapy. These nanoparticles can increase the half-life of incorporated drugs, can target tumors by incorporating tumor specific ligands, and can be tracked with imaging through the inclusion of a radiolabel. In this study, PEG/PLA or PEG/PCL micelles were modified through the addition of a cRGD targeting ligand and a DOTA chelating molecule for tracking with <sup>111</sup>In SPECT imaging. In vitro, cRGD-targeted micelles were incorporated into cells at a faster rate than non-targeted micelles and exhibited cytotoxicity rivaling that of free doxorubicin. Furthermore, SPECT imaging of <sup>111</sup>In-labeled micelles administered intravenously to tumor-bearing mice in vivo established the potential for micelle tracking with <sup>111</sup>In and confirmed the prolonged distribution half-life of micelles. Future research will focus on further development of this micelle platform with the ultimate goal of simultaneously tracking micelle localization and monitoring antitumor efficacy. Fluorescent tracking of micelles through the incorporation of quantum dots and monitoring antitumor efficacy with fluorescently labeled Annexin V may provide an alternate and superior method of achieving this goal.

DTIC

*Breast; Cancer; Chemotherapy; Mammary Glands; Micelles; Tumors*

**20070001609** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Assessing Biodegradability of Hydraulic Fluids Using Bio-Kinetic Model**

Rhee, In-Sik; Jan 2006; 12 pp.; In English

Report No.(s): AD-A458480; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458480>; Avail.: CASI: [A03](#),  
Hardcopy

Throughout the industrial age, natural resources have been turned into products no longer recognizable by

microorganisms and enzymes converting natural substances into their basic building blocks. To make more environmentally friendly products, significant efforts are being made to develop biodegradable materials and technologies fully compatible with the environment. One of concerns in these efforts is the evaluation of their biodegradability in laboratory environments within a short period. Currently, several ASTM and OECD biodegradation test methods are available for determining this environmental property, but they take a long time (28 days) and special biological knowledge is required. To resolve this problem, a bio-kinetic model was developed to predict the biodegradability of hydraulic fluids. This report presents how to develop a bio-kinetic model and its results are discussed in a comparison with modified Sturm test (ASTM D 5864) and Aerobic Closed Respirometer test (ASTM D 6731).

DTIC

*Biodegradability; Biodegradation; Hydraulic Fluids*

**20070001611** North Carolina Univ., Chapel Hill, NC USA

**Development of Biologically Based Therapies for Basal-Like Tumors**

Hoadley, Katherine A; Apr 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0288

Report No.(s): AD-A458484; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458484>; Avail.: CASI: A03, Hardcopy

The basal-like subtype of breast cancer is both estrogen receptor and HER2 negative and therefore is not effectively treated by hormonal therapy or trastuzumab. The purpose of this research is to identify treatment options for this subset of breast cancer patients. Breast cell lines of basal-like and luminal origin were treated with five different chemotherapeutics to determine sensitivity levels. The basal-like cell lines were more sensitive to carboplatin than luminal lines. Next, we focused on identifying a biologic therapy targeting the basal-like subtype. HER1/EGFR is expressed in approximately 50% of the basal-like tumors while not expressed in the luminal tumors. The basal-like cell lines showed an increased sensitivity to HER1 tyrosine kinase inhibitor, gefitinib, compared to the luminal lines. Concurrent combinations of gefitinib and four chemotherapeutics indicate that most combinations are additive to synergistic. Of particular interest is carboplatin and gefitinib, which as single agents were more sensitive in the basal-like lines are also synergistic in combination. This work is support for a clinical trial at UNC, which will treat basal-like breast cancer patients with a HER1 inhibitor with or without carboplatin.

DTIC

*Breast; Cancer; Mammary Glands; Neoplasms; Therapy; Tumors*

**20070001612** McMaster Univ., Hamilton, Ontario Canada

**Enhancing Involvement in Treatment Decision Making by Women With Breast Cancer**

O'Brien, Mary Ann; Whelan, Timothy; Gafni, Amiram; Charles, Cathy; Ellis, Peter; Jul 2006; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0329

Report No.(s): AD-A458485; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458485>; Avail.: CASI: A03, Hardcopy

Women with breast cancer desire more information about their disease, in part, to be involved in making treatment decisions (TDs). Patient involvement responds to patients' desires for autonomy and addresses ethical concerns about rights to make TDs. However, several researchers have reported that patients' actual experiences in TDM did not match their preferences. The study objectives are to 1) understand the meaning of involvement in TDM from the perspectives of women with early stage breast cancer (ESBO); 2) identify stages or steps of TDM used by women and their physicians during the treatment consultation(s); and 3) identify the behaviors of women and physicians that facilitate or impede women's involvement in TDM. A qualitative approach with interviews and video-stimulated recall is being used. In Phase 1 interviews with 19 women with ESBO were held to understand the concept of involvement in TDM. In Phase 2, consultations of a second group of 20 women are being digitally videotaped. Subsequently, women and their physicians (separately) view their consultation to identify any behaviors that facilitated or inhibited involvement in TDM. All interviews were taped, transcribed verbatim and analyzed. Phase 1: Most women wanted high quality information soon after diagnosis but many felt isolated and uninformed until the surgical or even the medical oncology visit. Most women thought they were heavily involved in a TDM process before, during and after the consultation. The results of the Phase 2 pilot testing indicated that videotaping the consultation was feasible. The information from this study will be useful to patients and physicians for promoting patient

involvement It can be used to develop and evaluate training programs for both physicians and patients to involve patients with cancer in decisions about their care

DTIC

*Breast; Cancer; Decision Making; Females; Mammary Glands*

**20070001616** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Polysaccharide Microarray Technology for the Detection of Burkholderia Pseudomallei and Burkholderia Mallei Antibodies**

Parthasarathy, Narayanan; DeShazer, David; England, Marilyn; Waag, David M; Apr 27, 2006; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458492; RPP-06-016; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458492>; Avail.:

CASI: A01, Hardcopy

A polysaccharide microarray platform was prepared by immobilizing Burkholderia pseudomallei and Burkholderia mallei polysaccharides. This polysaccharide array was tested with success for detecting B. pseudomallei and B. mallei serum (human and animal) antibodies. The advantages of this microarray technology over the current serodiagnosis of the above bacterial infections were discussed.

DTIC

*Antibodies; Polysaccharides*

**20070001622** Library of Congress, Washington, DC USA

**The National Institutes of Health (NIH): Organization, Funding, and Congressional Issues**

Smith, Pamela W; Oct 19, 2006; 45 pp.; In English

Report No.(s): AD-A458502; CRS-RL33695; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458502>; Avail.:

CASI: A03, Hardcopy

The National Institutes of Health is the focal point for federal health research. An agency of the Department of Health and Human Services (HHS), it uses its \$28.5 billion budget to support more than 200,000 scientists and research personnel working at over 3,100 institutions across the U.S. and abroad, as well as to conduct biomedical and behavioral research and research training at its own facilities. The agency consists of the Office of the Director, in charge of overall policy and program coordination, and 27 institutes and centers, each of which focuses on particular diseases or research areas in human health. A range of basic and clinical research is funded through a highly competitive system of peer-reviewed grants and contracts. The NIH appropriation in the past three years has shifted from marked growth to low or no increases. Appropriators and authorizers face many issues in working with NIH to set research priorities in the face of tight budgets. Congress accepts, for the most part, the priorities established through the agency's complex process of weighing scientific opportunity and public health needs. While the Public Health Service Act (PHSA) provides the statutory basis for NIH programs, it is primarily through appropriations report language, not budget line items or earmarks, that Congress gives direction to NIH and allows a voice for advocacy groups. Congress also monitors ethics rules on conflicts of interest and tracks the efficacy of procedures intended to make results of NIH-sponsored research accessible to the public.

DTIC

*Health; Medical Science; Organizations; Public Health; United States*

**20070001625** Naval Health Research Center, San Diego, CA USA

**Redefining Projections of Disease and Nonbattle Injury Patient Condition Code Distributions with Casualty Data from Operation Iraqi Freedom**

Zouris, James M; Wade, Amber L; Magno, Cheryl; Jul 30, 2006; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458506; NHRC-TR-06-21; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458506>; Avail.:

CASI: A03, Hardcopy

Modeling and simulation applications require accurate estimates of the frequency and types of illnesses and injuries incurred during military operations in order to assess medical resource needs. Data from the Navy-Marine Corps Combat Trauma Registry and the Joint Patient Tracking Application were used to identify US military disease and nonbattle injury casualties from Operation Iraqi Freedom during the time period of 01 March 2003 to 30 April 2005. Casualties were categorized by the 17 major ICD-9 diagnostic groups. Frequencies, standardized residuals, and chi-square statistics were used to compare the diagnostic categories among casualties by phase of operation, branch of service, and gender. The diagnostic categories varied by phase of Operation Iraqi Freedom, branch of service, and gender. Overall, there were a higher percentage

of nonbattle injuries during the Major Combat Phase and a higher percentage of musculoskeletal disorders during the Post Combat Phase. Compared with all other services, the US Marine Corps had the highest percentage of injuries as well as the lowest percentage of musculoskeletal disorders. Men had more injuries than women, whereas women had more diseases of the genitourinary system than men. The Patient Condition Occurrence Frequency tool was developed to account for these differences in patient streams.

DTIC

*Casualties; Diseases; Injuries; Military Personnel; Patients; Streams*

**20070001633** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

**Hair Follicle Bulb as a Bidosimeter for Low-Level VX Vapor Exposure: Initial Studies Validating the Presence of Potential Protein Biomarkers of Exposure in the Sprague-Dawley Rat Whisker Follicle**

Chambers, Amanda E; Benton, Bernard J; Valdes, James J; Sekowski, Jennifer W; Oct 2006; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458523; ECBC-TR-491; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458523>; Avail.:

CASI: A03, Hardcopy

Over the past fifty years, numerous studies have been performed to determine the health effects of exposure to organophosphorus (OP) nerve agents. The traditional approaches to determine OP exposure are invasive (e.g. require blood samples) laboratory-based assays that are not ideal for rapid, reliable testing in the event of a mass exposure scenario. However, advances in biomarker discovery make it possible to develop a less invasive, more expedient assay. The active hair follicle bulb expresses a large number of proteins, is easily accessible, and is an excellent candidate from which to assess biomarkers. In this report, we describe a novel immunohistochemistry (IHC) method developed for this initial hair follicle investigation, as well as the initial work completed to determine the presence of fifteen potential protein OP agent exposure biomarkers in the rat whisker follicle bulb. Each potential biomarker protein was chosen because of its change in expression in non-hair follicle tissue following exposure to pesticides and/or OP nerve agents. Using Western blotting, the expression of these proteins was verified in the rat whisker follicle bulb. Following verification in the digested hair follicle intact whole-hair IHC was performed to determine protein expression levels in the intact whisker follicle bulb.

DTIC

*Biomarkers; Bulbs; Exposure; Hair; Nerves; Organic Phosphorus Compounds; Proteins; Rats; Vapors*

**20070001634** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

**Catalytic Enzyme-Based Methods for Water Treatment and Water Distribution System Decontamination. 2. Experimental Results**

DeFrank, Joseph J; Fry, Ilona J; Pellar, Gregory J; Jun 2006; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458524; ECBC-TR-489; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458524>; Avail.:

CASI: A03, Hardcopy

Many special considerations are needed in the application of enzymes to contaminated drinking water systems. Because of the large volumes of water contained in water distribution and treatment systems, a decontaminant will need to be active for a much longer time than in military operations. Since drinking water flows very quickly in pipes, methods need to be developed to ensure that the enzymes maintain sufficient contact with the contaminated water or materials. The goal of this project is to identify, develop, and evaluate at least one enzyme-based method for treating flowing contaminated water, and one enzyme-based method for decontaminating drinking water pipes. A thorough literature search was previously undertaken to fully identify the potential of enzymes to treat contaminated drinking water and/or to decontaminate distribution systems equipment. Based on that literature search, methods for enzyme immobilization and stabilization were selected for evaluation.

DTIC

*Decontamination; Enzymes; Immobilization; Potable Water; Water; Water Treatment*

**20070001647** Howard Univ., Washington, DC USA

**A Partnership Training Program in Breast Cancer Research Using Molecular Imaging Techniques**

Wang, Paul C; Jul 2006; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0291

Report No.(s): AD-A458541; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458541>; Avail.: Defense Technical Information Center (DTIC)

In the first year of this training grant, five faculty members from different departments at the Howard University were

trained in molecular imaging with the faculty at the In Vivo Cellular Molecular Imaging Center at the Johns Hopkins University. Two research projects have started and progressed well. A Molecular Imaging Laboratory, a university core facility, has been established. Major optical imaging equipment, Xenogen IVIS 200, was acquired through this funding. The Molecular Imaging Lab is staffed with an imaging scientist, a molecular biologist, a pharmacologic chemist, and a research assistant. The lab has regular bi-weekly group meetings, a journal club, seminars, and workshops. The trainees have attended various seminars and a one-day retreat at JHU. The PI and the partnership leader have been coordinating the training

DTIC

*Breast; Cancer; Education; Images; Imaging Techniques; Mammary Glands; Medical Science*

**20070001648** Georgia Univ., Athens, GA USA

**Development of a PBPK Model for JP-8**

Fisher, Jeff; Bartlett, Michael; Gregg, Shonetta D; Nov 15, 2006; 16 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0157

Report No.(s): AD-A458543; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458543>; Avail.: CASI: [A03](#),

Hardcopy

The overarching goal of this research project was to develop a mathematical dosimetry model for aerosolized JP-8 to better understand human exposure to inhaled JP-8. The JP-8 dosimetry model could then be used to determine human health risks from exposure to JP-8. For the first time, individual hydrocarbon data were collected to characterize the atmospheric exposures and dosimetry for laboratory animals exposed to vaporized or aerosolized JP-8. Both chamber atmosphere and body burden data were collected using analytical methods developed by our team. Our dosimetry work was curtailed at end of this grant and remains to be completed. However, preliminary findings suggest that important differences in exposure of rats to individual hydrocarbons occur when JP-8 is aerosolized vs vaporized. This provide some evidence for explaining the apparent discrepancies reported for the toxicology of JP-8 when exposed to vapor vs. aerosol/vapor mixtures.

DTIC

*Jet Engine Fuels; JP-8 Jet Fuel; Models; Toxicology*

**20070001656** Southwest Missouri State Univ., Springfield, MO USA

**Multiple Strategy Bio-Detection Sensor Platforms Made From Carbon and Polymer Materials**

Giedd, Ryan; Ghosh, Kartik; Curry, Matt; Patel, Rishi; Durham, Paul; Han, Xuliang; Kinlen, Pat; Aug 10, 2006; 83 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0893

Report No.(s): AD-A458560; 6; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458560>; Avail.: CASI: [A05](#),

Hardcopy

This project involved the development of a biosensor based on a carbon and polymer micro-electromechanical system (CPMEMS) array comprised of micro-bridges to allow multiple bio-detection strategies. It would have the advantages of being autonomous, with quick response and high selectivity, as well as low cost. The multiple-strategy bio-detection platform will include systems that were developed by the Missouri State University and systems that were developed by our corporate partners and collaborators; Brewer Science, Inc. and Crosslink, Inc. One platform strategy is the use of a chemical release electro-active polymer to perform sense and release experiments. In conjunction to a broad-band biological/chemical detection system, a bio-collection system was also developed. The focus of this project was to produce a generalized system or substrate of transducers that can be applied to many emerging bio-detection strategies. We will demonstrate feasibility with well known methods of detection as well as many other new detection strategies that can be accommodated on this platform.

DTIC

*Biological Effects; Carbon; Detection; Microelectromechanical Systems; Oligonucleotides; Polymers*

**20070001657** Massachusetts Inst. of Tech., Cambridge, MA USA

**Relating the Biogeochemistries of Zinc, Cobalt, and Phosphorus to Phytoplankton Activities in the Sea**

Wisniewski, Rachel J; Jun 2006; 204 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): OCE-0136835

Report No.(s): AD-A458561; MIT/WHOI-2006-07; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458561>;

Avail.: CASI: [A10](#), Hardcopy

This thesis explores the potential of zinc, cobalt and phosphorus to influence phytoplankton production. In the North Pacific and Bering Sea, total zinc concentrations were measured in the near-surface and in deep profiles. Zinc speciation was

measured with a novel anodic stripping voltammetry method. Zinc's ability to influence primary production in the North-Pacific was demonstrated in a shipboard incubation and by comparing two phytoplankton pigments to zinc concentrations. In the North Atlantic, total dissolved zinc and cobalt were measured along with dissolved inorganic and organic phosphorus. In parts of the North Atlantic, zinc and cobalt were decoupled. The relationship between cobalt and inorganic phosphorus suggests that cobalt drawdown may be related to an alkaline phosphatase related demand. This compliments a shipboard incubation where alkaline phosphatase activity increased after cobalt addition. The presence of alkaline phosphatase activity indicated that the phytoplankton community in the Sargasso Sea was experiencing phosphorus- stress. Shipboard incubations generally confirmed this with chlorophyll- increases observed after additions of phosphate and dissolved organic phosphorus. This suggests that dissolved organic phosphorus may be an important phosphorus source in low phosphorus environments. This thesis contributes to the understanding of how phosphorus, zinc, and cobalt influence primary production.

DTIC

*Chlorophylls; Cobalt; Phosphorus; Phytoplankton; Sargasso Sea; Seas; Zinc*

**20070001685** Naval Medical Research Inst. Detachment, Lima, Peru

**Short Report: High Incidence of Shigellosis Among Peruvian Soldiers Deployed in the Amazon River Basin**

Jones, Franca R; Sanchez, Jose L; Meza, Rina; Batsel, Tanis M; Burga, Rosa; Canal, Enrique; Block, Karla; Perez, Juan; Bautista, Christian T; Escobedo, Jorge; Jan 2004; 4 pp.; In English

Report No.(s): AD-A458614; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458614>; Avail.: CASI: A01, Hardcopy

We investigated the etiology of acute diarrhea among Peruvian military recruits undergoing three months of basic combat training near the Amazonian city of Iquitos. From January through September 2002, 307 of 967 recruits were seen at the Health Post for diarrhea (attack rate [AR] 31.8%, incidence 1.28 95% confidence interval [CI] 1.14 1.43) episodes/person-year). *Shigella* spp. were the most common bacterial pathogen recovered from recruits experiencing diarrhea episodes. These bacteria were isolated from 89 (40%) of 225 diarrheal stools examined (AR 7.6%, incidence 0.30 [95% CI 0.24 0.38] episodes/person-year). Most (83 of 90; 92%) of the *Shigella* isolates were *S. flexneri*, of which 57 (69%) were serotype 2a. Seventy-six percent of *Shigella* isolates were resistant to sulfamethoxazole/ trimethoprim and all were sensitive to ciprofloxacin. Peruvian soldiers may be an excellent population in which to test the efficacy of *S. flexneri* vaccines in advanced development.

DTIC

*Amazon Region (South America); Deployment; Peru; River Basins*

**20070001741** Naval Health Research Center, San Diego, CA USA

**Western Blot Banding Patterns of HIV Rapid Progressors in the U.S. Navy Seropositive Cohort: Implications for Vaccine Development**

Garland, Frank C; Garland, Cedric F; Gorham, Edward D; Brodine, Stephanie K; Mar 18, 1996; 9 pp.; In English

Report No.(s): AD-A458697; 94-26; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458697>; Avail.: CASI: A02, Hardcopy

Although human immunodeficiency virus (HIV) infection is progressive, the rate of decline in CD4+ lymphocyte counts varies. The role of the immune system components in limiting HIV infection has yet to be defined, but a previous report in the U.S. Navy HIV Seropositive Cohort reported that strong reactivity in the anti-p55 (core precursor), p24 (core) and p53 (reverse transcriptase) Western blot bands was associated with higher CD4+ lymphocyte counts at the first clinical evaluation for HIV. The previous report examined the cross-sectional association between Western blot banding patterns and initial CD4+ lymphocyte counts. This report examines the association between these banding patterns in individuals who progressed rapidly as compared with patterns of patients who did not, based on their trends in repeated CD4+ lymphocyte counts as a marker of progression. Rapid and slower progressors were identified from a cohort of 3414 Navy and Marine Corp personnel who had a first positive HIV Western blot during 1986-1991. For purposes of this study, rapid progressors were defined as individuals whose CD4+ lymphocyte counts declined to < 500 cells/cubic mm within 1 year of seroconversion.

DTIC

*Navy; Vaccines; Viruses*

**20070001862** Federation of American Societies for Experimental Biology, Bethesda, MD USA

**Selection Criteria and Prioritization of Resuscitation Fluid Adjuvants**

Falk, Michael; Dec 2005; 170 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-C-0569

Report No.(s): AD-A458487; No Copyright; Avail.: CASI: A08, Hardcopy

To provide the sponsor with advice on criteria useful for evaluating potential technologies/products for resuscitation fluid for use by first-responders in combat. LSRO was also tasked with prioritizing pre-proposals and full proposals most warranting an investment in Sponsor resources. SCOPE The Phase I review of pre-proposals included those received in response to a public call for information on the topic of resuscitation fluids or components of fluids or adjuvant therapies and excluded equipment such as infusion and monitoring devices. Reviews were to include consideration of the military relevance of the product, the stage of product development, and the scientific merits of the investigation. In Phase 2, processes and forms currently in use by the military and other federal programs for the review of scientific research were examined with an eye towards improvements that would yield the type of data and information necessary for future expert reviews. The Phase 3 review of full proposals was limited to 12 received in response to 16 invitations (i.e., the highest ranking pre-proposals). MAJOR FINDINGS Phases I and 2: Of the 10 clinical pre-proposals reviewed, the expert panel identified 2 leading candidates. Of the 49 preclinical pre-proposals reviewed, the expert panel identified 5 top-tier pre-proposals and 9 second-tier pre-proposals. Phase 3: The review of 12 full proposals yielded 5 high ranking experimental products, most of which are likely to be ready for clinical testing by 2008. SIGNIFICANCE Development of one or more of the highest ranking novel strategies to treat hemorrhagic shock may improve effectiveness of resuscitation fluids, reducing the number of military casualties who are killed-in-action. Furthermore, the LSRO expert panel developed new proposal forms, that improved the quality, relevance, and organization of information provided for review of proposals beyond that provided by earlier instructions.

DTIC

*Resuscitation; Shock (Physiology)*

**20070001878** George Washington Univ., Washington, DC USA

**Model-Based Clustering and Data Transformations for Gene Expression Data**

Yeung, Ka Y; Fraley, Chris; Murua, Alejandro; Raftery, Adrian E; Ruzzo, Walter L; Apr 30, 2001; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458752; TR-396; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Clustering is a useful exploratory technique for the analysis of gene expression data, and many different heuristic clustering algorithms have been proposed in this context. Clustering algorithms based on probability models offer a principled alternative to heuristic algorithms. Model-based clustering assumes that the data is generated by a finite mixture of underlying probability distributions such as multivariate normal distributions. This Gaussian mixture model has been shown to be a power tool for many applications. In addition, the issues of selecting a 'good' clustering method and determining the 'correct' number of clusters are reduced to model selection problems in the probability framework. We benchmarked the performance of model-based clustering on several synthetic and real gene expression data sets for which external evaluation criteria were available. The model-based approach has superior performance on our synthetic data sets, consistently selecting the correct model and the right number of clusters.

DTIC

*Algorithms; Gene Expression; Heuristic Methods*

**20070001909** Air Force Research Lab., Hanscom AFB, MA USA

**Radiated Pulses Decay Exponentially in Materials in the Far Fields of Antennas**

Roberts, Thomas M; Feb 28, 2002; 3 pp.; In English

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

Report No.(s): AD-A458812; AFRL-SN-HS-TP-2002-0173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There has been recent interest in using short-pulse radar to detect targets in lossy clutter. The analysis presented here shows that the energy and peak-power densities of pulses decay exponentially with depth in homogeneous, lossy, dispersive materials, provided the frequency bands of the pulses are separated from DC. Many numerical examples verify the analytical results.

DTIC

*Antennas; Far Fields; Numerical Analysis; Radar*

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*.

**20070000526** NASA Johnson Space Center, Houston, TX, USA

**Micronuclei Induction in Human Fibroblasts Exposed In Vitro to Los Alamos High-Energy Neutrons**

Gersey, Brad; Sodolak, John; Hada, Megumi; Saganti, Prem; Wilkins, Richard; Cucinotta, Francis; Wu, Honglu; [2006]; 14 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

High-energy secondary neutrons, produced by the interaction of galactic cosmic rays with the atmosphere, spacecraft structure and planetary surfaces, contribute to a significant fraction to the dose equivalent in crew members and passengers during commercial aviation travel, and astronauts in space missions. The Los Alamos Nuclear Science Center (LANSCE) neutron facility's ICE House 30L beamline is known to generate neutrons that simulate the secondary neutron spectra of earth's atmosphere. The neutron spectrum is also similar to that measured onboard spacecraft like the MIR and International Space Station (ISS). To evaluate the biological damage, we exposed human fibroblasts in vitro to the LANSCE neutron beams without degrader at an entrance dose rate of 25 mGy/hr and analyzed the micronuclei (MN) induction. The cells were also placed behind a 9.9 cm water column to study effect of shielding in the protection of neutron induced damages. It was found that the dose response in the MN frequency was linear for the samples with and without shielding and the slope of the MN yield behind the shielding was reduced by a factor of 3.5. Compared to the MN induction in human fibroblasts exposed to a gamma source at a low dose rate, the RBE was found to be 16.7 and 10.0 for the neutrons without and with 9.9 cm water shielding, respectively.

Author

*Fibroblasts; Neutrons; Radiation Dosage; Biological Effects; Neutron Irradiation; Radiation Effects; Radiobiology; Dosage*

**20070000529** NASA Johnson Space Center, Houston, TX, USA

**The International Space Station Ultrasound Imaging Capability Overview for Prospective Users**

Sargsyan, Ashot E.; Hamilton, Douglas R.; Melton, Shannon L.; Young, Jeffrey; December 2006; 70 pp.; In English; Original contains color illustrations

Report No.(s): NASA/TP-2006-213731; S-989; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070000529>; Avail.: CASI: [A04](#), Hardcopy

The feasibility of ultrasonic imaging in human space flight has been demonstrated on NASA and Russian spacecraft. Several ultrasound systems have been successfully operated by both physician and non-physician astronauts and cosmonauts in pre-International Space Station (ISS) space flights, yielding valuable scientific information. A multipurpose ultrasound system was adapted for space and installed aboard ISS to continue human research in microgravity environments at a new level of sophistication and fidelity. Alone or in combination with other components of the Human Research Facility (HRF), this system provides a research capability never before available in space. The system can operate in B, M, Color Doppler, Power Angiography, Flow Propagation, Pulsed Spectral Doppler, and Continuous Wave Doppler modes and their combinations. Thus, the HRF Ultrasound System allows the realization of the great scientific potential of ultrasound imaging in conditions of space flight, acquiring morphological/morphometric and physiological/functional information from virtually every area or organ system of the human body. This will now allow ultrasound to be used in space for medical risk mitigation and has driven the medical concept of operations to recognize and treat as many medical conditions as possible while on orbit, delaying or avoiding return to a definitive medical care facility.

Author

*Microgravity; Research Facilities; Ultrasonics; Medical Equipment; Telemedicine; Biotechnology; Aerospace Medicine; Patients*

**20070000765** Air Force Research Lab., Brooks AFB, TX USA

**In Search of Circasemidian Rhythms**

Miller, James C; Nov 2006; 23 pp.; In English

Contract(s)/Grant(s): F33615-00-C-6013

Report No.(s): AD-A458153; AFRL-HE-BR-TR-2006-0074; No Copyright; Avail.: CASI: [A03](#), Hardcopy

There is controversy over the existence of physiological or behavioral circasemidian (12-hour period) rhythms. However, a number of reports have shown a circasemidian error pattern in industrial and transportation environments and a



circasemidian pattern in body temperature. To help us quantify the effects of fatigue, we hypothesized that body temperature, subjective sleepiness, simple response time and working memory speed would oscillate with a period of 12 hours (the circasemidian frequency); and that the parameter values describing the circasemidian oscillations of the measures would differ across genders and age groups. Measurements were acquired from 37 male and female subjects at half hourly intervals from 0700h to 1900h in constant conditions. Circasemidian cosine curves were fitted to the data of individual subjects by the least squares method. A statistically-significant, 12-hour pattern was found for body temperature and for subjective sleepiness, but not for simple response time or working memory speed. No differences were found with respect to gender or age group. Body temperature peaked at 16:49h and sleepiness peaked at 17:40h. Considering the large numbers of field observations of a two-peak pattern in errors and accidents, the failure to detect a circasemidian rhythmicity in task performance was attributed to the nature of task, itself. Future investigations should attempt to replicate our findings, acquire 24 h/day body temperature data, combine circasemidian with circadian cosinor estimates, determine which laboratory tasks display a circasemidian rhythmicity, try to determine why only some tasks may display that rhythmicity, and consider models other than the cosine curve.

DTIC

*Body Temperature; Circadian Rhythms; Sleep*

**20070001061** NASA Johnson Space Center, Houston, TX, USA

**Physiological Targets of Artificial Gravity: The Sensory-Motor System, Chapter 4**

Paloski, William; Groen, Eric; Clarke, Andrew; Bles, Willem; Wuyts, Floris; Paloski, William; Clement, Gilles; [2006]; 25 pp.; In English; Copyright; Avail.: CASI: [A03](#), Hardcopy

This chapter describes the pros and cons of artificial gravity applications in relation to human sensory-motor functioning in space. Spaceflight creates a challenge for sensory-motor functions that depend on gravity, which include postural balance, locomotion, eye-hand coordination, and spatial orientation. The sensory systems, and in particular the vestibular system, must adapt to weightlessness on entering orbit, and again to normal gravity upon return to Earth. During this period of adaptation, which persists beyond the actual gravity-level transition itself the sensory-motor systems are disturbed. Although artificial gravity may prove to be beneficial for the musculoskeletal and cardiovascular systems, it may well have negative side effects for the neurovestibular system, such as spatial disorientation, malcoordination, and nausea.

Author

*Artificial Gravity; Sensorimotor Performance; Physiological Effects; Central Nervous System; Vestibules; Cardiovascular System; Musculoskeletal System*

**20070001062** NASA Johnson Space Center, Houston, TX, USA

**Recommended Research on Artificial Gravity, Chapter 13**

Vernikos, Joan; Paloski, William; Fuller, Charles; Clement, Gilles; [2006]; 13 pp.; In English; Copyright; Avail.: CASI: [A03](#), Hardcopy

Based on the summaries presented in the above sections of what is still to be learned on the effects of artificial gravity on human functions, this chapter will discuss the short- and long-term steps of research required to understand fundamentals and to validate operational aspects of using artificial gravity as an effective countermeasure for long-duration space travel.

Author

*Artificial Gravity; Aerospace Medicine; Research and Development; Bionics*

**20070001441** NASA Johnson Space Center, Houston, TX, USA

**The Gravity of the Situation, Chapter 1**

Paloski, William; Clement, Gilles; Buckley, Angie; Paloski, William; [2006]; 18 pp.; In English; Copyright; Avail.: CASI: [A03](#), Hardcopy

Prolonged exposure in humans to a microgravity environment can lead to significant loss of bone and muscle mass, cardiovascular and sensory-motor deconditioning, and hormonal changes. These adaptive changes to weightlessness present a formidable obstacle to human exploration of space, particularly for missions requiring travel times of several months or more, such as on a trip to Mars. Countermeasures that address each of these body systems separately show only limited success. One possible remedy for this situation is artificial gravity, because it tackles all these systems across the board.

Author

*Artificial Gravity; NASA Space Programs; Long Duration Space Flight; Aerospace Medicine; Human Factors Engineering*

**20070001978** NASA Johnson Space Center, Houston, TX, USA

**Skeletal Recovery Following Long-Duration Spaceflight Missions as Determined by Preflight and Postflight DXA Scans of 45 Crew Members**

Sibonga, J. D.; Evans, H. J.; Sung, H. G.; Spector, E. R.; Lang, T. F.; Oganov, V. S.; Bakulin, A. V.; Shackelford, L. C.; LeBlanc, A. D.; November 29, 2006; 21 pp.; In English

Contract(s)/Grant(s): NAS9-99055; NNJ05HC7SA; Copyright; Avail.: CASI: [A03](#), Hardcopy

Introduction: The loss of bone mineral in astronauts during spaceflight has been investigated throughout the more than 40 years of bone research in space. Consequently, it is a medical requirement at NASA that changes in bone mass be monitored in crew members by measurements of bone mineral density (BMD) with dual-energy x-ray absorptiometry (DXA). This report is the first to evaluate medical data to address the recovery of bone mineral that is lost during spaceflight. Methods: DXA scans are performed before and after flight in astronauts who serve on long-duration missions (4-6 months) to ensure that medical standards for flight certification are met, to evaluate the effects of spaceflight and to monitor the restoration to preflight BMD status after return to Earth. Through cooperative agreements with the Russian Space Agency, the Bone and Mineral Lab at NASA Johnson Space Center (Houston, TX), also had access to BMD data from cosmonauts who had flown on long-duration missions yielding data from a total of 45 individual crew members. Changes in BMD (between 56 different sets of pre- and postflight measurements) were plotted as a function of time (days after landing); plotted data were fitted to an exponential mathematical model that determined i) BMD change at day 0 after landing and ii) the number of days after which 50% of the lost bone was recovered ('Recovery Half-Life'). These fits were performed for BMD of the lumbar spine, trochanter, pelvis, femoral neck and calcaneus. Results: In sum, averaged losses of bone mineral after spaceflight ranged between 2-9% for sites in the axial and appendicular skeleton. The fitted postflight BMD values predicted a 50% recovery of bone loss for all sites within 9 months.

Author

*Bone Mineral Content; Musculoskeletal System; Bone Demineralization; Astronauts; Space Flight; Pelvis; Lumbar Region; Flight Crews*

**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*.

**20070000530** NASA Johnson Space Center, Houston, TX, USA

**NASA Utilization of the International Space Station and the Vision for Space Exploration**

Robinson, Julie A.; Thomas, Donald A.; Thumm, Tracy L.; [2006]; 10 pp.; In English; AIAA Aerospace Sciences Meeting, 8 - 11 Jan. 2007, Reno, NV, USA; Original contains color illustrations; No Copyright; ONLINE:

<http://hdl.handle.net/2060/20070000530>; Avail.: CASI: [A02](#), Hardcopy

In response to the U.S. President's Vision for Space Exploration (January 14, 2004), NASA has revised its utilization plans for ISS to focus on (1) research on astronaut health and the development of countermeasures that will protect our crews from the space environment during long duration voyages, (2) ISS as a test bed for research and technology developments that will insure vehicle systems and operational practices are ready for future exploration missions, (3) developing and validating operational practices and procedures for long-duration space missions. In addition, NASA will continue a small amount of fundamental research in life and microgravity sciences. There have been significant research accomplishments that are important for achieving the Exploration Vision. Some of these have been formal research payloads, while others have come from research based on the operation of International Space Station (ISS). We will review a selection of these experiments and results, as well as outline some of ongoing and upcoming research. The ISS represents the only microgravity opportunity to perform on-orbit long-duration studies of human health and performance and technologies relevant for future long-duration missions planned during the next 25 years. Even as NASA focuses on developing the Orion spacecraft and return to the moon (2015-2020), research on and operation of the ISS is fundamental to the success of NASA's Exploration Vision.

Author

*Aerospace Environments; International Space Station; Long Duration Space Flight; Microgravity; Space Exploration; Spacecrews; Health; Countermeasures*

**20070000708** Journal of the Safe Association, Creswell, OR USA

**SAFE Journal. Volume 34, Number 1, Fall 2006**

Darrah, Mark I; Benton, Jeani; DeWald, Sandra; Darrah, James; Jan 2006; 45 pp.; In English

Report No.(s): AD-A458046; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The primary objective of the SAFE Association is to stimulate research and development in the fields of safety, survival, and life support. The SAFE Association publishes the SAFE Journal at least twice a year. Table of Contents for this issue: Degradation of Pilot Reach Under G. Helicopter Ditching: Time of Crash and Survivability Evaluation of Acceleration Response During AFRL + Gz Vertical Deceleration Mathematical Simulation of the Human Ventilatory Response during and Altitude Chamber Physiological Training Profile First Hand Witnesses of Sled Testing Over the Past Forty Years Then and Now: Flight Research in the Second Half of the 20th Century.

DTIC

*Life Support Systems; Safety*

**20070000727** Society of Naval Architects and Marine Engineers, Jersey City, NJ USA

**The National Shipbuilding Research Program, 1992 Ship Production Symposium Proceedings, Paper No. 5A-2: Human Factors - An Initiative in the USA Coast Guard**

Wilson, Marc B; Sep 1992; 13 pp.; In English

Report No.(s): AD-A458085; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Although the concept of human factors is not new, it is new within the marine system. Ship design and operations are just a part of the marine system. The marine system is everything and anything associated with the marine community, environment, industry, etc.; whether it is public or private. Human factors is a means to improve and maintain a better quality of life in both the workplace and the home. Human factors is compatible and complimentary with good managerial practices, and is back by sound engineering. The aim of this paper is to expose the reader to human factors.

DTIC

*Coasts; Conferences; Human Factors Engineering; Marine Technology; Ships; United States*

**20070001004** NASA Johnson Space Center, Houston, TX, USA

**Metabolic Heat Regenerated Temperature Swing Adsorption for CO(sub 2) and Heat Removal/Rejection in a Martian PLSS**

Iacomini, Christine; Powers, Aaron; Bowers, Chad; Straub-Lopez, Katie; Anderson, Grant; MacCallum, Taber; Paul, Heather; [2007]; 1 pp.; In English

Contract(s)/Grant(s): WBS 384.06.04.01.05.10; Copyright; Avail.: Other Sources; Abstract Only

Two of the fundamental problems facing the development of a Portable Life Support System (PLSS) for use on Mars, are (i) heat rejection (because traditional technologies use sublimation of water, which wastes a scarce resource and contaminates the premises), and (ii) rejection of CO<sub>2</sub> in an environment with a ppCO<sub>2</sub> of 0.4-0.9 kPa. Patent-pending Metabolic heat regenerated Temperature Swing Adsorption (MTSA) technology is being developed to address both these challenges. The technology utilizes an adsorbent that when cooled with liquid CO<sub>2</sub> to near sublimation temperatures (~195K) removes metabolically-produced CO<sub>2</sub> in the vent loop. Once fully loaded, the adsorbent is then warmed externally by the vent loop (approx. 300K), rejecting the captured CO<sub>2</sub> to Mars ambient. Two beds are used to effect a continuous cycle of CO<sub>2</sub> removal/rejection as well as facilitate heat exchange out of the vent loop. Any cryogenic fluid can be used in the application; however, since CO<sub>2</sub> is readily available at Mars and can be easily produced and stored on the Martian surface, the solution is rather elegant and less complicated when employing liquid CO<sub>2</sub>. As some metabolic heat will need to be rejected anyway, finding a practical use for metabolic heat is also an overall benefit to the PLSS. To investigate the feasibility of the technology, a series of experiments was conducted which lead to the selection and partial characterization of an appropriate adsorbent. The adsorbent NaX successfully removed CO<sub>2</sub> from a simulated vent loop at the prescribed temperature swing anticipated during PLSS operating conditions on Mars using a cryogenic fluid. Thermal conductivity of the adsorbent was also measured to eventually aid in a demonstrator design of the technology. These results provide no show stoppers to the development of MTSA technology and allow its development to focus on other design challenges as listed in the conclusions.

Author

*Carbon Dioxide Removal; Heat Transfer; Mars Surface; Metabolism; Portable Life Support Systems; Adsorption*

**20070001005** NASA Johnson Space Center, Houston, TX, USA

**Demonstration of Metabolic Heat Regenerated Temperature Swing Adsorption Technology**

Paul, Heather; Iacomini, Christine; Powers, Aaron; Dunham, Jonah; Straub-Lopez, Katie; Anerson, Grant; MacCallum, Taber; [2007]; 1 pp.; In English; 37th International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA

Contract(s)/Grant(s): WBS 384.06.04.01.05.10; Copyright; Avail.: Other Sources; Abstract Only

Patent-pending Metabolic heat regenerated Temperature Swing Adsorption (MTSA) technology is currently being

investigated for removal and rejection of CO<sub>2</sub> and heat from a Portable Life Support System (PLSS) to a Martian environment. The metabolically-produced CO<sub>2</sub> present in the vent loop gas is collected using a CO<sub>2</sub> selective adsorbent that has been cooled via a heat exchanger to near CO<sub>2</sub> sublimation temperatures (approx.195K) with liquid CO<sub>2</sub> obtained from Martian resources. Once the adsorbent is fully loaded, fresh warm, moist vent loop (approx.300K) is used to heat the adsorbent via another heat exchanger. The adsorbent will then reject the collected CO<sub>2</sub> to the Martian ambient. Two beds are used to achieve continuous CO<sub>2</sub> removal by cycling between the cold and warm conditions for adsorbent loading and regeneration, respectively. Small experiments have already been completed to show that an adsorbent can be cycled between these PLSS operating conditions to provide adequate conditions for CO<sub>2</sub> removal from a simulated vent loop. One of the remaining technical challenges is extracting enough heat from the vent loop to warm the adsorbent in an appreciable time frame to meet the required adsorb/desorb cycle. The other key technical aspect of the technology is employing liquid CO<sub>2</sub> to achieve the appropriate cooling. A technology demonstrator has been designed, built and tested to investigate the feasibility of 1) warming the adsorbent using the moist vent loop, 2) cooling the adsorbent using liquid CO<sub>2</sub>, and 3) using these two methods in conjunction to successfully remove CO<sub>2</sub> from a vent loop and reject it to Mars ambient. Both analytical and numerical methods were used to perform design calculations and trades. The demonstrator was built and tested. The design analysis and testing results are presented along with recommendations for future development required to increase the maturity of the technology.

Author

*Heat Exchangers; Metabolism; Carbon Dioxide Removal; Portable Life Support Systems; Life Support Systems; Design Analysis*

**20070001006** NASA Johnson Space Center, Houston, TX, USA

#### **Development of a Rapid Cycling CO<sub>2</sub> and H<sub>2</sub>O Removal Sorbent**

Paul, Heather; Alptekin, Goekhan; Cates, Matthew; Bernal, Casey; Dubovik, Margarita; Gershanovich, Yevgenia; [2007]; 1 pp.; In English; 37th International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA

Contract(s)/Grant(s): WBS 384.06.04.01.05.10

Report No.(s): 07ICES-207; Copyright; Avail.: Other Sources; Abstract Only

The National Aeronautics and Space Administration (NASA) planned future missions set stringent demands on the design of the Portable Life Support System (PLSS), requiring dramatic reductions in weight, decreased reliance on supplies and greater flexibility on the types of missions. Use of regenerable systems that reduce weight and volume of the Extravehicular Mobility Unit (EMU) is of critical importance to NASA, both for low orbit operations and for long duration manned missions. The carbon dioxide and humidity control unit in the existing PLSS design is relatively large, since it has to remove and store 8 hours worth of CO<sub>2</sub>. If the sorbent regeneration can be carried out during the extravehicular activity (EVA) with a relatively high regeneration frequency, the size of the sorbent canister and weight can be significantly reduced. The progress of regenerable CO<sub>2</sub> and humidity control is leading us towards the use of a rapid cycling amine system. TDA Research, Inc. is developing compact, regenerable sorbent materials to control CO<sub>2</sub> and humidity in the space suit ventilation loop. The sorbent can be regenerated using space vacuum during the EVA, eliminating all carbon dioxide and humidity duration-limiting elements in the life support system. The material also has applications in other areas of space exploration such as the Orion spacecraft and other longer duration exploration missions requiring regenerable technologies. This paper summarizes the results of the sorbent development, testing, and evaluation efforts to date. The results of a preliminary system analysis are also included, showing the size and volume reductions for PLSS provided by the new system.

Author

*Carbon Dioxide Removal; Portable Life Support Systems; Carbon Dioxide; Sorbents; Systems Engineering*

**20070001008** NASA Johnson Space Center, Houston, TX, USA

#### **Physics of Artificial Gravity**

Bukley, Angie; Paloski, William; Clement, Gilles; [2006]; 14 pp.; In English; Copyright; Avail.: CASI: A03, Hardcopy

This chapter discusses potential technologies for achieving artificial gravity in a space vehicle. We begin with a series of definitions and a general description of the rotational dynamics behind the forces ultimately exerted on the human body during centrifugation, such as gravity level, gravity gradient, and Coriolis force. Human factors considerations and comfort limits associated with a rotating environment are then discussed. Finally, engineering options for designing space vehicles with artificial gravity are presented.

Author

*Artificial Gravity; Physics; Spacecraft Design; Technology Utilization; Human Factors Engineering*

**20070001010** NASA Johnson Space Center, Houston, TX, USA

**Space Suit Radiator Performance in Lunar and Mars Environments**

Nabity, James; Mason, Georgia; Copeland, Robert; Libberton, Kerry; Trevino, Luis; Stephan, Ryan; Paul, Heather; [2007]; 1 pp.; In English; 37th International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA  
Contract(s)/Grant(s): WBS 384.06.04.01.05.10; Copyright; Avail.: Other Sources; Abstract Only

During an ExtraVehicular Activity (EVA), both the heat generated by the astronaut's metabolism and that produced by the Portable Life Support System (PLSS) must be rejected to space. The heat sources include the heat of adsorption of metabolic CO<sub>2</sub>, the heat of condensation of water, the heat removed from the body by the liquid cooling garment and the load from the electrical components. Although the sublimator hardware to reject this load weighs only 3.48 lbs, an additional eight pounds of water are loaded into the unit of which about six to eight are sublimated and lost; this is the single largest expendable during an eight-hour EVA. Using a radiator to reject heat from the Astronaut during an EVA, we can significantly reduce the amount of expendable water consumed by the sublimator. Last year we reported on the design and initial operational assessment tests of our novel radiator designated the Radiator And Freeze Tolerant heat eXchanger (RAFT-X). Herein, we report on tests conducted in the NASA Johnson Space Center Chamber E Thermal Vacuum Test Facility. Up to 800 Btu/h of heat were rejected in lunar and Mars environments with temperatures as cold as -150 F. Tilting the radiator did not cause an observable loss in performance. The RAFT-X endured freeze / thaw cycles and in fact, the heat exchanger was completely frozen three times without any apparent damage to the unit. We were also able to operate the heat exchanger in a partially frozen configuration to throttle the heat rejection rate from 530 Btu/h at low water flow rate down to 300 Btu/h. Finally, the deliberate loss of a single loop heat pipe only degraded the heat rejection performance by about 2 to 5%.

Author

*Lunar Environment; Mars Environment; Space Suits; Radiators*

**20070001117** NASA Johnson Space Center, Houston, TX, USA

**Reach Envelope and Field of Vision Quantification in Mark III Space Suit using Delaunay Triangulation**

Abercromby, Andrew F. J.; Thaxton, Sherry S.; Onady, Elizabeth A.; Rajulu, Sudhakar L.; November 2006; 58 pp.; In English; Original contains color illustrations  
Report No.(s): NASA/TP-2006-213729; S-987; Copyright; Avail.: CASI: [A04](#), Hardcopy

The Science Crew Operations and Utility Testbed (SCOUT) project is focused on the development of a rover vehicle that can be utilized by two crewmembers during extra vehicular activities (EVAs) on the moon and Mars. The current SCOUT vehicle can transport two suited astronauts riding in open cockpit seats. Among the aspects currently being developed is the cockpit design and layout. This process includes the identification of possible locations for a socket to which a crewmember could connect a portable life support system (PLSS) for recharging power, air, and cooling while seated in the vehicle. The spaces in which controls and connectors may be situated within the vehicle are constrained by the reach and vision capabilities of the suited crewmembers. Accordingly, quantification of the volumes within which suited crewmembers can both see and reach relative to the vehicle represents important information during the design process.

Author

*Extravehicular Activity; Portable Life Support Systems; Scout Project; Recharging; Roving Vehicles; Space Suits; Triangulation*

**20070001124** NASA Johnson Space Center, Houston, TX, USA

**A Novel Method for Breath Capture Inside a Space Suit**

Paul, Heather; Filburn, Tom; [2007]; 1 pp.; In English; 34th International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA

Contract(s)/Grant(s): WBS 384.06.04.01.05.10; Copyright; Avail.: Other Sources; Abstract Only

Any non-robotic mission to the Mars surface will need to rely on various life support technologies. The large metabolic generation rate and low tolerance to elevated levels of carbon dioxide (CO<sub>2</sub>) in the Mars atmosphere make CO<sub>2</sub> removal one of the preeminent tasks in this domain. In addition, these same features provide a strong impetus for using regenerable CO<sub>2</sub> removal technologies. In the past, many of these regenerable technologies have relied on the low partial pressure CO<sub>2</sub> surrounding the vehicle to provide an ultimate sink for removing this gas contaminant, however any Mars mission will have to overcome the presence of the Mars atmosphere. This paper describes the investigation of methods to capture the exhaled CO<sub>2</sub> from a suited crewmember before it becomes diluted with the high volumetric air flow present within the space suit. Typical expired air contains CO<sub>2</sub> partial pressures in the range of 20-35 mm Hg. This research investigated methods to capture this high partial pressure CO<sub>2</sub> prior to its dilution with the low partial pressure CO<sub>2</sub> ventilation flow. Specifically the research looked at potential designs for a collection cup for use inside the space suit helmet. This collection cup should not be

considered the same as a breathing mask typical of that worn by firefighters, etc. Instead, the collection cup is a non-contact device that makes use of detailed analyses of the ventilation flow environment within the helmet. The research used a detailed Computational Fluid Dynamic (CFD) code called Fluent to provide modeling of the various gas species (CO<sub>2</sub>, water vapor, O<sub>2</sub>) as they pass through a helmet. This same model was used to numerically evaluate several different collection cup designs for this same CO<sub>2</sub> segregation effort.

Author

*Computational Fluid Dynamics; Mars Missions; Space Suits; Life Support Systems; Breathing; Expired Air*

**20070001152** Joint Military Intelligence Coll, Washington, DC USA

**The Breakdown of the PC Paradigm: A Critical Look At Information Display Technology As An Analysis Inhibitor**

Rue, Steven F; Aug 2003; 91 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458326; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The Department of Defense (DoD) has come to rely on Commercial-Off-The-Shelf (COTS) acquisition as the primary means to introduce and upgrade computer technologies throughout the military. In adopting this approach, the personal computer (PC), based on a commercial, business-model design, has become a de-facto standard. Within the thesis, this common, and widely-accepted desktop computer environment is defined as the PC Paradigm and encompasses the typical office-suite software, the information display, and the use of the desktop metaphor as the user-interface. The author contends that this near-exclusive reliance on COTS technologies is based on market-driven, commercial product solutions rather than a 'domain specific' system design that is optimized to support intelligence analysis. The thesis addresses the following research question: Could the current personal computer environment (characterized as the PC Paradigm) function as an analysis inhibitor, rather than as a tool to facilitate analysis? Key findings suggested that a 'paradigm conflict' exists between the needs of intelligence analysis and the commercial, office-based persona! computer employing the desktop metaphor as a user interface. Additionally, COTS technology acquisition, and its associated commercial standards, have appeared to supplant a design process optimized for the needs of the intelligence analyst. Such an approach disregards domain specificity in favor of a generalized, 'one-size-fits-all' product solution. The thesis concludes that the PC Paradigm environment does contribute to inhibited analysis. The current paradigm is not derived from cognitive ergonomic requirements unique to intelligence analysis, nor does it support the analytic methodologies widely regarded as 'best practices' within the field. The author contends that domain relevance is lacking in business-model tools when applied to the problems of intelligence analysis.

DTIC

*Display Devices; Human-Computer Interface; Information Systems; Inhibitors; Intelligence*

**20070001219** Army Construction Engineering Research Lab., Champaign, IL USA

**Evaluation of Models to Support Habitat Fragmentation Analysis**

Jul 2006; 133 pp.; In English

Contract(s)/Grant(s): Proj-A896

Report No.(s): AD-A458442; ERDC/CERL TR-06-18; No Copyright; Avail.: CASI: [A07](#), Hardcopy

No abstract available

*Fragmentation; Habitats; Fragments*

**20070001463** Renaissance Sciences Corp., Chandler, AZ USA

**Physics-Based Stimulation for Night Vision Goggle Simulation**

Nov 2006; 64 pp.; In English

Contract(s)/Grant(s): F41624-97-D-5000; Proj-4924

Report No.(s): AD-A458393; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Goggles; Night Vision; Simulation; Stimulation*

**20070001526** Army Communications-Electronics Command, Fort Belvoir, VA USA

**Full Scale Evaluation of Lightweight Personal Protective Ensembles for Demining**

Jan 2006; 12 pp.; In English

Report No.(s): AD-A458413; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Mining; Protective Clothing*

**20070001621** Med-Eng Systems, Inc., Ottawa, Ontario Canada  
**Comparative Study of Different Lightweight Head Protection Systems with Full-Face Visors for Humanitarian Deminers**

Nerenberg, J; Islam, S; Makris, A; Dionne, J P; Chichester, C; Jan 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458501; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458501>; Avail.: CASI: A03, Hardcopy

A key component for of any personal protective ensemble for demining is the helmet and/or face shield. For obvious reasons, protecting the face of a deminer is of utmost importance in the case of an accidental detonation of a mine. Currently, there is a wide range of different head and face protective devices available for the deminer, and this study attempts to perform a first evaluation of these devices from several different perspectives.

DTIC

*Clearances; Evaluation; Helmets; Protection; System Effectiveness; Visors*

**20070001730** Army Communications-Electronics Command, Fort Belvoir, VA USA  
**A Test Methodology for Assessing Demining Personal Protective Equipment (PPE)**

Chichester, Charles; Bass, Cameron; Boggess, Brian; Davis, Martin; Sanderson, Ellory; Di Marco, Gin; May 2001; 75 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-DTC-0-CO-160-000-031

Report No.(s): AD-A458677; RM-1; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458677>; Avail.: CASI: A04, Hardcopy

To reduce human casualties associated with demining, a wide range of protective wear has been designed to shield against accidental detonation of antipersonnel (AP) landmines. Injury protection offered by personal protective equipment (PPE) may include, but is not limited to, head/face protection and thorax protection that may offer the potential for substantial defense against fragments, blunt force trauma, burns, and other consequences of mine blasts. In this study, five commercially available PPEs were evaluated. These suits represent a wide range of materials and armor masses. In addition, the PPEs offer varied areas of head, neck, thorax and extremity coverage. This study utilized the Hybrid III dummy, all instrumented biofidelic surrogate that is anthropometrically similar to the human body. The primary dummy was a 50th percentile male, anthropometrically scaled to the average North American adult male. Tests were conducted with both an unprotected dummy and a dummy clothed with one of the five commercially available PPEs. Based on recorded dummy values, injury risk assessments were made using human or animal injury models. The PPEs were evaluated against two levels of simulated mines containing 100 g and 200 g of C-4 explosive against a widely fielded antipersonnel mine, the PMN containing 240 g of TNT. The test matrix consisted of 102 tests to confirm repeatability and robustness of the dummies, as well as to evaluate the five PPEs, two size dummies, and two positions (kneeling and prone).

DTIC

*Mines (Ordnance); Protectors*

## 55

### EXO BIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 *Aerospace Medicine*; on animals and plants see 51 *Life Sciences*. For psychological and behavioral effects of aerospace environments see 53 *Behavioral Sciences*.

**20070000527** NASA Ames Research Center, Moffett Field, CA, USA  
**The AstroBiology Explorer (ABE) MIDEX Mission Concept: Using Infrared Spectroscopy to Identify Organic Molecules in Space**

Sandford, Scott A.; Ennico, Kimberly; Allamandola, Louis; Bregman, Jesse; Greene, Thomas; Hudgins, Douglas; April 11, 2002; 2 pp.; In English; Astrobiology Science Conference 2002, 7 - 11 Apr. 2002, Ames Research Center, Moffett Field, CA, USA

Contract(s)/Grant(s): RTOP 997-24-00; No Copyright; Avail.: Other Sources; Abstract Only

One of the principal means by which organic compounds are detected and identified in space is by infrared spectroscopy. Past IR telescopic and laboratory studies have shown that much of the carbon in the interstellar medium (ISM) is in complex organic species but the distribution, abundance and evolutionary relationships of these materials are not well understood. The

Astrobiology Explorer (ABE) is a MIDEX mission concept designed to conduct IR spectroscopic observations to detect and identify these materials and address outstanding problems in astrobiology, astrochemistry, and astrophysics. ABE's core science program includes observations of planetary nebulae and stellar outflows, protostellar objects, Solar System objects, and galaxies, and lines of sight through dense molecular clouds and the diffuse ISM. ABE is a cryogenically-cooled 60 cm diameter space telescope equipped with 3 cross-dispersed R-2000 spectrometers that share a single common slit. Each spectrometer measures one spectral octave and together cover the entire 2.5-20 micron region simultaneously. The spectrometers use state-of-the-art InSb and Si:As 1024x1024 pixel detectors. ABE would operate in a heliocentric, Earth drift-away orbit and have a core science mission lasting approximately 1.5 years. ABE is currently under study at NASA's Ames Research Center in collaboration with Ball Aerospace and Technologies Corp.

Author

*Exobiology; Interstellar Matter; Molecular Clouds; Organic Compounds; Spaceborne Telescopes; Extraterrestrial Life; Biomarkers*

## 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*.

**2007000022** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

#### **Securing Resources in Collaborative Environments: A Peer-to-Peer Approach**

Berket, K.; Essiari, A.; Thompson, M. R.; Sep. 2005; 10 pp.; In English

Report No.(s): DE2006-885232; No Copyright; Avail.: Department of Energy Information Bridge

We have developed a security model that facilitates control of resources by autonomous peers who act on behalf of collaborating users. This model allows a gradual build-up of trust. It enables secure interactions among users that do not necessarily know each other and allows them to build trust over the course of their collaboration. This paper describes various aspects of our security model and describes an architecture that implements this model to provide security in pure peer-to-peer environments.

NTIS

*Computer Information Security; Internets; Computer Security*

**2007000023** Arizona Univ., Tucson, AZ, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

#### **Towards an Automatic and Application-Based Eigensolver Selection**

Zhang, Y.; Li, X. S.; Marques, O.; Sep. 2005; 14 pp.; In English

Report No.(s): DE2006-885240; No Copyright; Avail.: Department of Energy Information Bridge

The computation of eigenvalues and eigenvectors is an important and often time-consuming phase in computer simulations. Recent efforts in the development of eigensolver libraries have given users good algorithms without the need for users to spend much time in programming. Yet, given the variety of numerical algorithms that are available to domain scientists, choosing the 'best' algorithm suited for a particular application is a daunting task. As simulations become increasingly sophisticated and larger, it becomes infeasible for a user to try out every reasonable algorithm configuration in a timely fashion. Therefore, there is a need for an intelligent engine that can guide the user through the maze of various solvers with various configurations. In this paper, we present a methodology and a software architecture aiming at determining the best solver based on the application type and the matrix properties. We combine a decision tree and an intelligent engine to select a solver and a preconditioner combination for the application submitted by the user. We also discuss how our system interface is implemented with third party numerical libraries. In the case study, we demonstrate the feasibility and usefulness of our system with a simplified linear solving system. Our experiments show that our proposed intelligent engine is quite adept in choosing a suitable algorithm for different applications.

NTIS

*Computerized Simulation; Eigenvalues; Eigenvectors*

**20070000481** Texas Univ., Austin, TX, USA, Federal Highway Administration, Austin, TX USA

#### **Design and Operation of Inland Ports as Nodes of the Trans-Texas Corridor, Project Summary**

Harrison, R.; Chiu, Y. C.; Henk, R.; Loftus-Otway, L.; Yang, H.; Aug. 31, 2005; 2 pp.; In English

Report No.(s): PB2007-103049; CTR-PS-0-4702; No Copyright; Avail.: CASI: [A01](#), Hardcopy



In 2002, Governor Rick Perry announced his vision for a new transportation system for Texas, the Trans Texas Corridors (TTC). He proposed that Texas be connected by a 4,000-mile network of corridors up to 1,200 feet wide with separate lanes for passenger vehicles and trucks. The initial corridor concept includes separated rail tracks (freight, commuter, and high-speed) and space for the provision of utilities, in addition to the highways.

NTIS

*Corridors; Texas*

**20070000518** Lawrence Livermore National Lab., Livermore, CA USA

**Methodologies and Metrics for Assessing the Strength of Relationships between Entities within Semantic Graphs**

Hickling, T. L.; Hanley, W. G.; Sep. 29, 2006; 38 pp.; In English

Report No.(s): DE2006-883760; No Copyright; Avail.: National Technical Information Service (NTIS)

Semantic graphs are becoming a valuable tool for organizing and discovering information in an increasingly complex analysis environment. This paper investigates the use of graph topology to measure the strength of relationships in a semantic graph. These relationships are comprised of some number of distinct paths, whose length and configuration jointly characterize the strength of association. We explore these characteristics through the use of three distinct algorithms respectively based upon an electrical conductance model, Newman and Girvan's measure of betweenness, and cutsets. Algorithmic performance is assessed based upon a collection of partially ordered subgraphs which were constructed according to our subjective beliefs regarding strength of association.

NTIS

*Knowledge Representation; Semantics*

**20070000522** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Potential of the Cell Processor for Scientific Computing**

Williams, S.; Shalf, J.; Oliker, L.; Husbands, P.; Kamil, S.; Oct. 2005; 22 pp.; In English

Report No.(s): DE2006-883789; No Copyright; Avail.: Department of Energy Information Bridge

The slowing pace of commodity microprocessor performance improvements combined with ever-increasing chip power demands has become of utmost concern to computational scientists. As a result, the high performance computing community is examining alternative architectures that address the limitations of modern cache-based designs. In this work, we examine the potential of the using the forth coming STI Cell processor as a building block for future high-end computing systems. Our work contains several novel contributions. We are the first to present quantitative Cell performance data on scientific kernels and show direct comparisons against leading superscalar (AMD Opteron), VLIW (IntelItanium2), and vector (Cray X1) architectures. Since neither Cell hardware nor cycle-accurate simulators are currently publicly available, we develop both analytical models and simulators to predict kernel performance. Our work also explores the complexity of mapping several important scientific algorithms onto the Cells unique architecture. Additionally, we propose modest microarchitectural modifications that could significantly increase the efficiency of double-precision calculations. Overall results demonstrate the tremendous potential of the Cell architecture for scientific computations in terms of both raw performance and power efficiency.

NTIS

*Microprocessors; Simulators*

**20070000525** NASA Ames Research Center, Moffett Field, CA, USA

**Role of High-End Computing in Meeting NASA's Science and Engineering Challenges**

Biswas, Rupak; Tu, Eugene L.; Van Dalsem, William R.; [January 2006]; 15 pp.; In English; The Fourth International Conference on Computational Fluid Dynamics, 10 - 14 Jul. 2006, Ghent, Belguim, Belgium; Original contains black and white illustrations; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070000525>; Avail.: CASI: A03, Hardcopy

Two years ago, NASA was on the verge of dramatically increasing its HEC capability and capacity. With the 10,240-processor supercomputer, Columbia, now in production for 18 months, HEC has an even greater impact within the Agency and extending to partner institutions. Advanced science and engineering simulations in space exploration, shuttle operations, Earth sciences, and fundamental aeronautics research are occurring on Columbia, demonstrating its ability to accelerate NASA s exploration vision. This talk describes how the integrated production environment fostered at the NASA Advanced Supercomputing (NAS) facility at Ames Research Center is accelerating scientific discovery, achieving parametric analyses of multiple scenarios, and enhancing safety for NASA missions. We focus on Columbia s impact on two key

engineering and science disciplines: Aerospace, and Climate. We also discuss future mission challenges and plans for NASA's next-generation HEC environment.

Author

*NASA Programs; Supercomputers; Computerized Simulation; Simulation*

**20070000531** NASA Langley Research Center, Hampton, VA, USA

**A Byzantine-Fault Tolerant Self-Stabilizing Protocol for Distributed Clock Synchronization Systems**

Malekpour, Mahyar R.; [2006]; 17 pp.; In English; 8th International Symposium on Stabilization, Safety, and Security of Distributed Systems, 17 - 19 Nov. 2006, Dallas, TX, USA; Original contains black and white illustrations; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070000531>; Avail.: CASI: A03, Hardcopy

Embedded distributed systems have become an integral part of safety-critical computing applications, necessitating system designs that incorporate fault tolerant clock synchronization in order to achieve ultra-reliable assurance levels. Many efficient clock synchronization protocols do not, however, address Byzantine failures, and most protocols that do tolerate Byzantine failures do not self-stabilize. Of the Byzantine self-stabilizing clock synchronization algorithms that exist in the literature, they are based on either unjustifiably strong assumptions about initial synchrony of the nodes or on the existence of a common pulse at the nodes. The Byzantine self-stabilizing clock synchronization protocol presented here does not rely on any assumptions about the initial state of the clocks. Furthermore, there is neither a central clock nor an externally generated pulse system. The proposed protocol converges deterministically, is scalable, and self-stabilizes in a short amount of time. The convergence time is linear with respect to the self-stabilization period. Proofs of the correctness of the protocol as well as the results of formal verification efforts are reported.

Author

*Clocks; Fault Tolerance; Protocol (Computers); Stabilization; Synchronism*

**20070000549** Department of Energy, Washington, DC USA

**CoDeveloper: A Secure, Web-Invocable Collaborative Software Development Tool**

January 2006; 16 pp.; In English

Report No.(s): DE2006-860595; No Copyright; Avail.: National Technical Information Service (NTIS)

Modern scientific simulations generate large datasets at remote sites with appropriate resources (supercomputers and clusters). Bringing these large datasets to the computers of all members of a distributed team of collaborators is often impractical or even impossible: there might not be enough bandwidth, storage capacity or appropriate data analysis and visualization tools locally available. To address the need to access remote data, avoid heavy Internet traffic and unnecessary data replication, Tech-X Corporation developed a tool, which allows running remote data visualization collaboratively and sharing the visualization objects as they get generated. The size of these objects is typically much smaller than the size of the original data.

NTIS

*Computer Programs; Internets; Software Development Tools; Software Engineering*

**20070001558** Newcastle-upon-Tyne Univ., Newcastle, UK

**Performance Study on the Signal-on-Fail Approach to Imposing Total Order in the Streets of Byzantium**

Inayat, Q.; Ezhilchelvan, P.; Jun. 2006; 13 pp.; In English

Report No.(s): PB2007-102195; CS-TR-967; Copyright; Avail.: National Technical Information Service (NTIS)

Any asynchronous total-order protocol must somehow circumvent the well-known FLP impossibility result. This paper exposes the performance gains obtained when this impossibility is dealt with through the use of abstract processes built to have some special failure semantics. Specifically, we build processes with signal-on-fail semantics by (i) having a subset of Byzantine-prone processes paired to check each other's computational outputs, and (ii) assuming that paired processes do not fail simultaneously. By dynamically invoking the construction of signal-on-fail processes, coordinator-based total-order protocols which allow less than one-third of processes to fail in a Byzantine manner are developed. Using a LAN-based implementation, failure-free order latencies and fail-over latencies are measured; the former are shown to be smaller compared to the protocol of Castro and Liskov which is generally regarded to perform exceedingly well in the best-case scenarios.

NTIS

*Evaluation; Failure; Semantics; Turkey*

**20070001559** Newcastle-upon-Tyne Univ., Newcastle, UK

**Bot, Cyborg, and Automated Turing Test**

Yan, J.; Jun. 2006; 12 pp.; In English

Report No.(s): PB2007-102198; CS-TR-970; Copyright; Avail.: National Technical Information Service (NTIS)

The Automated Turing test (ATT) is almost a standard security technique for addressing the threat of undesirable or malicious bot programs. In this paper, we motivate an interesting adversary model, cyborgs, which are either humans assisted by bots or bots assisted by humans. Since there is always a human behind these bots, or a human can always be available on demand, ATT fails to differentiate such cyborgs from humans. The notion of telling humans and cyborgs apart is novel, and it can be of practical relevance in network security. Although it is a challenging task, we have had some success in telling cyborgs and humans apart automatically.

NTIS

*Automatic Control; Communication Networks; Turing Machines*

**20070001561** Newcastle-upon-Tyne Univ., Newcastle, UK

**Transaction Manager Failover: A Case Study Using JBOSS Application Server**

Kistijantoro, A. I.; Morgan, G.; Shrivastava, S. K.; Jun. 2006; 25 pp.; In English

Report No.(s): PB2007-102202; CS-TR-975; Copyright; Avail.: National Technical Information Service (NTIS)

The extension of object-oriented middleware to component-oriented middleware is now commonplace, with many distributed applications structured as remote clients invoking services constructed from components. An advantage components offer over objects is that only the business logic of an application needs to be addressed by a programmer. An application server hosts components, managing supporting services to provide the execution environment for components. A transaction manager within an application server assumes responsibility for managing the execution of transactions. Failure of an application server instance could result in abortion of ongoing transactions that are being managed by the transaction manager on that server. This paper describes, for the case of Enterprise Java Bean components and JBoss application server, how replication for availability can be supported to tolerate application server/transaction manager failures. Replicating the state associated with the progression of a transaction (i.e., which phase of two-phase commit is enacted and the transactional resources involved) provides an opportunity to continue a transaction using a backup transaction manager if the transaction manager of the primary fails.

NTIS

*Object-Oriented Programming; System Failures*

**20070001562** Newcastle-upon-Tyne Univ., Newcastle, UK

**Model Based Analysis and Validation of Access Control Policies**

Bryans, J. W.; Fitzgerald, J. S.; Periorellis, P.; Jul. 2006; 18 pp.; In English

Report No.(s): PB2007-102203; CS-TR-976; Copyright; Avail.: National Technical Information Service (NTIS)

We present a model based approach to describing, analyzing and validating access control policies. Access control policies are described using VDM - a model oriented formal method. Policy descriptions are concise and may be easily manipulated. The structure of the VDM description is derived from the OASIS standard access control policy language XACML. It is therefore straightforward to translate between XACML policies and their corresponding VDM models. We show how the existing tool support for VDM enables a number of ways of validating these policies, each of which are valuable at different stages of the development and maintenance life cycle.

NTIS

*Access Control; Policies; Models*

**20070001564** Newcastle-upon-Tyne Univ., Newcastle, UK

**Nonoptimal Component Placement, but Short Processing Paths, Due to Long-Distance Projections in Neural Systems**

Kaiser, M.; Hilgetag, C. C.; Jul. 2006; 14 pp.; In English

Report No.(s): PB2007-102204; CS-TR-977; Copyright; Avail.: National Technical Information Service (NTIS)

It has been suggested that neural systems across several scales of organization show optimal component placement, in which any spatial rearrangement of the components would lead to an increase of total wiring. Using extensive connectivity datasets for diverse neural networks combined with spatial coordinates for network nodes, we applied an optimization algorithm to the network layouts, in order to search for wire-saving component rearrangements. We found that optimized component rearrangements could substantially reduce total wiring length in all tested neural networks. Specifically, total

wiring among 95 primate (Macaque) cortical areas could be decreased by 32%, and wiring of neuronal networks in the nematode *Caenorhabditis elegans* could be reduced by 48% on the global level, and by 49% for neurons within frontal ganglia. Wiring length reductions were possible due to the existence of long-distance projections in neural networks. We explored the role of these projections by comparing the original networks with minimally rewired networks of the same size, which possessed only the shortest possible connections. In the minimally rewired networks, the number of processing steps along the shortest paths between components was significantly increased compared to the original networks. Additional benchmark comparisons also indicated that neural networks are more similar to network layouts that minimize the length of processing paths, rather than wiring length. These findings suggest that neural systems are not exclusively optimized for minimal global wiring, but for a variety of factors including the minimization of processing steps.

NTIS

*Neural Nets; Data Processing*

**20070001565** Newcastle-upon-Tyne Univ., Newcastle, UK

**Comments on Several Years of Teaching of Modelling Programming Language Concepts**

Coleman, J. W.; Jefferson, N. P.; Jones, C. B.; Jul. 2006; 9 pp.; In English

Report No.(s): PB2007-102205; CS-TR-978; Copyright; Avail.: National Technical Information Service (NTIS)

This paper describes an undergraduate course taught at the University of Newcastle upon Tyne titled Understanding Programming Languages. The main thrust of the course is to understand how language concepts can be modeled and explored using semantics. Specifically, structural operational semantics (SOS) is taught as a convenient and light-weight way of recording and experimenting with features of procedural programming languages. We outline the content, discuss the contentious issue of tool support and relate experiences.

NTIS

*Education; Programming Languages; Models*

**20070001566** Newcastle-upon-Tyne Univ., Newcastle, UK

**Server Allocation in Grid Systems with On/Off Sources**

Slegers, J.; Mitrani, I.; Thomas, N.; Sep. 2006; 13 pp.; In English

Report No.(s): PB2007-102207; CS-TR-982; Copyright; Avail.: National Technical Information Service (NTIS)

A system consisting of a number of servers, where demands of different types arrive in bursts (modeled by interrupted Poisson processes), is examined in the steady state. The problem is to decide how many servers to allocate to each job type, so as to minimize a cost function expressed in terms of average queue sizes. First, an exact analysis is provided for an isolated IP/M/n queue. The results are used to compute the optimal static server allocation policy. The latter is then compared to two heuristic policies which employ dynamic switching of servers from one queue to another (such switches take time and hence incur costs).

NTIS

*Computers; Steady State; Client Server Systems*

**20070001568** Newcastle-upon-Tyne Univ., Newcastle, UK

**Adding Dynamism to OGSA-DQP: Incorporating the DynaSOAr Framework in Distributed Query Processing**

Mukherjee, A.; Watson, P.; Aug. 2006; 15 pp.; In English

Report No.(s): PB2007-102215; CS-TR-979; Copyright; Avail.: National Technical Information Service (NTIS)

OGSA-DQP is a Distributed Query Processing system for the Grid. It uses the OGSA-DAI framework for querying individual databases and adds on top of it an infrastructure to perform distributed querying on these databases. OGSA-DQP also enables the invocation of analysis services, such as Blast, within the query itself, thereby creating a form of declarative workflow system. DynaSOAr is an infrastructure for dynamically deploying web services over a Grid or a set of networked resources. The DynaSOAr view of grid computing revolves around the concept of services, rather than jobs where services are deployed on demand to meet the changing performance requirements. This paper describes the merging of these two frameworks to enable a certain amount of dynamic deployment to take place within distributed query processing.

NTIS

*Distributed Processing; Query Languages; Grid Computing (Computer Networks)*

**20070001569** Newcastle-upon-Tyne Univ., Newcastle, UK

**Time As a Dimension in the Design and Analysis of Interactive Systems**

Harrison, M. D.; Loer, K.; Aug. 2006; 23 pp.; In English

Report No.(s): PB2007-102216; CS-TR-980; Copyright; Avail.: National Technical Information Service (NTIS)

This paper discusses the relevance of timing to the design of interactive systems. It introduces a set of dimensions to assist the process of making appropriate time design decisions in interactive systems. Timing issues are associated with the dynamic behavior of the design and with the information resources that may serve to control the pace of the interaction. Finally the paper considers two examples of system for which time design is appropriate and considers how a model of the system can provide assistance in design. The analysis of interactive properties of the systems uses a specification based on uppaal which enables the exploration of real-time properties.

NTIS

*Design Analysis; Interactive Control; Computer Systems Design*

**20070001683** Mississippi State Univ., Mississippi State, MS, USA

**Estimating Wildlife Response to the Conservation Reserve Program: Bobwhite and Grassland Birds**

Riffell, S. K.; Burger, L. W.; January 2006; 49 pp.; In English

Report No.(s): PB2007-102173; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We provided retrospective analysis of correlative relationships among land use/land cover types, Conservation Reserve Program habitats and indices of grassland bird populations in response to FSA's request for 'national and regional estimates of per acre CRP effects on wildlife populations for CRP conservation practices (RFP for FSA-R-28-04DC).' Although robust per acre estimates of the real effect of CRP on wildlife species can only be derived from an ongoing monitoring program based on probabilistic sampling design, correlative analyses are the only possibility with retrospective data. We conducted two different analyses with different CRP databases at different spatial extents, and we also set up a probabilistic monitoring program for CP33 (a new CRP practice) that will allow robust estimates of per acre CRP effects.

NTIS

*Birds; Conservation; Estimating; Grasslands; Habitats; Populations; Wildlife*

**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*.

**20070000697** Iowa Univ., Iowa City, IA USA

**Verification and Validation of CFD Simulations**

Stern, Fred; Wilson, Robert V; Coleman, Hugh W; Paterson, Eric G; Sep 1999; 55 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-96-1-0018; N00014-97-1-0014

Report No.(s): AD-A458015; IIHR-407; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Computational Fluid Dynamics; Simulation*

**20070000703** Mitre Corp., Bedford, MA USA

**Collaborative Operations in Joint Expeditionary Force Experiment (JEFX) 99**

Cokus, Michael S; Howley, Thomas J; Krutsch, Michael C; MacBrien, Andrew R; Parton, III, George P; Rhode, Esther; Shaffer, Jr, Robert L; Feb 2000; 246 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F199628-99-C-0001; Proj-03006111-BB

Report No.(s): AD-A458029; MP-00B0000003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document describes collaborative operations in Joint Expeditionary Force Experiment (JEFX 99). It addresses both the collaborative aerospace environment and the technical aspects of collaboration including the unique CVW system architecture, the supporting networking and security infrastructure, analysis of the loading data collected, and a guide for successful system deployment. It also offers observations on the general impact of virtual environments on distributed operations and recommendations for future experimentation.

DTIC

*Architecture (Computers); Client Server Systems; Interprocessor Communication; Security*

**20070000721** SRI International Corp., Menlo Park, CA USA

**Practical Natural-Language Processing by Computer**

Moore, Robert C; Oct 1981; 32 pp.; In English

Contract(s)/Grant(s): N00039-80-C-0645; Proj-SRI-1605

Report No.(s): AD-A458076; SRI-TN-251; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes the state of the art in practical computer systems for natural-language processing. We first consider why one would want to use natural language to communicate with computers at all, looking at both general issues and specific applications. Next we examine what it really means for a system to have a natural-language capability. This is followed by a discussion of some major limitations of current technology. The bulk of the paper is devoted to looking in detail at a single application of natural-language processing: database retrieval by natural-language query. We lay out an overall system architecture, explaining what types of processing and information are required. Then we look at two general classes of systems, special-purpose and general-purpose, explaining how they differ and their relative advantages and disadvantages. Afterwards we point out some remaining problems that will require additional basic research. Finally we conclude by discussing when language-processing technology at various levels of capability is likely to be commercially practical, and what it may cost to develop and use applications of that technology.

DTIC

*Computers; Natural Language (Computers); Natural Language Processing*

**20070000725** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Distributed Computation in the Digitized Battlefield**

Sarkar, Susanta; Richardson, Paul; Jan 1999; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458081; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A distributed computation is defined as several computers performing computation for a common purpose. There are three basic characteristics of this kind of systems, multiplicity of nodes, interconnection of nodes, and shared states among these nodes. This paradigm is analogous to a group of combat vehicles in a battlefield, pursuing a common goal. The three characteristics stated above have corresponding elements in a battlefield. The shared states among nodes are similar to a common goal for a group of combat vehicles. Moreover, combat vehicles correspond to multiple nodes in a distributed system. Finally, communication links among the combat vehicles are akin to interconnections of computing nodes. Due to these striking similarities, technologies developed for distributed computations may be readily applicable for a digitized battlefield of the future. However, due to a few distinctive factors of digitized ground combat, techniques of classical distributed systems must be extended to be useful. At the U.S. Army VETRONICS Technology Center, we have started an initiative to accomplish these enhancements. In this report, essential elements of the program and some interim findings are reported.

DTIC

*Computation; Digital Systems*

**20070001708** Massachusetts Inst. of Tech., Cambridge, MA USA

**A Fault-Tolerant Multiprocessor Architecture for Digital Signal Processing Applications**

Song, William S; Jan 1989; 144 pp.; In English

Contract(s)/Grant(s): AFOSR-86-0164

Report No.(s): AD-A458650; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458650>; Avail.: CASI: [A07](#), Hardcopy

Proposed is a fault-tolerant multiprocessor architecture which needs much less redundant hardware than Modular Redundancy architectures. The architecture uses weighted checksum techniques and is suited for linear Digital Signal Processing applications in which multiple copies of the identical processor are used to meet the through-put requirement. Single fault detection/correction and multiple detection/correction techniques are discussed. Also proposed are statistical fault detection/correction algorithms for systems containing numerical roundoff or truncation noise such as fixed point or floating point systems. Presented are the simulations of these algorithms as well as the simulations of numerical noise distributions in real fixed point system applications. Our choice of weights reduces the dynamic range requirement of the checksum processors and minimizes the masking of small faults by the numerical noise. Efficient fault detection/correction algorithms for the exact arithmetic systems are presented, including one for residue arithmetic systems. Practical architectures for implementing the single fault detection/correction algorithm are also presented. These architectures are designed to mask any single component failure in the system.

DTIC

*Digital Systems; Fault Tolerance; Multiprocessing (Computers); Signal Processing*

**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.

**20070000661** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Expanding the Interaction Lexicon for 3D Graphics**

Pierce, Jeffrey S; Nov 2001; 146 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-97-2-0251; F33615-93-1-1330

Report No.(s): AD-A457626; CMU-CS-01-160; No Copyright; Avail.: CASI: [A07](#), Hardcopy

This thesis focuses on one of the key challenges for interactive 3D graphics: creating the interaction lexicon. The author's hypothesis is that we can create new interaction techniques by breaking our assumptions about the real world and about existing practice. These new interaction techniques will provide new capabilities and/or make the user more efficient. This research makes several contributions to 3D interaction and virtual reality. The Voodoo Dolls technique is a new technique for manipulating objects in immersive 3D environments in which users manipulate hand-held copies of objects. A formal evaluation comparing Voodoo Dolls and Indirect HOMER (Hand-centered Object Manipulation Extending Ray-casting), a best practice manipulation technique, demonstrates that Voodoo Dolls users can position and orient objects more accurately than Indirect HOMER users, perhaps because of the additional feedback the technique provides. A new technique for navigating large virtual worlds uses place representations and visible landmarks. A formal evaluation comparing navigation with Places and Landmarks with navigation using panning and zooming demonstrates that users can travel between locations faster when navigating with Places and Landmarks. A new process for specifying a 3D model's interaction semantics allows designers to paint interaction surfaces onto the model. The system then saves the painted surfaces in an interaction map. A qualitative evaluation of this process demonstrates that designers, regardless of artistic ability, can easily specify the interaction semantics of 3D models and assign them interactive behaviors when using it. The author also presents 18 ideas that will enhance existing techniques or provide starting points for further exploration, including creating copies to aid selection, multiple light-weight views of an object, system maintained repositories, and symbolic linking.

DTIC

*Computer Graphics; Graphical User Interface; Navigation; Virtual Reality*

**20070000662** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Self-Securing Network Interfaces: What, Why and How?**

Ganger, Gregory R; Economou, Gregg; Bielski, Stanley M; May 2002; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-01-1-0433

Report No.(s): AD-A457627; CMU-CS-02-144; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Self-securing network interfaces (NIs) examine the packets that they move between network links and host software, looking for and potentially blocking malicious network activity. This paper describes self-securing network interfaces, their features, and examples of how these features allow administrators to more effectively spot and contain malicious network activity. The authors present a software architecture for self-securing NIs that separates scanning software into applications (called scanners) running on an NI kernel. The resulting scanner Application Programming Interface (API) simplifies the construction of scanning software and allows its powers to be contained even if it is subverted. They illustrate the architecture's potential via a prototype self-securing NI and two example scanners: one that identifies and blocks known e-mail viruses and one that identifies and inhibits rapidly propagating worms like Code Red.

DTIC

*Application Programming Interface; Computer Networks; Embedding*

**20070000674** Southampton Univ., UK

**Automatic Gait Recognition for Human ID at a Distance**

Nixon, Mark S; Carter, John N; Nov 2004; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N68171-01-C-9002

Report No.(s): AD-A457973; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Recognising people by their gait is a biometric of increasing interest. Now, analysis has progressed from evaluation by few techniques on small databases with encouraging results to large databases and still with encouraging results. The potential of gait as a biometric was encouraged by the considerable amount of evidence available, especially in biomechanics and literature. This report describes research within the Human ID (HiD) at a Distance program sponsored by the Defense

Advanced Projects Research Agency through the European Research Office of the U.S. Army at the University of Southampton from 2000-2004. The research program was essentially designed to explore the capability of basic of gait as a biometric and potential for translation from a laboratory to a real world scenario. By development of specialized databases, by development of new techniques and by evaluation of laboratory and real-world data we contend that these objectives have indeed been achieved. There is a considerable volume of subsidiary developments not just of new computer vision techniques but also of approaches for spatiotemporal image analysis, particularly targeted at the modeling and understanding of human movement through image sequences. The ongoing interest in gait in a biometric is in a large part the wider remit of the analysis of human motion by computer vision techniques and due to the capability of gait as a biometric, as demonstrated by the results achieved by the HiD program

DTIC

*Biometrics; Computer Vision; Data Bases; Gait*

**20070000675** Texas A&M Univ., College Station, TX USA

**Backing Up Behaviors in Teams: The Role of Personality and Legitimacy of Need**

Porter, Christopher O; Hollenbeck, John R; Ilgen, Danie R; Ellis, Aleksander P; West, Bradley J; Moon, Henry K; Jan 2002; 45 pp.; In English

Contract(s)/Grant(s): N00014-96-1-0983

Report No.(s): AD-A457974; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Backing up behavior has generally been defined as helping other team members perform their roles and is thought to be critical for effective performance in teams. To date, there has been no empirical investigation of backing up in teams, despite its importance. We develop and test an input process output model of backing up behavior in teams, proposing that backing up behavior in teams can be predicted at the team level by two types of team inputs: (1) team composition characteristics in terms of the personality of the members of the team and (2) team task characteristics in terms of the extent to which the nature of the task is one that legitimately calls for backing up behavior by members of the team. Results from a study of 71 teams performing a computerized tactical decision-making task suggest that the legitimacy of the need for back up has an important main effect on the extent to which team members provide assistance to and receive assistance from each other. In addition, legitimacy also has important interactive effects with both the personality of the back up recipient and the personality of the back up providers on backing up behaviors in teams.

DTIC

*Backups; Computer Techniques; Personality*

**20070000680** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Creating and Testing a Windows Version of the ADRPM Acoustic Model**

Evans, Roger; Mantey, Jr , Robert M; Cartwright, Lloyd; Jan 1989; 10 pp.; In English

Report No.(s): AD-A457982; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ADRPM (Acoustic Detection Range Prediction Model) is a software program that models the propagation of acoustic energy through the atmosphere and the detectability of that energy. This paper describes ADRPM's history, capabilities, and future. A new PC/Windows version of ADRPM is presented which will soon be made available to the ground vehicle survivability community.

DTIC

*Acoustics; Models; Sound Detecting and Ranging*

**20070000692** Colorado Univ., Boulder, CO USA

**A Case for Caching File Objects Inside Internetworks**

Danzig, Peter B; Hall, Richard S; Schwartz, Michael F; Mar 1993; 19 pp.; In English

Contract(s)/Grant(s): F49620-93-1-0082

Report No.(s): AD-A458004; CU-CS-642-93; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents evidence that several, judiciously placed file caches could reduce the volume of FTP traffic by 42%, and hence the volume of all NSFNET backbone traffic by 21%. In addition, if FTP client and server software automatically compressed data, this savings could increase to 27%. We believe that a hierarchical architecture of whole file caches, modeled after the existing name server's caching architecture, could become a valuable part of any internet. We derived these conclusions by performing trace driven simulations of various file caching architectures, cache sizes, and replacement policies. We collected the traces of file transfer traffic employed in our simulations on a network that connects the NSFNET backbone



to a large, regional network. This particular regional network is responsible for about 5 to 6% of NSFNET traffic. While this paper's analysis and discussion focus on caching for FTP file transfer, the proposed caching architecture applies to caching objects from other internetwork services.

DTIC

*Internets; Protocol (Computers)*

**20070000693** Mitre Corp., McLean, VA USA

**A Guide to Understanding Emerging Interoperability Technologies**

Bollinger, Terry; Jul 2000; 86 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAB07-99-C-C201

Report No.(s): AD-A458005; MP-00W0000088; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Interoperability is the ability to use resources from diverse origins as if they had been designed as parts of a single system. Over time, individual interoperability problems tend to disappear as the resources involved literally become part of one system through integration and standardization, but the overall problem of interoperability itself never disappears. Instead, it simply moves up to a new level of complexity that accepts earlier integrations as a given. Interoperability is especially critical for military systems, where international politics can lead to abrupt realignments where yesterday's foe becomes today's coalition partner. This report on interoperability has five sections. The first section is an introduction to the interoperability problem, and the second section describes fundamental interoperability concepts and develops a terminology for describing interoperability issues and needs. The second section also addresses the vital issue of interoperability security. The third section is about the processes by which interoperability technologies are standardized, including comparisons of the interoperability benefits of different processes. The fourth section is an overview of a number of emerging information technologies relevant to interoperability, and the fifth section suggests opportunities for further action.

DTIC

*Computer Information Security; Computer Programming; Data Processing; Interoperability; Protocol (Computers); Software Engineering; Standardization*

**20070000694** Mitre Corp., McLean, VA USA

**Real-Time Java Commercial Product Assessment**

Piszcz, Alan; Vidrine, Kent; Oct 2000; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458007; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Traditional real-time operating system vendors have recently started to consider Java as a potential platform in real-time operating system products and embedded solutions. Specification status and implementation towards an industry standard application-programming interface are split between two consortiums striving to introduce different paradigms of Java integration with real-time (RT) services. This paper provides a background and understanding of the direction of real-time Java in the commercial market place and includes status information about the specifications. In addition, a preliminary review of a few of the products with respect to timing jitter and priority issues are examined.

DTIC

*Application Programming Interface; Computer Programming; Java (Programming Language); Real Time Operation*

**20070000695** Mitre Corp., Bedford, MA USA

**State of the Art in CyberSecurity Monitoring**

LaPadula, Leonard J; Sep 2000; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-99-C-0001

Report No.(s): AD-A458008; MP-99B0000020R1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents a view of the state of the art in cybersecurity monitoring technology. The paper develops the view from six sources: three prior reports (two national, one MITRE), a survey of commercially available software, a survey of government software, and a survey of government-funded research projects. The author performed the surveys for this paper. The six sources are as follows: National Info-Sec Technical Baseline (summary of findings); Report of Hill and Aguirre (summary of findings); Intrusion Detection Subgroup's Report (summary of findings); Commercial Products (summary of product types and characteristics); Government Products (summary of product types and characteristics); and Research Efforts (summary of principal lines of investigation). A summary section presents a Capsule Description of the State of the Art in CyberSecurity Monitoring.

DTIC

*Computer Information Security; Computer Networks; Computer Programs; Security*

**2007000699** Space and Naval Warfare Systems Command, San Diego, CA USA

**Enabling Interoperability Via Software Architecture**

Hamilton, Jr , John A; Murtagh, Jeanne L; Jan 2000; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458021; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper will address the critical role of software architecture in achieving large-scale system interoperability as well as initiatives underway to promote architectural-based interoperability solutions for the Unified Commands. Software architecture is the means to define systems composed of systems. This definition is critical to achieving interoperability. Joint Publication 1-02 defines interoperability as the ability of systems, units or forces to provide services to and accept services from other systems, units or forces and use the services to enable them to operate effectively together [JP 1-02, 1994]. In order to achieve interoperability, compatible systems, doctrine and policy must exist. The technical challenges to interoperability can be daunting -- particularly when a new requirement is established that requires existing (legacy) systems to interoperate. Military forces do not operate as a fully connected graph; modern warfare does not require every system to interoperate. Joint doctrine is the key to determining interoperability requirements. Doctrine tells us how to fight and how we fight determines interoperability requirements. Policy sets the bounds on acceptable doctrine.

DTIC

*Architecture (Computers); Interoperability*

**2007000701** Mitre Corp., Bedford, MA USA

**Comparison of Narrowband Adaptive Filter Technologies for GPS**

Rifkin, R; Vaccaro, J J; Mar 2000; 27 pp.; In English

Contract(s)/Grant(s): F19628-99-C-0001; Proj-03006132AJ

Report No.(s): AD-A458023; MTR-00B0000015; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Narrowband interference can seriously degrade the performance of GPS systems. Several techniques exist for reducing this interference, including adaptive transversal filters, overlapped FFTs, and filter banks. All these techniques attempt to filter out the interference before the GPS receiver performs correlation. This paper compares these three interference suppression techniques for application to GPS. Likely VLSI-based designs with various levels of complexity (i.e., operation counts) for each technique are proposed and described. The effects of these designs as pre-processors on GPS ranging performance is then compared using computer simulation.

DTIC

*Adaptive Filters; Computerized Simulation; Global Positioning System; Narrowband*

**2007000713** Marine Corps Combat Development Command, Quantico, VA USA

**Distributed Intrusion Detection for Computer Systems Using Communicating Agents**

Ingram, Dennis J; Kremer, H S; Rowe, Neil C; Jan 2000; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458055; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Intrusion detection for computer systems is a key problem of the Internet, and the Windows NT operating system has a number of vulnerabilities. The work presented here demonstrates that independent detection agents under Windows NT can be run in a distributed fashion, each operating mostly independent of the others, yet cooperating and communicating to provide a truly distributed detection mechanism without a single point of failure. The agents can run along with user and system software without noticeable consumption of system resources, and without generating an overwhelming amount of network traffic during an attack.

DTIC

*Communicating; Computer Programs; Computers; Detection; Warning Systems*

**2007000718** SRI International Corp., Menlo Park, CA USA

**Deductive Retrieval Mechanisms for State Description Models**

Fikes, Richard E; Jul 1975; 27 pp.; In English

Contract(s)/Grant(s): DAHC04-72-C-008; Proj-SRI-3805

Report No.(s): AD-A458070; SRI-TN-106; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents some programming facilities for modeling the semantics of a task domain and for describing the situations that occur in that domain as a task is being carried out. Each such description models a 'state' of the task environment, and any given state can be transformed into a new state by the occurrence of an event that alters the environment. Such modeling systems are vital in many AI systems, particularly those that do question-answering and those that do automatic

generation and execution monitoring of plans. The modeling mechanisms described are basically extensions and modifications of facilities typically found in AI programming languages such as PLANNER, CONNIVER, and QA4. In particular, we discuss our use of a 3 valued logic, generator functions to deduce answers to model queries, the saving and maintaining of derived results, and new facilities for modeling state changes produced by the occurrence of events.

DTIC

*Computer Programming; Semantics*

**20070000719** SRI International Corp., Menlo Park, CA USA

**Progress on a Computer Based Consultant**

Hart, Peter E; Jan 1975; 41 pp.; In English

Contract(s)/Grant(s): DAHC04-72-C-0008; Proj-SRI-3805

Report No.(s): AD-A458073; SRI-TN-99; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Computer based consultants are systems that incorporate specialized bodies of knowledge and make this knowledge conveniently available to users who are not computer experts. This paper summarizes initial progress on a computer based consultant project aimed at helping a novice mechanic work with electromechanical equipment. We describe some properties and abilities of consultants, and present results to date on the problem solving, vision, and natural language components of our evolving system.

DTIC

*Computer Assisted Instruction; Natural Language (Computers)*

**20070000735** Maryland Univ., College Park, MD USA

**Nuun: A System for Developing Platform and Browser Independent Arabic Web Applications**

Habash, Nizar Y; Sep 2001; 9 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250; EIA0130422

Report No.(s): AD-A458106; LAMP-TR-076; UMIACS-TR-2001-60; No Copyright; Avail.: CASI: [A02](#), Hardcopy

For a human language to reach its full potential in cyberspace, platform and browser independent support for data entry and display are required. Arabic web applications are far from this state of ubiquitous support. Full support is available only under Arabic Windows, while little support is provided under other versions of Windows, and no support at all under UNIX systems. The Nuun toolkit addresses this challenge. Nuun uses an allographic encoding in which each letter form is encoded separately to provide an Arabic display capability in any web browser on any platform. The display capabilities are augmented with an input method that provides the necessary extensions to HTML forms to handle Arabic script. Nuun tools can be used to build interfaces for new or existing web applications that use any Arabic encoding, and can support any language based on the Arabic script (e.g., Persian, Urdu, or Kurdish).

DTIC

*Coding; Computer Programs; Data Processing*

**20070000741** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Measuring a System's Attack Surface**

Manadhata, Pratyusa; Wing, Jeannette M; Jan 2004; 26 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0485; CCR-0121547

Report No.(s): AD-A458115; CMU-CS-04-102; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We propose a metric to determine whether one version of a system is relatively more secure than another with respect to the system's attack surface. Intuitively, the more exposed the attack surface, the more likely the system could be successfully attacked, and hence the more insecure it is. We define an attack surface in terms of the system's actions that are externally visible to its users and the system's resources that each action accesses or modifies. To apply our metric in practice, rather than consider all possible system resources, we narrow our focus on a 'relevant' subset of resource types, which we call attack classes; these reflect the types of system resources that are more likely to be targets of attack. We assign payoffs to attack classes to represent likelihoods of attack; resources in an attack class with a high payoff value are more likely to be targets or enablers of an attack than resources in an attack class with a low payoff value. We outline a method to identify attack classes and to measure a system's attack surface. We demonstrate and validate our method by measuring the relative attack surface of four different versions of the Linux operating system.

DTIC

*Computer Information Security; Security*

**20070000752** Massachusetts Inst. of Tech., Cambridge, MA USA

**Robust Sound Localization: An Application of an Auditory Perception System for a Humanoid Robot**

Irie, Robert E; Jun 1995; 72 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458133; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Localizing sounds with different frequency and time domain characteristics in a dynamic listening environment is a challenging task that has not been explored in the field of robotics as much as other perceptual tasks. This thesis presents an integrated auditory system for a humanoid robot, currently under development, that will, among other things, learn to localize normal, everyday sounds in a realistic environment. The hardware and software has been designed and developed to take full advantage of the features and capabilities of the humanoid robot of which it will be an integral component. Sounds with different frequency components and time domain characteristics have to be localized using different cues; a neural network is also presented that has been developed off-line to learn to integrate the various auditory cues, using primarily visual data to perform self-supervised training.

DTIC

*Auditory Perception; Experiment Design; Robotics; Robots*

**20070000757** Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

**M4 Project: Head and Brain Development. Adding an Active Vision Head to the M4 Robot**

Mar 2000; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-96-C-0280

Report No.(s): AD-A458139; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report describes the development of M4, a mobile robot project in joint development with the MIT Leg Lab. Because M4 is a quadruped automaton it must incorporate a vision system that allows for real-time interpretation of its surroundings and response to its own initiatives in those surroundings. This mutual feedback and correlation between the active vision and sensory-motor systems is imperative for such biologically inspired designs.

DTIC

*Brain; Image Processing; Motion; Object-Oriented Programming; Real Time Operation; Robotics; Robots*

**20070000758** Mitre Corp., McLean, VA USA

**Engineering Issues for an Adaptive Defense Network**

Piszc, Alan; Orleans, Nicholas; Eyler-Walker, Zachary; Moore, David; Jun 2001; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAB07-00-C-C201

Report No.(s): AD-A458141; MTR-01W0000103; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Engineering Issues for an Adaptive Defense Network (ADN) examines the ability of network systems to change behavior dynamically to sustain service in response to attacks. To focus the research problem, Distributed Denial of Service (DDoS) attacks were used as the threat. The primary issue was the capability to detect and defend against DDoS. Experimentation was performed with a packet filtering firewall, a network Quality of Service manager, multiple DDoS tools, and traffic generation tools. Related efforts, recommendations, and experiments are covered in this paper. Adapting to network events in degraded environments is a challenge for applications, services, and systems where conditions are known. As network conditions change due to cyber attacks carried out by e-mail viruses, application viruses, and denial of service attacks, there is typically instantaneous network confusion. Network operator reaction and control of these events can take hours to days for determination and resolution. This effort examines a severe threat, DDoS, and potential techniques for an adaptive, automatic defense that would take place in seconds and represent the first level of defense until network operations or the system administrator can respond. The asymmetric nature of the DDoS threat allows an individual with minimal resources to disrupt or deny network service to critical information infrastructures. Adaptive defense of networks requires automated response to current and future threats. This effort utilized DDoS threats to motivate adaptive defense behavior and experimentation. To provide guidance with respect to DDoS, recommendations were developed by information security organizations. The recommendations presented here protect the packet producers versus the victim, however, they are applicable to all sites and should be implemented.

DTIC

*Adaptation; Computer Information Security; Computer Networks; Detection*

**2007000777** Mitre Corp., Bedford, MA USA

**Applying Cognitive Work Analysis to Time Critical Targeting Functionality**

Means, C D; Darling, Erika; Perron, Janet; Oct 2004; 162 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-04-C-0001

Report No.(s): AD-A458168; MTR-04B0000057; No Copyright; Avail.: CASI: [A08](#), Hardcopy

The ability to destroy fleeing targets in a time critical environment is a key capability for the successful completion of the Joint Forces Commander's operations. The Time Critical Targeting Functionality (TCTF) program combines the functionality of several tools aiding in the prosecution of significant threats of fleeting vulnerability. As with any system, active user involvement and Human Factors guidance are necessary to ensure a usable design. The TCTF program applies these principles through several techniques, including Applied Cognitive Work Analysis, GUI Working Groups, Heuristic Evaluations, as well as user surveys. The basis for all these analyses is determining the correct information to display to the user at the correct moment. This document illustrates these techniques, provides the results and recommendations from the evaluations, and presents lessons learned and example surveys.

DTIC

*Cognition; Decision Support Systems; Graphical User Interface; Human Factors Engineering; Sensitivity; Targets; Time Dependence*

**2007000785** Mitre Corp., McLean, VA USA

**Architecture Development Lessons-Learned: A Three-Year Retrospective**

Troche, Carlos; Eiden, Jr , Gerald F; Potts, Frederick C; Jan 2004; 34 pp.; In English

Contract(s)/Grant(s): FA8721-04-C-0001

Report No.(s): AD-A458178; MTR-04B0000036; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report is a retrospective synthesis of 3 years of experience developing detailed architectural views in compliance with the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Architecture Framework, the Department of Defense (DoD) guidance that implemented the statutory requirements of the Clinger-Cohen Act of 1997. It represents the collective judgment of nine professionals, all of whom had Air Force operational and/or systems development and experience, or both; were formally trained in architecture development; and have been dedicated to the development of these architecture views almost exclusively. After more than 3 years of developing architectures, all these lessons-learned point to one basic conclusion: architectures are developed to be used. Thus, it is incumbent upon the architecture developer to work with the user to create something that has practical and immediate application to that user's needs. Everything else -- development process, tools, methods, etc. -- should be subordinated to this utility. In this report, the authors take the point of view of an action or mid-level staff officer who has just been tasked with developing an architecture. They try to provide a minimum set of 'rules of the road' lessons learned to assist in architecture development and its tools. Two appendices detail their experiences with SA (Popkin Software's System Architect) and their analysis of the impacts of the new security policy imposed by the Office of Management and Budget on architecture information.

DTIC

*Computer Programming; Defense Program; Management Planning; Requirements; Software Engineering*

**2007000794** National Steel and Shipbuilding Co., San Diego, CA USA

**Application of PC-Based Project Management in an Integrated Planning Process**

Neumann, Richard J; MacQuaide, David J; May 1992; 200 pp.; In English

Report No.(s): AD-A458193; No Copyright; Avail.: CASI: [A09](#), Hardcopy

A shipyard working on several projects must schedule thousands of interrelated activities. For a shipyard to remain competitive, it must have a production planning system that optimizes the yard's overall use of facilities and manning. This paper discusses the development and implementation of a PC-based Integrated Production Planning System (IPPS) which serves as a tool to assist planning organizations in developing, updating, and revising schedules and associated manning, facility, and material utilization reports. Under this task, a PC-based IPPS has been developed which serves as a tool to assist planning organizations in developing, updating, and revising ship production schedules. The system will also create and update manning, facility, and material utilization reports. The scope of the system developed is limited to the ground assembly, outfit, join, and erect operations. The 'Project Report' describes the data required by the system to produce its outputs. The report explains the system development philosophy and gives an overview of the schedule generation system. To demonstrate the use of the system, data for a sample ship is given and a schedule developed based upon this data. The User's Manual serves as a reference for shipyards wishing to develop a PC-based IPPS. The software included in this package is not intended to be a turnkey system. For an IPPS to work for a particular shipyard, the shipyard must modify the coding so that the system will

conform to the yard's facilities and methods of operation. The IPPS should not be viewed as a computer system; it is a production planning system that makes use of computer tools. Simply obtaining and installing the software will not give a shipyard an operable system. Developing an Integrated Production Planning System is a significant task. However, once developed, the IPPS is a valuable tool that will assist shipyard personnel in making effective production decisions.

DTIC

*Management Planning; Planning; Project Management; Scheduling; Shipyards; Tasks*

**2007000809** NAVSYS Corp., Colorado Springs, CO USA

**Implementing a GPS Waveform Under the Software Communication Architecture**

Brown, Alison; Stricklan, Lynn; Babich, David; Nov 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458224; No Copyright; Avail.: CASI: [A03](#), Hardcopy

SCA governs the structure and operation of software defined radios, enabling programmable radios to load waveforms, run applications, and network into an integrated system. Adherence to standards detailed in the SCA definition document allows hardware and software designers to know what equipment and programs to design. The SCA Hardware (HW) Framework tells the designer what minimum design specifications must be met by hardware devices. These specifications assure software written to the SCA guidance will run on SCA compliant hardware. Similar software specifications are provided for software applications. The core framework provides an abstraction layer between the waveform application and the software defined radio, enabling application porting to multiple vendors SDR products. NAVSYS is engaged in creating an SCA compliant prototype for an embedded Global Positioning System (GPS) waveform in a software defined radio. The intent is to optimize GPS services by providing position and time as an embedded waveform within a Software Defined Radio rather than requiring additional GPS chip sets. This paper will cover the design of the GPS devices and prototype software defined radio (PowerPC processor and Xilinx FPGAs) used to implement and test the GPS waveform under the SCA. This application necessitates the ability to switch tasking and adjust to various mission types within the radio framework. Test results are included showing the ability to run the GPS waveform under the SCA and demonstrating the GPS waveform with performance in tracking the GPS satellites. A discussion is also included on how the waveform could be ported to different SDRs running the SCA with different host processors and FPGAs. The flexibility of the design will allow SDR-enabled devices to be programmed to include GPS functionality running within the same radio that is supporting communications functions.

DTIC

*Computer Programming; Global Positioning System; Networks; Radio Equipment; Software Engineering; Waveforms*

**2007000862** Massachusetts Inst. of Tech., Cambridge, MA USA

**Multimodal Virtual Environments: MAGIC Toolkit and Visual-Haptic Interaction Paradigms**

Hou, I-Chun A; Srinivasan, Mandayarn A; Jan 1998; 105 pp.; In English

Contract(s)/Grant(s): N61339-96-K-0002; N00014-97-1-0635

Report No.(s): AD-A458345; RLE-TR-620; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The MAGIC Toolkit is an application program and library file that allows users to see, manually feel, create, edit, and manipulate objects in the virtual environment. Using the PHANToM haptic interface, a user can build a complex virtual object or scene by adding object primitives to the virtual workspace. Object primitives are pre-programmed objects, such as a cylinder and a sphere, that have visual and haptic characteristics which can be modified with a touch to the virtual menu wall. Using the MAGIC Toolkit is a simple way to create multimodal virtual environments without directly writing the program code or creating the environment in another application and then translating the file. The library file has many useful routines for manipulating the virtual scene for the creation of a specific end application. The MAGIC Toolkit with extensions is useful for many applications including creation of environments for training, prototyping structures or products, developing standardized motor coordination tests to monitor patient recovery, or entertainment. This DOS-based application runs on a single Pentium 90 MHz processor that computes the haptic updates at 1500 Hz and the graphic updates at 30 Hz. Since the field of virtual environments is still fairly new, there are some fundamental questions about how best to interact with the environment. In this thesis, experiments on visual-haptic size ratios, visual scaling, and cursor control paradigms have been conducted to investigate user preference and performance. These experiments also investigate the role of vision and haptics in navigating through a maze. Visual-haptic size ratios refer to the relative size of the visual display to the haptic workspace. Visual scaling refers to the effects of increasing and decreasing the size of the visual display relative to the haptic workspace. Cursor control paradigms fall into two categories: position control and force control. Results of the experiments find

DTIC

*Environments; Man Machine Systems; Manuals; Touch; Vision*

**20070000863** Massachusetts Inst. of Tech., Cambridge, MA USA

**Force Shading for Shape Perception in Haptic Virtual Environments**

Morgenbesser, Hugh B; Srinivasan, Mandayan A; Dec 1996; 78 pp.; In English

Contract(s)/Grant(s): N61339-94-C-0087

Report No.(s): AD-A458346; RLE-TR-606; No Copyright; Avail.: CASI: [A05](#), Hardcopy

This thesis proposes a novel haptic rendering algorithm and describes two experiments that demonstrate its effectiveness in causing humans to perceive shapes in haptic virtual environments. Haptic rendering algorithms control haptic interfaces, the robotic devices which enable manual interaction between humans and virtual environments. The algorithm proposed in this thesis, called force shading, refers to a controlled variation in the direction of the force vector output by the haptic renderer for the purpose of creating the illusion of a non-flat shape on a nominally flat surface. The two experiments, a matching experiment and a classification experiment, were done on 5 subjects. In the matching experiment, subjects were asked to change the size of a virtual 'matching' bump until it matched a virtual 'reference' bump. The reference bump was always a circular cylinder, while the matching bump was either another circular cylinder or one of three force shaded polyhedral approximations. As the number of polygons increased in the polyhedral approximations, the subjects' performance approached their performance in matching cylinders. Even for the nominally flat surface with force shading, subjects correlated their matching radii with the reference radii. When visual stimuli was added to the polyhedral approximations, performance was even closer to that in matching two cylinders. In the classification experiment, subjects were asked to classify the shape of various virtual polyhedral approximations to a circular cylindrical bump. Without force shading, the subjects accurately identified the polyhedral nature of the virtual bumps. With force shading, however, the subjects identified the polyhedral approximations as conveying approximately the same feel as a smooth cylinder.

DTIC

*Human-Computer Interface; Shapes; Touch; Virtual Reality*

**20070000864** Mitre Corp., McLean, VA USA

**M&S Interoperability within the DII COE: Building a Technical Requirements Specification**

Carr, Francis H; Hieb, Michael R; Jan 2001; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458347; PAPER-00F-SIW-133; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Key to the future interoperability of Simulations with Command, Control, Communications, Computers and Intelligence (C4I) systems is the Defense Information Infrastructure Common Operating Environment (DII COE) Architecture. The DII COE is composed of configurable, layered, reusable software components that work together with specific C4I mission software to perform a task. All future DoD C4I systems will design to the DII COE. However, because Modeling and Simulation (M&S) has not been involved in the development of DII COE components to date, simulation capabilities fall short. Recently, a DII COE Technical Working Group (TWG) was set up to address M&S Functionality. This paper describes the development of an initial Technical Requirements Specification (TRS) that will formalize M&S Requirements to the DII COE Community. The DII COE M&S TRS seeks to identify requirements for functions, features, and capabilities of the DII COE that would facilitate the interface of models or simulations. Through implementation of these M&S requirements, developers of DII COE infrastructure software will be able to provide this missing M&S functionality. DII COE TWGs typically have a Software Requirements Specification (SRS) that guides the development of common infrastructure software. The DII COE M&S TRS identifies requirements in other SRSs (such as the Common Operational Picture TWG, the Message Processing TWG, and the Data Access TWG), as well as unique M&S requirements that do not belong in any other TWG SRS. The initial TRS is organized according to an established C4I/M&S Interoperability Technical Reference Model (TRM) developed over the last 3 years and cited in the SISO C4I Study Group Report. This paper describes how the TRS is being developed within the DII COE TWG structure and the organization of the TRS, gives an overview of the requirements, and gives examples of the software functionality in the DII COE that is expected to be developed from these requirements.

DTIC

*Command and Control; Computer Programming; Computerized Simulation; Defense Program; Interoperability; Requirements; Software Engineering; Specifications*

**20070000871** Instituto Politecnico de Setubal, Setubal, Portugal

**Prevention or Identification of Web Intrusion via Human Computer Interaction Behaviour - A Proposal**

Gamboa, Hugo; Fred, Ana; Vieira, Antonio A; Oct 25, 2004; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458364; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Biometrics; Computer Information Security; Human-Computer Interface; Internets; Intrusion; Prevention; Security*

**20070000872** Drexel Univ., Philadelphia, PA USA

**A Collaborative 3D Environment for Authoring of Design Semantics**

Cera, Christopher D; Regli, William C; Braude, Ilya; Shapirstein, Yuri; Foster, Cheryl V; Sep 2001; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0618

Report No.(s): AD-A458372; DU-CS-01-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, the authors present MUG, a collaborative 3D environment to support knowledge-based conceptual design. This work integrates Computer-Aided and Collaborative Design methods with the representation framework being developed for the SemanticWeb. In this work, they have created a unique environment that allows a group of users working together over the Internet to create both a 3D layout and a knowledge-based description of a conceptual product design. MUG accepts domain-specific engineering ontologies described with the DARPA Agent Markup Language (DAML) and provides a multi-modal collaborative 3D environment, supporting shared audio and shared 3D manipulation, for users to define product structures. MUG is written entirely in the Java language and runs across a wide variety of hardware and operating system platforms.

DTIC

*Computer Aided Design; Computer Programming; Internets; Knowledge Based Systems; Semantics; Software Engineering*

**20070001120** Defence Science and Technology Organisation, Salisbury, Australia

**Tools for Requirements Management: A Comparison of Telelogic DOORS and the HiVe**

Jul 2006; 62 pp.; In English

Report No.(s): AD-A458433; DSTO-GD-0466; AR-013-689; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Artificial Intelligence; Requirements*

**20070001618** Naval Postgraduate School, Monterey, CA USA

**Modeling and 3D Visualization for Evaluation of Anti-Terrorism/Force Protection Alternatives: Phase II Final Report**

Brutzman, Donald P; Blais, Curtis L; Norbraten, Terry D; Nov 21, 2006; 171 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00025-06-WR-06603; N00014-06-WR-20154

Report No.(s): AD-A458494; NPS-MV-06-002; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458494>; Avail.: Defense Technical Information Center (DTIC)

Modern Modeling and Simulation (M&S) techniques offer flexible, economical capabilities for assessing naval installation security systems, equipment, and CONOPS. These tools are useful for assessing risk and vulnerability in a broad range of operational situations and in response to a spectrum of threat scenarios. Of particular interest to both military and homeland defense analysts is the combined shore-side and water-side protection of naval and harbor facilities. In August of 2005, the NPS MOVES Institute was funded by the Naval Facilities Engineering Service Center (NFESC) to investigate and develop such an analytic tool. This report describes the work accomplished during Phase II of the Modeling and 3D Visualization for Evaluation of Anti-Terrorism/Force Protection Alternatives project to achieve that goal. Waterside protection includes surveillance, delay (e.g., barriers), and warning and response means (e.g., patrol craft). The purpose of the Phase II effort was to develop an analysis tool that supports assessment of the effectiveness of various sensor, barrier, and response systems to enable decision makers to make good judgments on what to purchase and employ. For example, if there is no physical barrier in a port to protect naval assets then when does a threat need to be detected to permit sufficient time to intercept/neutralize it, and how many patrol craft are needed to provide an acceptable level of protection? Alternatively, if a barrier is employed that effectively stops all small boats for a designated period of time, then when does detection need to occur and how many patrol boats are needed for the same level of protection? With various surveillance system assets (including surface and/or subsurface sensors), how much time is available between detection/reporting and response? The selection of effective combinations of sensors, barriers, and response systems requires a tool that can represent all these assets and physical factors.

DTIC

*Computerized Simulation; Evaluation; Harbors; Installing; Protection; Security; System Effectiveness; Terrorism*



**20070001651** N-Space, Xenia, OH USA

**Perceptual Cognition in the Distributed Cognition (DCOG) Framework: A Study of Dual Coding and Temporal Factors in a Knowledge-Based Memory System**

Eggleston, Robert G; McCreight, Katherine L; Aug 2006; 252 pp.; In English

Contract(s)/Grant(s): Proj-2313

Report No.(s): AD-A458550; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458550>; Avail.: CASI: [A12](#),  
Hardcopy

Distributed Cognition (DCOG) is a framework for the design and construction of computational models of cognitive behavior. The framework is based on a state-change theory of mind that emphasizes the interplay of recognitional and reasoning methods in the cognitive activities of acquiring and using knowledge. It attempts to provide a single coherent account of knowing, thinking, and learning forms of cognitive behavior. A key feature of the DCOG framework is the incorporation of an associative-based memory model that includes dual coding of conceptual knowledge. This produces a recognition-based system that is less brittle and more cognitively adaptable than other known modeling approaches. The DCOG framework is implemented as an agent-based system with a distributed control structure over 'mind domains,' each presumed to include an associative memory model that provides robust, flexible and adaptive knowledge formation and its use in work performance. This study explores the use of the dual coding of conceptual knowledge as a central component of the knowing process in perceptual cognition. It examines how a dual-coding memory system can model percept formation, and associated perceptual phenomena. More specifically, it focuses on the interaction of temporal factors with dual coding to account for perceptual 'knowing'.

DTIC

*Coding; Cognition; Expert Systems; Knowledge Based Systems; Mathematical Models; Memory (Computers)*

**20070001658** Florida Inst. for Human and Machine Cognition, Inc., Pensacola, FL USA

**Human-System Technology: Human-Robot Interaction to Address Critical Navy Needs of the Present and Future**

Hansen, Robert J; Bradshaw, Jeffrey M; Raj, Anil; Glymour, Clark; Pratt, Jerry; Oct 31, 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0926

Report No.(s): AD-A458562; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458562>; Avail.: CASI: [A03](#),  
Hardcopy

The Institute for Human and Machine Cognition (IHMC) is pleased to submit a report of progress on the project 'Human Systems Technology' for the 2005 fiscal year. This fiscal year work began on May 1, 2005 and was completed on July 31, 2006. Also called Human-Centered Computing, this multidisciplinary field exploits advances in cognitive research together with those in computer science and related areas to optimize the cognitive, perceptual, and/or physical performance of experts and expert teams and the information systems that support them. The FY 2005 work focused in particular on the following: (1) psychophysical studies of tactile interfaces for sensory substitution or augmentation in complex tasks; (2) continued development of advanced algorithms for Knowledge Discovery and Data Mining (KDD) from large data sets and associated investigations of displays and training principles to improve human abilities to recognize causal relationships; (3) fundamental studies of the trustworthiness of agents through a theory of adjustable autonomy; and (4) fundamental studies of exoskeletons for human performance enhancement. The work in each of these areas reflects the growing appreciation for the enormous potential that information technology has to leverage and amplify human capabilities. Realization of this potential requires a deep understanding of human cognition, perception, and/or locomotion; the relevant areas of computer science; and the nature of the human activity to be enabled. This report describes the progress that was made in each of these research areas in FY 2005. For each area the authors describe the objective of the work and the approach taken; provide a concise progress statement and an expanded description of accomplishments; and list relevant publications, awards, patents, and technology transfer activities.

DTIC

*Artificial Intelligence; Classifications; Computer Programming; Decision Making; Human-Computer Interface; Learning; Man Machine Systems; Navy; Robotics; Robots; Software Engineering*

**20070001669** Army Tank-Automotive Research and Development Command, Warren, MI USA

**MuSES BRDF VV&A First Phase**

Garth, Alicia; Polsen, Erik; Evans, Roger; Aug 2003; 17 pp.; In English

Report No.(s): AD-A458583; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458583>; Avail.: CASI: [A03](#),  
Hardcopy

Contents of the briefing include: Objectives; the Big Picture; BRDF; Sandford-Robertson; Test Setup; Results; Limitations and Recommendations; Future Plans.

DTIC

*Infrared Signatures; Software Development Tools*

**20070001692** Pennsylvania State Univ., University Park, PA USA

**Narrated Animation: A Case for Generation**

Steedman, Mark; Badler, Norman; Webber, Bonnie L; Jan 1990; 4 pp.; In English

Contract(s)/Grant(s): DAAL03-89-C-0031; NAG-2-426

Report No.(s): AD-A458624; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458624>; Avail.: CASI: A01, Hardcopy

Our project rests on the belief that computer animation in the form of narrated animated simulations can provide an engaging, effective and flexible medium for instructing agents of varying capabilities to perform tasks that make varying demands in workplaces of varying layout. To this end, we have been designing and implementing an integrated system which combines: animated agents which can demonstrate the behavior to be emulated and automatic generation of appropriate Natural Language narration which can explain what is being done and why.

DTIC

*Computer Graphics; Natural Language (Computers)*

**20070001700** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Minimizing Speaker Variation Effects for Speaker-Independent Speech Recognition**

Huang, Xuedong; Jan 1992; 7 pp.; In English

Contract(s)/Grant(s): N00039-85-C-0163

Report No.(s): AD-A458633; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458633>; Avail.: CASI: A02, Hardcopy

ABSTRACT For speaker-independent speech recognition, speaker variation is one of the major error sources. In this paper, a speaker-independent normalization network is constructed such that speaker variation effects can be minimized. To achieve this goal, multiple speaker clusters are constructed from the speaker-independent training database. A codeword-dependent neural network is associated with each speaker cluster. The cluster that contains the largest number of speakers is designated as the golden cluster. The objective function is to minimize distortions between acoustic data in each cluster and the golden speaker cluster. Performance evaluation showed that speaker-normalized front-end reduced the error rate by 15% for the DARPA resource management speaker-independent speech recognition task.

DTIC

*Errors; Neural Nets; Performance Tests; Speech Recognition*

**20070001702** Naval Research Lab., Bay Saint Louis, MS USA

**Improving the Numerics of a Third-Generation Wave Action Model**

Rogers, W E; Kaihatu, James M; Booij, Nico; Holthuijsen, Leo; Dec 3, 1999; 82 pp.; In English

Report No.(s): AD-A458637; NRL/FR/7320--99-9695; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458637>; Avail.: CASI: A05, Hardcopy

A higher order numerical scheme for geographic wave action propagation is chosen as a potential alternative to the existing scheme in the third-generation wave action model SWAN. The chosen scheme is a cyclic hybrid of upwind and centered differencing. The SWAN model with the new scheme (dubbed SWAN-X ) is tested against analytical solutions and experimental (lab and field) data. SWAN-X requires significantly more computational time than SWAN (primarily in stationary mode), since nonphysical oscillations are manifested with high Courant numbers despite the stability of the scheme. It is felt that the advantages of the scheme are best seen in large-scale propagation problems and in wave propagation over rugged bathymetry and/or islands. For most situations over the continental shelf and in nearshore areas, SWAN-X exhibits greater variability than SWAN an indication of reduced numerical diffusion. Artificial diffusion techniques to combat the garden sprinkler effect are discussed.

DTIC

*Computer Programs; Mathematical Models; Wave Propagation*

**20070001709** Maryland Univ., College Park, MD USA

**Lexical Selection for Cross-Language Applications: Combining LCS with WordNet**

Dorr, Bonnie J; Katsova, Maria; Oct 1998; 12 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250; EIA0130422

Report No.(s): AD-A458651; LAMP-TR-021; UMIACS-TR-98-49; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458651>; Avail.: CASI: **A03**, Hardcopy

This paper describes experiments for testing the power of large-scale resources for lexical selection in machine translation (NIT) and cross-language information retrieval (CLIR). We adopt the view that verbs with similar argument structure share certain meaning components, but that those meaning components are more relevant to argument realization than to idiosyncratic verb meaning. We verify this by demonstrating that verbs with similar argument structure as encoded in Lexical Conceptual Structure (LCS) are rarely synonymous in WordNet. We then use the results of this work to guide our implementation of an algorithm for cross-language selection of lexical items, exploiting the strengths of each resource: LCS for semantic structure and WordNet for semantic content. We use the Parka Knowledge-Based System to encode LCS representations and WordNet synonym sets and we implement our lexical-selection algorithm as Parka-based queries into a knowledge base containing both information types.

DTIC

*Cross Correlation; Machine Translation*

**20070001717** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Evaluation of the CMU ATIS System**

Ward, Wayne; Jan 1991; 6 pp.; In English

Contract(s)/Grant(s): N00039-85-C-0163

Report No.(s): AD-A458661; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458661>; Avail.: CASI: **A02**,

Hardcopy

The CMU Phoenix system is an experiment in understanding spontaneous speech. It has been implemented for the Air Travel Information Service task. In this task, casual users are asked to obtain information from a database of air travel information. Users are not given a vocabulary, grammar or set of sentences to read. They compose queries themselves in a spontaneous manner. This task presents speech recognizers with many new problems compared to the Resource Management task. Not only is the speech not fluent, but the vocabulary and grammar are open. Also, the task is not just to produce a transcription, but to produce an action, retrieve data from the database. Taking such actions requires parsing and 'understanding' the utterance. Word error rate is not as important as utterance understanding rate. Phoenix attempts to deal with phenomena that occur in spontaneous speech. Unknown words, restarts, repeats, and poorly formed or unusual grammar are common in spontaneous speech and are very disruptive to standard recognizers. These events lead to misrecognitions which often cause a total parse failure. Our strategy is to apply grammatical constraints at the phrase level and to use semantic rather than lexical grammars. Semantics provide more constraint than parts of speech and must ultimately be dealt with in order to take actions. Applying constraints at the phrase level is more flexible than recognizing sentences as a whole while providing much more constraint than word-spotting. Restarts and repeats are most often between phrase occurrences, so individual phrases can still be recognized correctly. Poorly constructed grammar often consists of well-formed phrases, and is often semantically well-formed. It is only syntactically incorrect. We associate phrases by frame-based semantics. Phrases represent word strings that can fill slots in frames. The slots represent information which the frame is able to act on.

DTIC

*Errors; Grammars; Resources Management; Speech Recognition*

**20070001720** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Towards Automatic Sign Translation**

Yang, Jie; Gao, Jiang; Zhang, Ying; Waibel, Alex; Jan 2001; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458664; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458664>; Avail.: CASI: **A02**,

Hardcopy

ABSTRACT Signs are everywhere in our lives. They make our lives easier when we are familiar with them. But sometimes they also pose problems. For example, a tourist might not be able to understand signs in a foreign country. In this paper, we present our efforts towards automatic sign translation. We discuss methods for automatic sign detection. We describe sign translation using example based machine translation technology. We use a usercentered approach in developing an automatic sign translation system. The approach takes advantage of human intelligence in selecting an area of interest and domain for translation if needed. A user can determine which sign is to be translated if multiple signs have been detected

within the image. The selected part of the image is then processed, recognized, and translated. We have developed a prototype system that can recognize Chinese signs input from a video camera which is a common gadget for a tourist, and translate them into English text or voice stream.

DTIC

*Information Systems; Machine Translation; Symbols; Telecommunication; Translating; Video Signals; Voice Communication*

**20070001721** Paramax Systems Corp., Paoli, PA USA

**Language Understanding Research at Paramax**

Dahl, Deborah A; Weir, Carl; Taylor, Suzanne L; Norton, Lewis M; Linebarger, Marcia C; Lipshutz, Mark; Jan 1992; 3 pp.; In English

Contract(s)/Grant(s): N000014-89-C-0171

Report No.(s): AD-A458665; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458665>; Avail.: CASI: A01, Hardcopy

Language understanding work at Paramax focuses on applying general-purpose language understanding technology to spoken language understanding, text understanding, and document processing, integrating language understanding with speech recognition, knowledge-based information retrieval and image understanding.

DTIC

*Information Retrieval; Knowledge Based Systems; Programming Languages; Speech Recognition*

**20070001733** Maryland Univ., College Park, MD USA

**Multimedia Presentation and Transmission Standards and Their Support for Automatic Analysis, Conversion and Scaling: A Survey**

Koivisto, A; Mar 2000; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA9049-C6-1250; EIA0130422

Report No.(s): AD-A458680; LAMP-TR-039; CAR-TR-039; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458680>; Avail.: CASI: A03, Hardcopy

The increasing popularity of WWW-based services, the rapidly increasing penetration of smart phones and PDAs, and the effect of emerging technologies such as WAP, has awakened the service provider and content producer community to the need for providing lightweight versions of their applications. Another recent trend has been user-adaptive services, which most of the popular search engines already provide through customizable front ends as well as a wide range of audio and multimedia search facilities. Services that facilitate streaming media are gaining popularity but are creating even more stress on the overloaded Internet. High-speed subscriber lines, however, would give the user the necessary bandwidth to use multimedia in its most complex form. The adaptation of services- vices to meet users' settings is usually done without considering media or transmission thus requiring the user to be aware of many technical details and creating a constant need for them to upgrade their hardware and software. In this survey, we study the most common representation standards and protocols used to deliver multimedia over the public Internet and demonstrate how the information we extract from them can be used in automatic, media-wise adaptation of multimedia to improve the quality of service. We conclude with a comprehensive application example that demonstrates how standard multimedia and transmission protocols can be utilized in application-independent adaptation of multimedia.

DTIC

*Computer Programs; Internets; Multimedia; Networks; Surveys; Wireless Communication*

**20070001871** Maryland Univ., College Park, MD USA

**Error Propagation and Statistical Validation of Computer Vision Software**

Liu, Xufei; Kanungo, Tapas; Haralick, Robert M; Feb 2001; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA0949-6C-1250; 9802167270

Report No.(s): AD-A458742; LMAP-TR-063; CAR-TR-960; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Computer vision software is complex, involving many tens of thousands of lines of code. Coding mistakes are not uncommon. When a vision algorithm is run on controlled data which meet all the algorithm assumptions, the results are often statistically predictable. This renders it possible to statistically validate the algorithm and its associated theoretical derivations. In this paper we review the general theory of some relevant kinds of statistical tests and then illustrate the experimental methodology of statistical algorithm validation to validate a program that estimates parameters of buildings in aerial

photographs. This program estimates the 3D positions of building vertices based on input data obtained from multi-image photogrammetric resection calculations and 3D geometric information relating some of the points, lines and planes of the building to each other.

DTIC

*Coding; Computer Programs; Computer Vision; Data Links; Error Analysis; Photographs; Program Verification (Computers); Statistical Tests*

**20070001875** Maryland Univ., College Park, MD USA

**Lexical Resource Integration Across the Syntax-Semantics Interface**

Green, Rebecca; Pearl, Lisa; Door, Bonnie J; Resnik, Philip; Mar 2001; 8 pp.; In English

Contract(s)/Grant(s): EIA0130422; MDA9049-C6-1250

Report No.(s): AD-A458747; LAMP-TR-069; CS-TR-4231; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper examines extending a database of English verbs, grouped into syntactico-semantic classes, with WordNet senses. Probabilistic associations between theta-grids and WordNet verb frames, SEMCOR frequency data, and disambiguation based on an information-theoretic notion of semantic similarity are used. Mapping successes and failures are illustrated with drop.

DTIC

*Application Programming Interface; English Language; Semantics; Syntax*

**20070001887** Maryland Univ., College Park, MD USA

**Creating Parsing Lexicons from Semantic Lexicons Automatically and Its Applications**

Ayan, Necip F; Dorr, Bonnie; Jan 2002; 12 pp.; In English

Contract(s)/Grant(s): EIA0130422; MDA9049-C6-1250

Report No.(s): AD-A458779; LAMP-TR-084; CS-TR-4352; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In an earlier study, we described a method to create a parsing lexicon from semantic-based lexicon using manual rules. This paper describes an automated mapping methodology for the same purpose. Our approach maps lexical entries in a large LCS-based repository of semantically classified verbs to their corresponding syntactic patterns automatically. We evaluate the accuracy and coverage of this lexicon using LDOCE syntactic codes as a gold standard. We show that this lexicon is comparable to the hand-generated Minipar lexicon (i.e., similar recall and precision values). We also present the effects of using such a lexicon on the parser performance. The advantage of automating the process is that the same technique can be applied directly to lexicons we have for other languages, for example, Arabic, Chinese, and Spanish. The results indicate that our method will help us generate parsing lexicons which can be used by a broad-coverage parser that runs on different languages.

DTIC

*Computer Techniques; Parsing Algorithms; Semantics*

**20070002026** Military Academy, West Point, NY USA

**High-Tech Terror: Al-Qaeda's Use of New Technology**

Brachman, Jarret M; Jan 2006; 17 pp.; In English

Report No.(s): AD-A458499; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458499>; Avail.: CASI: [A03](#), Hardcopy

Al-Qaeda has transformed itself into an organic social movement, using the Internet to make its virulent ideology accessible to anyone with a computer. For the USA to defeat al-Qaeda and the broader jihadi movement, it must first gain a better appreciation of the ways in which the movement is successfully fueling itself by harnessing new technologies.

DTIC

*Information Systems; Internets*

**20070002066** Rand Arroyo Center, Santa Monica, CA USA

**The Impact of Network Performance on Warfighter Effectiveness**

Porche, III, Isaac R; Wilson, Bradley; Jan 2006; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DASW01-01-C-0003

Report No.(s): AD-A458278; XA-CIO/G6; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The objective of the research effort described in this report is to quantify the marginal impact of networking as part of

an effort to evaluate the concept of network-centric operations (NCO). Specifically, this report analyzes networking concepts and uses simulation results from agent-based combat models to quantify and assess the marginal benefit of networking concepts with respect to warfighter effectiveness at the tactical level. It will give the Army unique and relevant information to guide its transition to a new force makeup that will be knowledge-based and network-centric. We consider three sets of parameters of networking (or network-centric operations) as a means to investigate the impact of networking on warfighter effectiveness. We identify these components as follows: \* Sense/acquire data (sensing capability). \* Disseminate and communicate data (communication capability). \* Interpret, fuse, and react to the data (cognitive capability).

DTIC

*Communication Networks; Warfare*

**20070002097** Boeing Co., Saint Louis, MO USA

**Transforming Legacy Systems to Obtain Information Superiority**

Corman, David E; Herm, Thomas; Keller, Kirby; Satterthwaite, Charles; Jan 2001; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A457962; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The USA and its allies are being challenged by the advantages (and threats) of the Global Information Age. In response to these challenges, a new force structure is being proposed which is built upon global awareness, global engagement, and rapid deployment of specific (effects based) forces. Revolutionary advances in information resources and technology are key contributors to this force structure. In the face of a constrained DOD budget, an unprecedented system demand for lean operations in both peacetime and wartime, and the emergence of threats requiring immediate response, it is imperative that innovative technologies be developed to enable legacy weapon systems to exploit the information revolution, achieve information dominance, and meet the required operational tempo. This paper presents an embedded-system architecture, open system middleware services, and a software wrapper schema that will enable legacy systems to fully exploit evolving information technology capabilities in the context of an Network Centric Information Architecture (NCIA).

DTIC

*Information Systems; Information Management*

**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.

**20070000683** Army War Coll., Carlisle Barracks, PA USA

**Proteus, New Insights for a New Age**

Waddell, William; Kim, Joanne; Smith, Jack; Jan 2004; 16 pp.; In English

Report No.(s): AD-A457989; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Successful military, intelligence, or private sector planners and visionaries need new insights into what will affect the future. The Proteus concept offers a range of new insights that, when used in the planning process, will assist military, intelligence, and industry leaders in their efforts to prepare for future success on battlefields, in intelligence activities, and within commercial or private sector endeavors. One of the major shifts in warfare in the year 2004 is the move toward non-standard military operations. Despite the OIF success, the objective of winning the peace has not been completely accomplished. The greatest issue in making OIF successful will be whether the asymmetric portion of the operation will be won. It would be advantageous for the US and its Allies to understand various future scenarios with their threats and challenges. The US military, intelligence community, and government services are in the midst of transformation. Coming from Industrial Age operations and structure they must make the leap into the Information Age, and perhaps the next level as well, the Knowledge Age. Private industry is also experiencing the move to information-powered commerce, as service and utility organizations make full usage of computer networks to conduct their business. As these organizations transform, a clear focus on objectives is imperative. Insight becomes critical to the planning process for command and organizational structure, procurement, training and education, and doctrine. Knowing and understanding the opposition in military and intelligence operations is paramount. The construct of Proteus insights and lenses has emerged as applicable to future planning for not only intelligence, but for military planners, for interagency planners, and for (potentially) private sector planners. These lenses are

derived from the Proteus team's publication focusing conceptually on 10 insights applied to 5 global scenarios.  
DTIC

*Computer Networks; Intelligence; Military Operations; Proteus*

**20070000707** Ultra Corp., Syracuse, NY USA

**Extreme Simulation of C4ISR Communications and Networking**

Leskiw, Donald M; Jan 1999; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-99-C-0089; N6601-96-C-8530

Report No.(s): AD-A458044; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Internet is viewed by many to be the network of choice for worldwide communications. Indeed, as the Internet proliferates, one will have a global base from which to choose technologies and methods for building intra- and inter- network systems. This emerging information infrastructure comprises wire and wireless networks of vast complexity. A fundamental issue for military users, however, is how to describe the Internet so as to predict its behavior under various conflict scenarios. An unpredictable Internet would certainly contribute to the 'fog of uncertainty' that inevitably accompanies command and control operations. In this paper we describe ongoing research that is focused upon modeling the Internet and simulating its behavior: Extreme Simulation of C4ISR Communications and Networking project. Its objective is to demonstrate the feasibility of producing a Global Network Simulator (GNS) for Air Force C4ISR operations, focusing on the Internet for Air Force Operations within the Global Grid. Our approach employs: hierarchical modeling abstraction techniques using object-oriented design and implementation; a new parallel, discrete event simulation framework for large, scalable simulations; and a database schema to specify input and system constructs at runtime.

DTIC

*Command and Control; Communication Networks; Internets; Simulation*

**20070000763** California Univ., Santa Cruz, CA USA

**On-Demand Link-State Routing in Ad-Hoc Networks**

Roy, Soumya; Jun 2003; 186 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-97-2-0338; F49620-00-1-0330

Report No.(s): AD-A458151; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis explores the challenges, merits and demerits of using link-state information for on-demand routing in ad hoc networks, such that routers maintain path information for only those destinations for which they have data traffic. We first present the source tree on-demand adaptive routing (SOAR) protocol, in which each router exchanges with its neighbors a 'source tree' containing paths to only those destinations for which the router is the source or relay of data packets. The main advantage of SOAR is that it is more scalable and better performing than current state-of-the-art on-demand routing protocols. However, a limitation of SOAR is that it requires data packets to specify the paths they traverse to detect loops. To eliminate the need for source routing or path traversal information in data packets, we introduce the on-demand link-vector (OLIVE) protocol, which prevents temporary loops for each destination by synchronizing relevant link-state information among neighbors. In OLIVE, the advertised paths combine to form a source graph, rather than a source tree. OLIVE is shown to outperform the current routing protocols proposed for mobile ad-hoc networks in terms of control overhead, throughput and network delay.

DTIC

*Computer Networks; Protocol (Computers)*

**20070000797** Army Tank-Automotive and Armaments Command, Warren, MI USA

**Pervasive Computing and Its Impact on Next Generation Military Systems**

Bailey, Timothy A; Jun 9, 2003; 10 pp.; In English

Report No.(s): AD-A458201; AMSTA-QH-13862; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The former CEO of IBM, Louis Gerstner, once defined Pervasive Computing (PvC) as 'a billion people interacting with a million e-businesses with a trillion intelligent devices interconnected.' This is the vision of pervasive computing; a web of interconnected and interoperable devices, information, services and people. Enabled by the advent of broadband wireless and wired networks, the increased power and commodification of information technology (IT) components, and the emergence of a new class of software called middleware, technology companies around the world are spending trillions of dollars a year to make this vision of PvC a reality. This paper examines PvC, or, as it is sometime called ubiquitous computing, within the context of the greater IT-based 'convergence' phenomenon. It also reveals how the technologies and solutions supporting this

new compute paradigm will soon impact our next generation military systems.

DTIC

*Applications Programs (Computers); Communication Networks; Computer Networks; Electronic Commerce; Information Systems; Microcomputers*

**20070000802** NAVSYS Corp., Colorado Springs, CO USA

**Real-Time Web-based Image Distribution using an Airborne GPS/Inertial Image Server**

Brown, Alison; Hollan, Heather; Lu, Yan; Sep 2006; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458212; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The use of web-based tools for viewing and sharing imagery has expanded significantly over the last few years. Web services such as Google Earth have whet the public's appetite for georegistered and georectified imagery. While there is a large amount of registered imagery available for display on these Servers, much of the data is old and outdated, some by many years. NAVSYS has developed a GPS/inertial/video product (GI-Eye) that can be used to collect georegistered imagery in real-time. We have combined this with a GeoReferenced Information Manager (GRIM) Server that allows this imagery to be converted to a georectified image. In this paper, we describe the GI-Eye and GRIM products and the auto-mosaicing capability that they provide. We also include examples of mosaic imagery that was generated during flight tests of the system.

DTIC

*Global Positioning System; Images; Internets; Real Time Operation*

**20070000860** Massachusetts Inst. of Tech., Cambridge, MA USA

**Determination of Mechanical Properties of the Human Fingerpad In Vivo Using a Tactile Stimulator**

Gulatl, Rogeve J; Srinivasan, Mandayarn A; Jan 1997; 270 pp.; In English

Contract(s)/Grant(s): N00014-92-J-1814

Report No.(s): AD-A458343; RLE-TR-605; No Copyright; Avail.: CASI: [A12](#), Hardcopy

A desire to better understand the mechanics of the human fingerpad, in vivo, as related to haptic performance and tactual perception prompted an investigation of the fingerpad's characteristic force response to indentation. A computer-controlled, high- precision tactile stimulator was constructed to deliver a combination of uniaxial static, ramp and sinusoidal indentations normal a specific region of the stationary and passive fingerpads of five different subjects. Both input indentation depth and fingerpad force response were recorded as a function of time to capture transients and steady state features. Three aluminum indentors, a point, a 6.35 mm diameter circular probe and a flat plate, were used for indentation to represent three general classes of loading profiles encountered in manual exploration and manipulation. With each shape, repeatability of the response was tested and the effects of varying amplitude, velocity and frequency of indentation were investigated.

DTIC

*Fingers; In Vivo Methods and Tests; Mechanical Properties*

**20070000861** Mitre Corp., McLean, VA USA

**Coalition Interoperability: A Pragmatic C4ISR Approach from the US Army CECOM Security Assistance Perspective**

Skidmore, Sr , William E; Klingenburg, Daniel; Apr 2003; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458344; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Achieving coalition interoperability is difficult, and competing National interests (military, economic or political) will probably necessitate imposing compromise solutions. Designing a solution that all respective parties can adopt and adhere to is therefore problematic. To address this problem, a combination of system architecture and design methodology is employed that emphasizes the use of COTS products. There are several recognizable phases within this approach: (1) operational capability requirement definition, (2) analysis, (3) architecture synthesis, (4) component solution identification and capabilities assessment, and (5) design synthesis. This paper discusses some of the problems involved in defining interoperable coalition system architectures and the authors' approach to circumventing any obstacles. The paper will be presented from the perspective of the U.S. Army CECOM Security Assistance Management Directorate in using U.S. grant funds such as Foreign Military Financing (FMF) to provide solutions for foreign militaries and multinational military organizations.

DTIC

*Commercial Off-the-Shelf Products; Communication Networks; Interoperability; Military Operations; Requirements; Security*



**20070001118** Naval Postgraduate School, Monterey, CA USA

**Worldwide Consortium for the Grid (W2COG) Research Initiative Phase 1**

Mar 31, 2006; 317 pp.; In English

Contract(s)/Grant(s): DWAM50072

Report No.(s): AD-A458434; NPS-96-06-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Data Processing; Internets; Government/Industry Relations*

**20070001476** California Univ., Santa Cruz, CA USA

**Ordered Core Based Trees**

Shields, Clay; Jun 1996; 65 pp.; In English

Contract(s)/Grant(s): N00014-92-J-1807

Report No.(s): AD-A458143; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This thesis presents a new protocol, the Ordered Core Based Tree (OCBT) protocol, which remedies several shortcomings of the Core Based Tree (CBT) multicast protocol. The CBT protocol can form loops during periods of routing instability, and it can fail to consistently build a connected multicast tree, even when the underlying routing is stable. The OCBT protocol provably eliminates these deficiencies and reduces the latency of tree repair following a link or core failure. OCBT also improves scalability by allowing exible placement of the cores that serve as points of connection to a multicast tree. Simulation results show that the amount of control traffic in OCBT is comparable to that in CBT.

DTIC

*Protocol (Computers); Trees (Mathematics)*

**20070001478** Harvard Univ., Cambridge, MA USA

**DNA Memory and Input/Output**

Sep 2006; 85 pp.; In English

Contract(s)/Grant(s): F30602-01-2-0586; Proj-BIOC

Report No.(s): AD-A458330; No Copyright; Avail.: CASI: [A05](#), Hardcopy

No abstract available

*Deoxyribonucleic Acid; Input/Output Routines; Memory (Computers)*

**20070001626** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Verifiable Secret Redistribution**

Wong, Theodore M; Wing, Jeannette M; Oct 2001; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-2-0523

Report No.(s): AD-A458508; CMU-CS-01-155; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458508>; Avail.:

CASI: [A03](#), Hardcopy

The authors present a new protocol to perform non-interactive verifiable secret redistribution (VSR) for secrets distributed with Shamir's secret sharing scheme. They base their VSR protocol on Desmedt and Jajodia's redistribution protocol for linear secret-sharing schemes, which they specialize for Shamir's scheme. They extend their redistribution protocol with Feldman's non-interactive verifiable secret sharing scheme to ensure that a SUBSHARES-VALID condition is true after redistribution. They show that the SUBSHARES-VALID condition is necessary but not sufficient to guarantee that the new shareholders have valid shares, so they present an additional SHARES-VALID condition.

DTIC

*Client Server Systems; Cryptography; Protocol (Computers)*

**20070001751** Massachusetts Inst. of Tech., Cambridge, MA USA

**Supporting Real-Time Applications in an Integrated Services Packet Network: Architecture and Mechanism**

Clark, David C; Shenker, Scott; Zhang, Lixia; Aug 1992; 14 pp.; In English

Contract(s)/Grant(s): NCR-8919038; NAG-2-582

Report No.(s): AD-A458728; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458728>; Avail.: Defense Technical Information Center (DTIC)

This paper considers the support of real-time applications in an Integrated Services Packet Network (ISPN). We first review the characteristics of real-time applications. We observe that, contrary to the popular view that real-time applications

necessarily require a fixed delay bound, some real-time applications are more flexible and can adapt to current network conditions. We then propose an ISPN architecture that supports two distinct kinds of real-time service: guaranteed service, which is the traditional form of real-time service discussed in most of the literature and involves pre-computed worst-case delay bounds, and predicted service which uses the measured performance of the network in computing delay bounds. We then propose a packet scheduling mechanism that can support both of these real-time services as well as accommodate datagram traffic. We also discuss two other aspects of an overall ISPN architecture: the service interface and the admission control criteria.

DTIC

*Real Time Operation; Telecommunication*

**20070001753** Maryland Univ., College Park, MD USA

**Forgery Detection by Local Correspondence**

Guo, Jinhong K; Apr 2000; 113 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250

Report No.(s): AD-A458733; LAMP-TR-041; CAR-TR-942; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458733>; Avail.: Defense Technical Information Center (DTIC)

Signatures may be stylish or unconventional and have many personal characteristics that are challenging to reproduce by anyone other than the original author. For this reason, signatures are used and accepted as proof of authorship or consent on personal checks, credit purchases and legal documents. Currently signatures are verified only informally in many environments, but the rapid development of computer technology has stimulated great interest in research on automated signature verification and forgery detection. In this thesis, we focus on forgery detection of off-line signatures. Although a great deal of work has been done on off-line signature verification over the past two decades, the field is not as mature as on-line verification. Temporal information used in on-line verification is not available off-line and the subtle details necessary for off-line verification are embedded at the stroke level and are hard to recover robustly. We approach the off-line problem by establishing a local correspondence between a model and a questioned signature. The questioned signature is segmented into consecutive stroke segments that are matched to the stroke segments of the model. The cost of the match is determined by comparing a set of geometric properties of the corresponding sub-strokes and computing a weighted sum of the property value differences. The least invariant features of the least invariant sub-strokes are given the biggest weight, thus emphasizing features that are highly writer-dependent. Random forgeries are detected when a good correspondence cannot be found, i.e., the process of making the correspondence between a model and a questioned signature. The questioned signature is segmented into consecutive stroke segments that are matched to the stroke segments of the model. The cost of the match is determined by comparing a set of geometric properties of the corresponding sub-strokes and computing a weighted sum of the property value differences.

DTIC

*Algorithms; Character Recognition; On-Line Systems; Signatures; Standard Deviation*

**20070002070** Air Force Research Lab., Rome, NY USA

**Establishing Tools for Computing Hybrids**

Oct 2006; 39 pp.; In English

Contract(s)/Grant(s): Proj-459T

Report No.(s): AD-A458367; AFRL-IF-RS-TR-2006-296; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Computation; Hybrid Computers*

**20070002088** Air Force Research Lab., Rome, NY USA

**Grid Computing for High Performance Computing (HPC) Data Centers**

Oct 2006; 22 pp.; In English

Contract(s)/Grant(s): Proj-459T

Report No.(s): AD-A458335; AFRL-IF-RS-TR-2006-298; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Grid Computing (Computer Networks); Information Dissemination*

**20070002090** Princeton Univ., NJ USA

**Very Large-Scale Multiuser Detection (VLSMUD)**

Sep 2006; 45 pp.; In English

Contract(s)/Grant(s): FA8750-05-2-0192; Proj-VLSM

Report No.(s): AD-A458334; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Detection; Architecture (Computers)*

**20070002091** California Univ., Berkeley, CA USA

**System on a Chip Real-Time Emulation (SOCRE)**

Sep 2006; 17 pp.; In English

Contract(s)/Grant(s): FA8750-05-1-0275; Proj-N584

Report No.(s): AD-A458333; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Systems-on-a-Chip; Real Time Operation*

**20070002095** Purdue Univ., West Lafayette, IN USA

**Benefits of Web-Based Construction Management in Naval Facilities Engineering Command**

Turke, Aaron; Aug 2004; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A457995; No Copyright; Avail.: CASI: [A05](#), Hardcopy

One of the most critical stages in introducing a new business technology is the implementation. At this stage the employees that are charged with using the new technology must relinquish the way of doing business they have been performing for some time. The employees more than likely have a certain comfort in the old way of doing business and will be reluctant to radical change. This is especially the case in the construction industry which is more reluctant in implementing technological advancements than most other industries due to historical and cultural reasons. Naval Facilities Engineering Command is currently at the critical stage of implementation of their web-based construction management tool called WebCM. This paper is written to support WebCM implementation by describing the potential benefits and making implementation and technological suggestions based on similar endeavors in the private sector. By highlighting the potential benefits, the validity and importance of the system should become clearer to the construction contractors, administrators, and clients that will use the system. The suggestions are for the WebCM promoters to consider during the implementation phase and into the future.  
DTIC

*Construction; World Wide Web; Navy; Engineering*

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**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*.

**20070000682** University of Southern California, Los Angeles, CA USA

**Towards a Warfighter's Associate: Eliminating the Operator Control Unit**

Pacis, E B; Everett, H R; Farrington, N; Khurana, S; Oct 2004; 14 pp.; In English

Report No.(s): AD-A457986; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper introduces the long-term concept of a supervised autonomous Warfighter 's Associate, which uses a natural-language interface for communication with (and oversight by) its human counterpart. More realistic near-term solutions to achieve intermediate success are then presented.

DTIC

*Control Equipment; Natural Language (Computers); Speech Recognition; Voice Communication*

**20070000685** SRI International Corp., Menlo Park, CA USA

**Use of the Hough Transformation to Detect Lines and Curves in Pictures**

Duda, Richard O; Hart, Peter E; Apr 1971; 18 pp.; In English

Report No.(s): AD-A457992; SRI-TN-36; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Hough has proposed an interesting and computationally efficient procedure for detecting lines in pictures. In this paper

we point out that the use of angle-radius rather than slope-intercept parameters simplifies the computation further. We also show how the method can be used for more general curve fitting, and give alternative interpretations that explain the source of its efficiency.

DTIC

*Image Processing; Pattern Recognition*

**2007000686** Massachusetts Inst. of Tech., Cambridge, MA USA

### **Component-Based Face Detection**

Heisele, Bernd; Serre, Thomas; Pontil, Massimiliano; Poggio, Tomaso; Dec 2001; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0907; IIS-9800032

Report No.(s): AD-A457993; No Copyright; Avail.: CASI: [A02](#), Hardcopy

We present a component-based, trainable system for detecting frontal and near-frontal views of faces in still gray images. The system consists of a two-level hierarchy of Support Vector Machine (SVM) classifiers. On the first level, component classifiers independently detect components of a face. On the second level, a single classifier checks if the geometrical configuration of the detected components in the image matches a geometrical model of a face. We propose a method for automatically learning components by using 3-D head models. This approach has the advantage that no manual interaction is required for choosing and extracting components. Experiments show that the component-based system is significantly more robust against rotations in depth than a comparable system trained on whole face patterns.

DTIC

*Classifiers; Computer Vision; Pattern Recognition*

**2007000689** Stanford Research Inst., Menlo Park, CA USA

### **Experiments in Scene Analysis**

Duda, Richard O; Hart, Peter E; Jan 1970; 30 pp.; In English

Report No.(s): AD-A457998; SRI-TN-20; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes an experimental computer program that analyzes pictures taken in a simple, but nevertheless real-world, robot environment. The analysis proceeds by building up, step by step, a partial line drawing representation of a digitized television picture. An interesting feature of the system is an executive program that uses detailed knowledge of the environment to control other programs that extract the partial line drawing. Examples are given to illustrate the operation of this experimental program.

DTIC

*Image Processing; Pattern Recognition; Robots; Scene Analysis*

**2007000712** Naval Postgraduate School, Monterey, CA USA

### **Analysis of Shipboard Firefighting-Team Efficiency Using Intelligent-Agent Simulation**

Andrade, Sylvio F; Rowe, Neil C; Gaver, Donald P; Jacobs, Patricia A; Jan 2002; 16 pp.; In English

Report No.(s): AD-A458054; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Analysis of the efficiency of organizational structures is important for command-and-control since an intuitively appealing structure may have unanticipated bottlenecks that occur with unexpected events and the skill levels of personnel. Good simulation can find some of these problems, but it hard to build good simulations. So we have developed tools to enable analysts to set up discrete-event multi-agent simulations in straightforward ways without having to program. We describe here our application of these tools to shipboard firefighting, which presents difficult problems for planners. Our tools uses artificial-intelligence techniques such as means-ends analysis to simulate the actions and interactions of a fire team, and uses a stochastic model for fire spread based on the kind of flammable material, its ignition and burnout rates, and the possibility of burnout and flashover effects. The duration of an action depends on the skill level of the team member in charge of the action. To assess the readiness of teams with different combinations of skills, we measured the duration of firefighting in random trials. We showed that a good scene leader is not sufficient to assure a good performance when unskilled nozzlemen and hosemen are part of the team, and we showed that skill levels did not matter much when ignition and burnout rates were high.

DTIC

*Fire Fighting; Simulation*

**20070000736** Washington Univ., Seattle, WA USA

**Accurate and Efficient Curve Detection in Images: The Importance Sampling Hough Transform**

Walsh, Daniel; Raftery, Adrian E; Feb 2001; 25 pp.; In English

Contract(s)/Grant(s): N00014-97-1-0736; N00014-96-1-0192

Report No.(s): AD-A458108; TR-388; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Hough transform is a well known technique for detecting parametric curves in images. We place a particular group of Hough transforms, the probabilistic Hough transforms, in the framework of importance sampling. This framework suggests a way in which probabilistic Hough transforms can be improved: by specifying a target distribution and weighting the sampled parameters accordingly to make identification of curves easier. We investigate the use of clustering techniques to simultaneously identify multiple curves in an image. We also use probabilistic arguments to develop stopping conditions for the algorithm. The resulting methodology is called the Importance Sampling Hough Transform (ISHT). We apply our method to both simulated and real data, and compare its performance with that of two much used versions of the Hough transform: the standard Hough transform and the randomized Hough transform. In our experiments, it is more accurate than either of these common methods, and it is faster than the randomized Hough transform.

DTIC

*Detection; Pattern Recognition; Sampling*

**20070000737** Massachusetts Inst. of Tech., Cambridge, MA USA

**Computational Models of Object Recognition in Cortex: A Review**

Riesenhuber, Maximilian; Poggio, Tomaso; Aug 7, 2000; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-93-1-3085; N00014-95-1-0600

Report No.(s): AD-A458109; AI-MEMO-1695; CBCL PAPER-190; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Understanding how biological visual systems perform object recognition is one of the ultimate goals in computational neuroscience. Among the biological models of recognition the main distinctions are between feedforward and feedback and between object-centered and view-centered. From a computational viewpoint the different recognition tasks -- for instance categorization and identification -- are very similar, representing different trade-offs between specificity and invariance. Thus the different tasks do not strictly require different classes of models. The focus of the review is on feedforward, view-based models that are supported by psychophysical and physiological data.

DTIC

*Bionics; Computer Vision; Mathematical Models; Models; Pattern Recognition*

**20070000779** Mitre Corp., Bedford, MA USA

**A Summary of Previous Grand Challenge Proposals for Cognitive Systems**

Bayer, Samuel; Damianos, Laurie; Hirschman, Lynette; Strong, Gary; Sep 2004; 11 pp.; In English

Report No.(s): AD-A458170; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The notion of a Grand Challenge (GC) in computational cognition is not new. It has been addressed both specifically and in the context of GCs in computing as a whole. One well-known example, DARPA's Autonomous Vehicle GC (AVGC), has captured the imagination of the media and the public. The AVGC is much more than a compelling research goal or a way to make DARPA's work relevant to the average layperson; it is a measurable test that can tell us where to focus our work and how much we have accomplished. The AVGC has 'raised the bar' for what it means for a GC to set the agenda for a field of research. There have been previous efforts to develop GCs for computer science, but none of these efforts has addressed directly the needs of DARPA IPTO, in particular, demonstrations of cognitive capabilities with a dimension in learning. To gain insight into why no proposal has yet to become an IPTO GC, the authors performed a historical review and analysis of several sources of GCs in cognitive systems and artificial intelligence. This document summarizes and characterizes these previous GC explorations and evaluates categories of proposals against the DARPA IPTO criteria for selecting a GC. The authors chose to focus their analysis on task-based GCs as the most appropriate for IPTO. Task-based GCs are more likely to be organized around a goal whose achievement can be measured and is decomposable and diagnostic, and whose usefulness and relevance is clear. An example of one such task-based GCs is 'Lead an Orienteering Team to Victory.' For purposes of discussion, they have clustered all GC proposals into categories. They then evaluated each proposal against the criteria for selecting an IPTO GC and summarized these evaluations, by category.

DTIC

*Artificial Intelligence; Cognition; Machine Learning; Measurement*

**20070000793** Newport News Shipbuilding and Drydock Co., VA USA  
**Initial Evaluation of the Hitachi Zosen WR-L50 Portable Welding Robot (The National Shipbuilding Research Program)**

Blasko, G J; Moniak, D J; Howser, B C; Mar 1992; 53 pp.; In English

Contract(s)/Grant(s): HO0167-90H-O057

Report No.(s): AD-A458191; NSRP 0343; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The application of robotics provides good potential to increase welding productivity, reduce dependence on skilled labor, and improve the competitive position of U.S. shipyards. However, shipyard robotic applications have generally been limited to small part sizes and repetitive batch lots. In December 1991, a team representing U. S. private and public shipyards and the David Taylor Research Center visited three Japanese shipyards to observe the Hitachi Zosen robots in operation and complete a technical assessment. The portable welding robots are not the conventional teach-playback variety, but rather a numerically controlled (NC) system that utilizes off-line programming. The robots and their robot origin transfer (self traveling) units are compact, durable, easy to operate and are readily adaptable to high-volume, non-repetitious structural welding tasks. The robots offer excellent productivity improvement due to their potential for 50-70% arc time, high deposition rates, and ease of operation and set-up. Typically, three robots were being operated by a single operator. There are several issues that a U.S. shipyard will have to resolve to ensure a successful implementation including determining the availability of the special Nippon flux-cored weld wire in the U. S., assessing weld quality in terms of U.S. regulatory requirements, and customizing the CAM software to suit specific design details. Based on the team's observation and the overall satisfactory technical assessment, it is recommended that at least one portable welding robot with a transfer unit be purchased for further evaluation in a U.S. shipyard.

DTIC

*Marine Technology; Robots; Ships; Welding*

**20070000801** Visitek, Inc., Ann Arbor, MI USA

**Color Image Segmentation in the Color and Spatial Domains**

Chen, Tie Q; Murphey, Yi L; Karlsen, Robert; Gerhart, Grant; Jan 2002; 13 pp.; In English

Report No.(s): AD-A458211; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper we describe a color image segmentation system that performs color clustering in a color space followed by color region segmentation in the image domain. In color space, we describe two different algorithms that cluster similar colors using different criteria and present our evaluation results on these two algorithms in comparison with three well-known color segmentation algorithms. The region segmentation algorithm merges clusters in the image domain based on color similarity and spatial adjacency. We developed three different methods for merging regions in the image domain. The color image segmentation system has been implemented and tested on a variety of color images, including satellite images and moving car images. The system has shown to be both effective and efficient.

DTIC

*Color; Domains; Image Processing; Imaging Techniques*

**20070000866** SRI International Corp., Menlo Park, CA USA

**Problem Solving Tactics**

Sacerdoti, Earl D; Jul 1979; 25 pp.; In English

Contract(s)/Grant(s): N00038-79-C-0118

Report No.(s): AD-A458349; TN-189; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes the basic strategies of automatic problem solving and then focuses on a variety of tactics for improving their efficiency. An attempt is made to provide some perspective on and structure to the set of tactics. Finally, some new directions for problem-solving research are discussed, and a personal perspective is provided on where the work is headed: toward greater flexibility of control and more intimate integration of plan generation, execution, and repair.

DTIC

*Artificial Intelligence; Problem Solving; Tactics*

**20070000870** SRI International Corp., Menlo Park, CA USA

**A Survey of Architectures for Distributed Artificial Intelligence**

Davies, Todd R; Jun 1988; 44 pp.; In English

Contract(s)/Grant(s): N0014-85-C-0251

Report No.(s): AD-A458359; TN-424; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report surveys literature and research in the field of distributed artificial intelligence (DAI) and provides an overview of computer architectures particularly suited to such research. It concentrates on work to date that has involved the construction of testbeds and development tools for DAI. It tries to draw some lessons from these efforts and suggests ways in which testbeds, which heretofore have been used primarily for experimentation, might be used in the full course of system development.

DTIC

*Artificial Intelligence; Surveys*

**20070001122** Naval Postgraduate School, Monterey, CA USA

**Integrated Portfolio Analysis: Return on Investment and Real Options Analysis of Intelligence Information Systems (Cryptologic Carry On Program)**

Sep 30, 2006; 67 pp.; In English

Report No.(s): AD-A458432; NPS-GSBPP-06-018; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Cryptography; Information Systems; Artificial Intelligence*

**20070001134** Naval Postgraduate School, Monterey, CA USA

**Changing Major Acquisition Organizations to Adopt the Best Loci of Knowledge, Responsibilities and Decision Rights**

Sep 30, 2006; 73 pp.; In English

Report No.(s): AD-A458430; NPS-GSBPP-06-015; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Loci; Organizations; Decision Making; Knowledge Bases (Artificial Intelligence)*

**20070001679** SRI International Corp., Menlo Park, CA USA

**Problems in Logical Form**

Moore, Robert C; Apr 1981; 35 pp.; In English

Contract(s)/Grant(s): N00039-80-C-0645; N00039-80-C-0575

Report No.(s): AD-A458596; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458596>; Avail.: CASI: [A03](#), Hardcopy

Most current theories of natural-language processing propose that the assimilation of an utterance involves producing an expression or structure that in some sense represents the literal meaning of the utterance. It is often maintained that understanding what an utterance literally means consists in being able to recover such a representation. In philosophy and linguistics this sort of representation is usually said to display the 'logical form' of an utterance. This paper surveys some of the key problems that arise in defining a system of representation for the logical forms of English sentences and suggests possible approaches to their solution. The author first looks at some general issues relating to the notion of logical form, explaining why it makes sense to define such a notion only for sentences in context, not in isolation, and then discusses the relationship between research on logical form and work on knowledge representation in artificial intelligence. The rest of the paper is devoted to examining specific problems in logical form. These include the following: quantifiers; events, actions and processes; time and space; collective entities and substances; propositional attitudes and modalities; and questions and imperatives.

DTIC

*Artificial Intelligence; Data Processing; Linguistics; Natural Language (Computers); Natural Language Processing*

**20070001681** SRI International Corp., Menlo Park, CA USA

**Plan Generation and Execution for Robotics**

Sacerdoti, Earl D; Apr 15, 1980; 16 pp.; In English

Contract(s)/Grant(s): F49620-79-C-0188; N00014-80-C-0300

Report No.(s): AD-A458598; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458598>; Avail.: CASI: [A03](#), Hardcopy

A robot device operates by performing a sequence of actions, drawn from a reasonably small repertoire of action types. Industrial robots commercially available today are typically configured to perform a fixed sequence of actions, cued by some visual or contact stimulus. The action sequence is not subject to any significant alteration -- it is performed identically each time the stimulus is presented. Such robots can be called 'reflex' robot systems, since they make a rather inflexible response

to a fixed stimulus. The applicability of such systems is limited. Truly flexible automation must make use of significant sensory feedback to respond appropriately to each new stimulus. Thus, a worthwhile goal for robotics research is to develop the capabilities needed to create what one may call 'instrumental' robot systems. The term 'instrumental' is used to suggest, by analogy with classical psychology, the mediation of explicit goals and deliberately initiated actions (i.e., goal-oriented behavior) in the performance of the robot system. The development of such instrumental robots will require extensions of current capabilities in many areas, including control systems, mechanics, and sensors. At the core of the capabilities to be developed lies fundamental research in problem solving and the monitoring of plan execution. This paper discusses a number of problems that are critically in need of further research in support of advanced robotics, including dealing with time, planning for parallel execution, planning for information gathering, planning for planning, learning, interactive planning, dynamic plan repair, and distributed robotics.

DTIC

*Adaptation; Artificial Intelligence; Machine Learning; Planning; Problem Solving; Robotics*

**20070001694** Stanford Research Inst., Menlo Park, CA USA

### **The Nonlinear Nature of Plans**

Sacerdoti, Earl D; Jan 1975; 36 pp.; In English

Contract(s)/Grant(s): DAHC04-72-C-008

Report No.(s): AD-A458627; SRI-TN-101; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458627>; Avail.:

CASI: [A03](#), Hardcopy

We usually think of plans as linear sequences of actions. This is because plans are usually executed one step at a time. But plans themselves are not constrained by physical limitations of linearity. This paper describes a new information structure, called the procedural net, that represents a plan as a partial ordering of actions with respect to time. By avoiding premature commitments to a particular order for achieving subgoals, a problem-solving system using this representation can deal easily and directly with problems that are otherwise very difficult to solve.

DTIC

*Nonlinearity; Planning*

**20070001696** Stanford Research Inst., Menlo Park, CA USA

### **A Region-Oriented Data Structure**

Fennema, Claude; Brice, Claude; May 1969; 21 pp.; In English

Contract(s)/Grant(s): F30602-69-C-0056

Report No.(s): AD-A458629; SRI-TN-7; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458629>; Avail.:

CASI: [A03](#), Hardcopy

This technical note describes a region-based data structure that is easily obtained, lends itself to description of the data in a rich manner by a process of pointer reduction and reduces combinatorial types of search by implicitly including positional information. The structure is also context-free and closed.

DTIC

*Data Structures; Image Processing*

**20070001698** Carnegie-Mellon Univ., Pittsburgh, PA USA

### **The Design of Voice-Driven Interfaces**

Rudnick, Alexander I; Jan 1989; 6 pp.; In English

Contract(s)/Grant(s): N00039-85-C-0163

Report No.(s): AD-A458631; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458631>; Avail.:

CASI: [A02](#), Hardcopy

This paper presents some issues that arise in building voice-driven interfaces to complex applications and describes some of the approaches that we have developed for this purpose. To test these approaches, we have implemented a voice spreadsheet and have begun observation of users interacting with it.

DTIC

*Data Processing; Speech Recognition; Spreadsheets; Telecommunication; Voice Communication*



**20070001699** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Automatic Title Generation for Spoken Broadcast News**

Jin, Rong; Hauptmann, Alexander G; Jan 2001; 4 pp.; In English

Contract(s)/Grant(s): DUE-0085834; MDA908-00-C-0037

Report No.(s): AD-A458632; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458632>; Avail.: CASI: [A01](#),  
Hardcopy

ABSTRACT In this paper, we implemented a set of title generation methods using training set of 21190 news stories and evaluated them on an independent test corpus of 1006 broadcast news documents, comparing the results over manual transcription to the results over automatically recognized speech. We use both F1 and the average number of correct title words in the correct order as metric. Overall, the results show that title generation for speech recognized news documents is possible at a level approaching the accuracy of titles generated for perfect text transcriptions.

DTIC

*Broadcasting; Machine Learning; Machine Translation; Speech; Speech Recognition; Statistics*

**20070001714** SRI International Corp., Menlo Park, CA USA

**A Structure for Plans and Behavior**

Sacerdoti, Earl D; Aug 1975; 160 pp.; In English

Contract(s)/Grant(s): DAHCO4-72-C-008

Report No.(s): AD-A458657; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458657>; Avail.: CASI: [A08](#),  
Hardcopy

This report describes progress to date in the ability of a computer system to understand and reason about actions. A new method of representing actions within a computer's memory has been developed, and this new representation, called the 'procedural net,' has been employed in developing new strategies for solving problems and monitoring the execution of the resulting solutions. A set of running computer programs, called the NOAH (Nets Of Action Hierarchies) system, embodies this representation. Its major goal is to provide a framework for storing expertise about the actions of a particular task domain, and to impart that expertise to a human in the cooperative achievement of nontrivial tasks. A problem is presented to NOAH as a statement that is to be made true by applying a sequence of actions in an initial state of the world. The actions are drawn from a set of actions previously defined to the system. NOAH first creates a one-step solution to the problem, then it progressively expands the level of detail of the solution, filling in ever more detailed actions. All the individual actions, composed into plans at differing levels of detail, are stored in the procedural net. The system avoids imposing unnecessary constraints on the order of the actions in a plan. Thus, plans are represented as partial orderings of actions, rather than as linear sequences. The same data structure is used to guide the human user through a task. Since the system has planned the task at varying levels of detail, it can issue requests for action to the user at varying levels of detail, depending on his/her competence and understanding of the higher level actions. If more detail is needed than was originally planned for, or if an unexpected event causes the plan to go awry, the system can continue to plan from any point during execution. In essence, the structure of a plan of actions is as important for problem solving and execution monitoring as the nature of the actions themselves.

DTIC

*Knowledge Based Systems; Machine Learning; Man Machine Systems; Planning; Problem Solving; Robotics*

**20070001719** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Evaluating Spoken Language Interaction**

Rudnicky, Alexander I; Sakamoto, Michelle; Polifroni, Joseph H; Jan 1989; 11 pp.; In English

Contract(s)/Grant(s): N00039-85-C-0163

Report No.(s): AD-A458663; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458663>; Avail.: CASI: [A03](#),  
Hardcopy

To study the spoken language interface in the context of a complex problem-solving task, a group of users were asked to perform a spreadsheet task, alternating voice and keyboard input. A total of 40 tasks were performed by each participant, the first thirty in a group (over several days), the remaining ones a month later. The voice spreadsheet program used in this study was extensively instrumented to provide detailed information about the components of the interaction. These data, as well as analysis of the participants's utterances and recognizer output, provide a fairly detailed picture of spoken language interaction. Although task completion by voice took longer than by keyboard, analysis shows that users would be able to perform the spreadsheet task faster by voice, if two key criteria could be met: recognition occurs in real-time, and the error rate is sufficiently low. This initial experience with a spoken language system also allows us to identify several metrics, beyond

those traditionally associated with speech recognition, that can be used to characterize system performance.

DTIC

*Data Processing; Natural Language (Computers); Problem Solving; Speech; Speech Recognition; Spreadsheets; Voice Communication*

**20070001726** Pennsylvania State Univ., University Park, PA USA

**Object Representation Using Appearance-Based Parts and Relations**

Huang, Chien-Yuan; Camps, Octavia I; Kanungo, Tapas; Jan 1999; 29 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250; IRI-93-09100

Report No.(s): AD-A458670; LAMP-TR-031; CAR-TR-905; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458670>; Avail.: CASI: A03, Hardcopy

The recognition of general three-dimensional objects in cluttered scenes remains a challenging problem. In particular, the design of a good representation that is suitable for modeling large numbers of generic objects, and is also robust to occlusion, has been a stumbling block to achieving success. In this paper, we propose a representation using appearance-based parts and relations to overcome these problems. Appearance-based parts and relations are defined in terms of closed regions and unions of these regions, respectively. The regions are segmented using the MDL principle; their appearance is obtained from collections of images and compactly represented by parametric manifolds in the two eigenspaces spanned by the parts and the relations. Qualitative and quantitative experiments illustrating the potential of the representation for successful object recognition in the presence of clutter and occlusion are presented.

DTIC

*Clutter; Images*

**20070001736** SRI International Corp., Menlo Park, CA USA

**Evidential Reasoning: An Implementation for Multisensor Integration**

Lowrance, John D; Garvey, Thomas D; Dec 1983; 114 pp.; In English

Contract(s)/Grant(s): N00014-81-C-0115; F33615-80-C-1110

Report No.(s): AD-A458684; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458684>; Avail.: CASI: A06,

Hardcopy

One common feature of most knowledge-based expert systems is that they must draw conclusions on the basis of evidential information. Yet there is very little agreement on how this should be done. In this paper, the authors present their view of this problem and its solution for multisensor integration. They begin by characterizing evidence as information that is uncertain, incomplete, and sometimes inaccurate. On the basis of this characterization, they conclude that evidential reasoning requires both a method for pooling multiple bodies of evidence to arrive at a consensus and some means of drawing the appropriate conclusions from that consensus. They contrast their approach, which is based on a relatively new mathematical theory of evidence, with those that have their basis in Bayesian probability models. They believe that their method has significant advantages over Bayesian methods in its ability to represent and reason from bounded ignorance. They describe an implementation of these techniques by means of two kinds of memory: long-term memory and short-term memory. This implementation provides for automated reasoning from evidential information at multiple levels of abstraction over time and space.

DTIC

*Air Defense; Knowledge Based Systems; Multisensor Fusion*

**20070001738** SRI International Corp., Menlo Park, CA USA

**Detection and Correction of Repairs in Human-Computer Dialog**

Bear, John; Dowding, John; Shriberg, Elizabeth; May 5, 1992; 12 pp.; In English

Contract(s)/Grant(s): N00014-90-C-0085

Report No.(s): AD-A458689; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458689>; Avail.: CASI: A03,

Hardcopy

The authors have analyzed 607 sentences of spontaneous human-computer speech data containing repairs that were drawn from a total corpus of 10,718 sentences. In this paper, they present criteria and techniques for automatically detecting the presence of a repair, its location, and making the appropriate correction. The criteria involve integration of knowledge from several sources: pattern matching, syntactic and semantic analysis, and acoustics. In summary, disfluencies occur at high enough rates in human-computer dialog to merit consideration. In contrast to earlier approaches, the authors have made it their

goal to detect and correct repairs automatically, without assuming an explicit edit signal. Without such an edit signal, however, repairs are easily confused both with false positives and with other repairs. Preliminary results show that pattern matching is effective at detecting repairs without excessive overgeneration. Their syntactic/semantic approaches are quite accurate at detecting repairs and correcting them. Acoustics is a third source of information that can be tapped to provide evidence about the existence of a repair. While none of these knowledge sources by itself is sufficient, they propose that by combining them, and possibly others, one can greatly enhance one's ability to detect and correct repairs. As a next step, they intend to explore additional aspects of the syntax and semantics of repairs, analyze further acoustic patterns, and pursue the question of how best to integrate information from these multiple knowledge sources.

DTIC

*Computers; Correction; Detection; Human-Computer Interface; Linguistics; Maintenance; Natural Language Processing*

**20070001744** SRI International Corp., Menlo Park, CA USA

**A Tuneable Performance Grammar**

Robinson, Jane J; Sep 1975; 17 pp.; In English

Contract(s)/Grant(s): DAHC04-75-C-0006

Report No.(s): AD-A458700; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458700>; Avail.: CASI: [A03](#),  
Hardcopy

This paper describes a tuneable performance grammar currently being developed for speech understanding. It shows how attributes of words are defined and propagated to successively larger phrases, how other attributes are acquired, how factors reference them to help the parser choose among competing definitions to interpret the utterance correctly, and how these factors can easily be changed to adapt the grammar to other discourses and contexts. Factors that might be classified as 'syntactic' are emphasized, but the attributes they reference need not be, and seldom are, purely syntactic.

DTIC

*Grammars; Linguistics; Natural Language Processing; Speech Recognition; Tuning; Voice Communication*

**20070001746** SRI International Corp., Menlo Park, CA USA

**Semantic Processing for Speech Understanding**

Hendrix, Gary G; Sep 1975; 17 pp.; In English

Contract(s)/Grant(s): DAHC04-75-C-0006

Report No.(s): AD-A458706; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458706>; Avail.: CASI: [A03](#),  
Hardcopy

This paper describes aspects of the semantic component of the speech understanding system currently being developed jointly by SRI and SDC. The semantic component consists of two major parts: a semantic network coding a model of the task domain and a battery of semantic composition routines (SCRs) that are coordinated with the language definition (i.e., the 'grammar' for the speech understanding system). This paper concentrates exclusively on the interplay between these two major parts during parsing. However, the semantic component also plays important roles in knowledge management, discourse analysis, prediction, and question answering. The semantic component of the speech understanding system discussed here rules out phrase combinations that are not meaningful and produces semantic interpretations for combinations that are. The system consists of a semantic network model and routines that interact with it. The net is partitioned into a set of hierarchically ordered subnets, facilitating the encoding of higher-order predicates and the maintenance of multiple parsing hypotheses. Outputs from these routines are network fragments consisting of several subnets that in aggregate capture the interrelationships between a phrase's syntax and semantics.

DTIC

*Linguistics; Natural Language Processing; Parsing Algorithms; Semantics; Speech Recognition; Voice Communication*

**20070001750** Massachusetts Inst. of Tech., Cambridge, MA USA

**Acoustic-Phonetic Constraints in Continuous Speech Recognition: A Case Study Using the Digit Vocabulary**

Chen, Francine R; Jun 1985; 160 pp.; In English

Report No.(s): AD-A458727; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458727>; Avail.: CASI: [A08](#),  
Hardcopy

Many types of acoustic-phonetic constraints can be applied in speech recognition. Shipman and Zue proposed an isolated word recognition model in which sequential constraints are applied at a broad phonetic level to hypothesize word candidates. Detailed acoustic constraints are then applied on a subsequent phone representation to determine the best word from the

remaining word candidates. This thesis examines how their model can be extended to continuous speech. We used the recognition of continuously spoken digits as a case study. We first conducted a feasibility study in which words and word boundaries were hypothesized from an ideal broad phonetic representation of a digit string. We found that strong sequential constraints exist in continuous digit strings and used these results to extend the Shipman and Zue isolated word recognition model to continuous speech. The continuous speech model consists of three components: broad phonetic classifier, lexical component, and verifier. These components have been implemented for the digit vocabulary for the purpose of exploring how acoustic-phonetic constraints can be applied to natural speech. The broad phonetic classifier produces a string of broad phonetic labels from a set of parameters describing the speech signal. The lexical component uses knowledge about statistical characteristics of the output produced by the broad phonetic classifier to score each of the word hypothesis. Evaluation of this part of the system suggests that it can prune unlikely word candidates effectively. Nine acoustic features were defined to characterize phones for verifying each of the word candidates. Evaluation of the verifier on the digit vocabulary demonstrates the power of a phone-based representation and of using a few well-motivated acoustic features for describing phones in an acoustic-phonetic approach.

DTIC

*Phonetics; Speech Recognition*

**20070001877** Maryland Univ., College Park, MD USA

**Mapping Lexical Entries in a Verbs Database to WordNet Senses**

Green, Rebecca; Pearl, Lisa; Dorr, Bonnie J; Mar 2001; 10 pp.; In English

Contract(s)/Grant(s): EIA0130422; MDA9049-C6-1250

Report No.(s): AD-A458750; LAMP-TR-068; M CS-TR-4230; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper describes automatic techniques for mapping 9611 entries in a database of English verbs to WordNet senses. The verbs were initially grouped into 491 classes based on syntactic categories. Mapping these classified verbs into WordNet senses provides a resource that may be used for disambiguation in multilingual applications such as machine translation and cross-language information retrieval. Our techniques make use of (1) a training set of 1791 disambiguated entries representing 1442 verb entries from 167 of the categories; (2) word sense probabilities based on frequency counts in a previously tagged corpus; (3) semantic similarity of WordNet senses for verbs within the same class (4) probabilistic correlations between WordNet data and attributes of the verb classes. The best results achieved 72% precision and 58% recall., versus a lower bound of 62% precision and 38% recall for assigning the most frequently occurring WordNet sense, and an upper bound of 87% precision and 75% recall for human judgment.

DTIC

*Data Bases; English Language; Machine Translation; Sensory Perception*

**20070001899** Maryland Univ., College Park, MD USA

**Use of Minimal Lexical Conceptual Structures for Single-Document Summarization**

Dorr, Bonnie J; Habash, Nizar Y; Monz, Christof; Schwartz, Richard; Jun 2004; 13 pp.; In English

Contract(s)/Grant(s): IIS-0326553

Report No.(s): AD-A458797; LAMP-TR-113; CAR-TR-997; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This reports provides an overview of the findings and software that have evolved from the Use of Minimal Lexical Conceptual Structures for Single-Document Summarization project over the last six months. We present the major goals that have been achieved and discuss some of the open issues that we intend to address in the near future. This report also contains some details on the usage of some software that has been implemented during the project.

DTIC

*Linguistics; Natural Language Processing*

**20070001910** Massachusetts Inst. of Tech., Cambridge, MA USA

**A Geometric Projection-Space Reconstruction Algorithm**

Prince, Jerry L; Willsky, Alan S; Dec 13, 1988; 47 pp.; In English

Contract(s)/Grant(s): DAAL03-86-K-1071

Report No.(s): AD-A458813; LIDS-P-1841; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We present a method to reconstruct images from finite sets of noisy projections that may be available only over limited or sparse angles. The algorithm calculates the maximum a posteriori (MAP) estimate of the full sinogram (which is an image of the 2-D Radon transform of the object) from the available data. It is implemented using a primal-dual constrained

optimization procedure that solves a partial differential equation in the primal phase with an efficient local relaxation algorithm and uses a simple Lagrange multiplier update in the dual phase. The sinogram prior probability is given by a Markov random field (MRF) that includes information about the mass, center of mass, and convex hull of the object, and about the smoothness, fundamental constraints, and periodicity of the 2-D Radon transform. The object is reconstructed using convolution back projection applied to the estimated sinogram. We show several reconstructed objects which are obtained from simulated limited-angle and sparse angle data using the described algorithm, and compare these results to images obtained using convolution back projection directly.

DTIC

*Algorithms; Image Reconstruction; Tomography*

**20070002072** Massachusetts Inst. of Tech., Cambridge, MA USA

**Semantic Web Development**

Sep 2006; 66 pp.; In English

Contract(s)/Grant(s): F30602-00-2-0593; DARPA ORDER-K535; Proj-DAML

Report No.(s): AD-A458366; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Semantics; World Wide Web*

**20070002080** SRI International Corp., Menlo Park, CA USA

**Parametric Correspondence and Chamfer Matching: Two New Techniques for Image Matching**

Barrow, H G; Tenenbaum, J M; Bolles, R C; Wolf, H C; Jan 1977; 17 pp.; In English

Contract(s)/Grant(s): DAAG29-76-C-0057; NASW-2865

Report No.(s): AD-A458355; TN-153; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Parametric correspondence is a technique for matching images to a three dimensional symbolic reference map. An analytic camera model is used to predict the location and appearance of landmarks in the image, generating a projection for an assumed viewpoint. Correspondence is achieved by adjusting the parameters of the camera model until the appearances of the landmarks optimally match a symbolic description extracted from the image. The matching of image and map features is performed rapidly by a new technique, called 'chamfer matching', that compares the shapes of two collections of shape fragments, at a cost proportional to linear dimension, rather than area. These two techniques permit the matching of spatially extensive features on the basis of shape, which reduces the risk of ambiguous matches and the dependence on viewing conditions inherent in conventional image-based correlation matching.

DTIC

*Image Processing; Matching*

**64**

**NUMERICAL ANALYSIS**

Includes iteration, differential and difference equations, and numerical approximation.

**20070000670** California Univ., Davis, CA USA

**Theoretical Modeling of Molecular Mechanism, Time Scales, and Strains in Prion Diseases**

Cox, Daniel L; Singh, Rajiv R; Jul 2004; 131 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0480

Report No.(s): AD-A457967; No Copyright; Avail.: CASI: [A07](#), Hardcopy

We have obtained significant research results on: 1) modeling the role of oligomeric intermediates in prion disease incubation dynamics and aggregation; 2) using an amino acid specific metal ions in the octarepeat regions of the prion protein, and 4) developing stochastic algorithm models for aggregation processes in prion disease. In the coming year we will: 1) attempt to extend our monte carlo code to allow for beta-sheet interactions between peptides; 2) develop more realistic electronic structure models for metal ions in prion diseases; 3) extend our stochastic kinetics algorithm to the study of strains, first in prion-like proteins for yeast, and 4) explore the possibility of a novel, non-invasive detection scheme based upon observations of metal ions content fluctuations both in vivo and in vitro.

DTIC

*Algorithms; Diseases; Mathematical Models; Proteins*

**20070000743** Massachusetts Inst. of Tech., Cambridge, MA USA

**TECCNET: A Testbed for Evaluating Command and Control NETWORKS**

Ducot, Elizabeth R; Aug 1982; 73 pp.; In English

Contract(s)/Grant(s): AFOSR-80-0229

Report No.(s): AD-A458117; LIDS-R-1227; No Copyright; Avail.: CASI: **A04**, Hardcopy

TECCNET (Testbed for Evaluating Command and Control NETWORKS) is a small, expandable software system created to support C3 system research. It has been designed: 1) to highlight the complex interactions between the distributed command and control network elements, the information flow network and the environment within which the systems function, and 2) to support the development of an Information Intermediary between the C3 Network and the User. TECCNET is interactive and accommodates three basic user activities: definition of a model to simulated, generation of a scenario, and execution of an experiment. An initial modeling environment has been specified to simulate the management of the network. The algorithm used to demonstrate the system is one proposed by Golestaani as part of his PhD research, which treats flow control and routing together within a unified framework.

DTIC

*Algorithms; Command and Control; Communication Networks*

**20070000750** Iowa Univ., Iowa City, IA USA

**Added Masses and Forces on Two Bodies Approaching Central Impact in an Inviscid Fluid**

Landweber, Louis; Shahshahan, Ali; Jan 1991; 92 pp.; In English

Report No.(s): AD-A458126; IHR-346; No Copyright; Avail.: CASI: **A05**, Hardcopy

In several papers, which will be referenced, a procedure based on integral equations has been developed and applied for determining the interaction forces on two bodies approaching central impact in an inviscid fluid. The present work was undertaken to evaluate the accuracy of the results from that procedure by applying it to a pair of circles and a pair of spheres with which one could obtain solutions, as accurate as desired, by the method of successive images. A second purpose was to refine the procedure so that accurate solutions could be obtained at closer distances than heretofore. Solutions by the method of images, given by Hicks and Herman over 100 years ago, are not very clear, and since we have significantly extended their theory in the present work, it seemed appropriate to include a new derivation which we consider more rational. The extensions of the theory consists of: 1) a truncation correction of the infinite series of the doublet strengths for the added masses and their derivatives, which can then be calculated accurately with a moderate number of terms even when the gap between the bodies is very small; 2) asymptotic formulas for the added masses and their derivatives at small gaps which show that, for circles, the derivatives with respect to a parameter asymptotically proportional to the square root of the gap, are finite, and that derivatives with respect to the gap approach infinity inversely as the square root of the gap; 3) a treatment of the case of a circular cylinder or a sphere, or bodies of arbitrary shape approaching a wall, showing that the forces on the body and wall are repulsive and of equal magnitude.

DTIC

*Fluids; Inviscid Flow; Marine Technology; Offshore Platforms*

**20070000818** Maryland Univ., College Park, MD USA

**Document Image Compression and Analysis**

Kia, O; Apr 1997; 142 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250; NSF-EIA0130422

Report No.(s): AD-A458239; LAMP-TR-010; CFAR-TR-856; No Copyright; Avail.: CASI: **A07**, Hardcopy

Image compression usually considers the minimization of storage space as its main objective. It is desirable, however, to code images so that we have the ability to process the resulting representation directly. In this thesis we explore an approach to document image compression that is efficient in both space (storage requirement) and time (processing flexibility). A representation is presented in which component-level redundancy is removed by forming a prototype library and component location table. This representation forms a basis for compression and provides direct access to image components. To generate the prototype library, a new clustering approach is developed which is suitable for document image components. The distance metric is based on a character degradation model so that degraded versions of the same character will be grouped together. To achieve a lossless representation when required, the residuals are encoded efficiently using a structural distance ordering. OCR is then used as a measure of readability to evaluate the rate distortion tradeoff for lossy compression. A set of algorithms is presented for typical document processing applications which operate effectively on the compressed representation.

DTIC

*Algorithms; Data Compression; Image Processing; Images*

**20070000874** Massachusetts Inst. of Tech., Cambridge, MA USA

**Kalman Filtering and Riccati Equations for Descriptor Systems**

Nikoukhah, Ramine; Willsky, Alan S; Levy, Bernard C; Jan 1991; 37 pp.; In English

Contract(s)/Grant(s): AFOSR-88-0032; DAAL03-86-K-0171

Report No.(s): AD-A458383; LIDS-P-2017; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper we consider a general formulation of a discrete-time filtering problem for descriptor systems. It is shown that the nature of descriptor systems leads directly to the need to examine singular estimation problems. Using a 'dual approach' to estimation we derive a so-called '3-block' form for the optimal filter and a corresponding 3-block Riccati equation for a general class of time-varying descriptor models which need not represent a well-posed system in that the dynamics may be either over- or under-constrained. Specializing to the time-invariant case we examine the asymptotic properties of the 3-block filter, and in particular analyze in detail the resulting 3-block algebraic Riccati equation, generalizing significantly the results in [23, 28, 33]. Finally, the noncausal nature of discrete-time descriptor dynamics implies that future dynamics may provide some information about the present state. We present a modified form for the descriptor Kalman filter that takes this information into account.

DTIC

*Kalman Filters; Riccati Equation*

**20070001477** Massachusetts Inst. of Tech., Cambridge, MA USA

**Estimation for Boundary-Value Descriptor Systems**

Nikoukhah, Ramine; Adams, Milton B; Willsky, Alan S; Levy, Bernard C; Jul 1988; 47 pp.; In English

Contract(s)/Grant(s): AFOSR-88-0032; ECS-8700903

Report No.(s): AD-A458132; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper we consider models for noncausal processes consisting of discrete-time descriptor dynamics and boundary conditions on the values of the process at the two ends of the interval on which the process is defined. We discuss the general solution and well-posedness of systems of this type and then apply the method of complementary processes to obtain a specification of the optimal smoother in terms of a boundary-value descriptor Hamiltonian system. We then study the implementation of the optimal smoother. Motivated by the Hamiltonian diagonalization results for non-descriptor systems we show how the descriptor Hamiltonian dynamics can be transformed to two lower-order systems by the use of transformation matrices involving the solution of two generalized Riccati equations. We present several examples illustrating our results and the nature of the smoothing solution and also present equations for covariance analysis of boundary-value descriptor processes including the smoothing error.

DTIC

*Boundary Value Problems; Numerical Analysis*

**20070001627** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Stochastic Search for Signal Processing Algorithm Optimization**

Singer, Bryan; Veloso, Manuela; May 2001; 14 pp.; In English

Contract(s)/Grant(s): DABT63-98-1-0004

Report No.(s): AD-A458509; CMU-CS-01-137; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458509>; Avail.:

CASI: [A03](#), Hardcopy

Many difficult problems can be viewed as search problems. However, given a new task with an embedded search problem, it is challenging to state and find a truly effective search approach. In this paper, the authors address the complex task of signal processing optimization. They first introduce and discuss the complexities of this domain. In general, a single signal processing algorithm can be represented by a very large number of different but mathematically equivalent formulas. Unfortunately, when these formulas are implemented in actual code, their running times differ significantly. Signal processing algorithm optimization aims at finding the fastest formula. The authors present a new approach that successfully solves this problem using an evolutionary stochastic search algorithm, Split Tree Evolution for Efficient Runtimes (STEER), to search through the very large space of formulas. They empirically compare STEER against other search methods, including dynamic programming, exhaustive search, and random search, and show that STEER can find faster formulas while still only timing a very small portion of the search space.

DTIC

*Algorithms; Optimization; Signal Processing; Stochastic Processes; Transformations (Mathematics)*

**20070001632** Stanford Univ., Stanford, CA USA

**A Computing Cluster for Numerical Simulation**

Fedkiw, Ronald; Oct 23, 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0479

Report No.(s): AD-A458522; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458522>; Avail.: CASI: [A02](#), Hardcopy

The acquired computing cluster is used in the development of novel techniques for computational fluid dynamics and continuum mechanics, with a focus on large Eulerian or Lagrangian discretizations. Applications that receive particular emphasis include the following: (1) simulation of discontinuous flows resulting from the interaction of several immiscible or chemically reacting phases; (2) adaptive discretizations of large fluid volumes that can resolve turbulent flows and the effects of highly variable bottom topography; (3) coupling of Lagrangian deformable or rigid objects to Eulerian discretizations of fluid volumes; and (4) simulation of nonlinear and anisotropic elastic continua under extreme deformation, severe impact, and fracture scenarios. This report provides a summary of the applications and algorithms whose development was enabled by the acquisition of the equipment allowed by the grant. The author also outlines the impact of this parallel computing resource on their future research roadmap.

DTIC

*Algorithms; Biodynamics; Computational Fluid Dynamics; Computerized Simulation; Continuum Mechanics; Parallel Processing (Computers)*

**20070001635** Massachusetts Inst. of Tech., Cambridge, MA USA

**Strategy for Designing Error Detection Schemes for General Data Networks**

Simmons, Jane M; Aug 1993; 19 pp.; In English

Report No.(s): AD-A458525; LIDS-P-2189; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458525>; Avail.:

CASI: [A03](#), Hardcopy

Any real-world network system is subject to a variety of errors. Error detection mechanisms such as CRCs and length fields must be included along with the data to prevent errored data from being accepted as error-free by the destination. This paper identifies the fundamental issues involved with providing error protection and specifies guidelines for designing protocols that effectively and efficiently handle errors. A five step methodology is presented that provides insight into first, the order in which errors should be considered when designing an error detection scheme, second, which types of error detection mechanisms are most effective, and third, which layer should be responsible for detecting a given type of error.

DTIC

*Computer Networks; Detection; Errors*

**20070001636** Northeastern Univ., Boston, MA USA

**A Multiscale, Statistically-Based Inversion Scheme for Linearized Inverse Scattering Problems**

Miller, Eric L; Willsky, Alan S; Sep 13, 1994; 51 pp.; In English

Contract(s)/Grant(s): N00014-91-J-1004; AFOSR-92-J-0002

Report No.(s): AD-A458526; LIDS-P-2270; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458526>; Avail.:

CASI: [A04](#), Hardcopy

The application of multiscale and stochastic techniques to the solution of a linearized inverse scattering problem is presented. This approach allows for the explicit and easy handling of many difficulties associated with problems of this type. Regularization is accomplished via the use of a multiscale prior stochastic model which offers considerable flexibility for the incorporation of prior knowledge and constraints. We use the relative error covariance matrix (RECM), introduced in [20], as a tool for quantitatively evaluating the manner in which data contributes to the structure of a reconstruction. Given a set of scattering experiments, the RECM is used for understanding and analyzing the process of data fusion and allows us to define the space-varying optimal scale for reconstruction as a function of the nature (resolution, quality, and distribution of observation points) of the available measurement sets. Examples of our multiscale inversion algorithm are presented using the Born approximation of an inverse electrical conductivity problem formulated so as to illustrate many of the features associated with inverse scattering problems arising in fields such as geophysical prospecting and medical imaging.

DTIC

*Inverse Scattering; Inversions*



**20070001637** Massachusetts Inst. of Tech., Cambridge, MA USA

**A Multiscale Approach to Sensor Fusion and the Solution of Linear Inverse Problems**

Miller, Eric L; Willsky, Alan S; Dec 1993; 38 pp.; In English

Contract(s)/Grant(s): N00014-91-J-1004; AFOSR-92-J-0002

Report No.(s): AD-A458527; LIDS-P-2220; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458527>; Avail.:

CASI: **A03**, Hardcopy

The application of multiscale and stochastic techniques to the solution of linear inverse problems is presented. This approach allows for the explicit and easy handling of a variety of difficulties commonly associated with problems of this type. Regularization is accomplished via the incorporation of prior information in the form of a multiscale stochastic model. We introduce the relative error covariance matrix (RECM) as a tool for quantitatively evaluating the manner in which data contributes to the structure of a reconstruction. In particular, the use of a scale space formulation is ideally suited to the fusion of data from several sensors with differing resolutions and spatial coverage (eg. sparse or limited availability). Moreover, the RECM both provides us with an ideal tool for understanding and analyzing the process of multisensor fusion and allows us to define the space-varying optimal scale for reconstruction as a function of the nature (resolution, quality, and coverage) of the available data. Examples of our multiscale maximum a posteriori inversion algorithm are demonstrated using a two channel deconvolution problem formulated so as to illustrate many of the features associated with more general linear inverse problems.

DTIC

*Multisensor Fusion*

**20070001638** Massachusetts Inst. of Tech., Cambridge, MA USA

**Wavelet Transforms and Multiscale Estimation Techniques for the Solution of Multisensor Inverse Problems**

Miller, Eric L; Willsky, Alan S; Jan 1994; 13 pp.; In English

Contract(s)/Grant(s): N00014-91-J-1004; AFOSR-92-J-0002

Report No.(s): AD-A458528; LIDS-P-2224; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458528>; Avail.:

CASI: **A03**, Hardcopy

The application of multiscale and stochastic techniques to the solution of linear inverse problems is presented. This approach allows for the explicit and easy handling of a variety of difficulties commonly associated with problems of this type. Regularization is accomplished via the incorporation of prior information in the form of a multiscale stochastic model. We introduce the relative error covariance matrix (RECM) as a tool for quantitatively evaluating the manner in which data contributes to the structure of a reconstruction. In particular, the use of a scale space formulation is ideally suited to the fusion of data from several sensors with differing resolutions and spatial coverage (eg. sparse or limited availability). Moreover, the RECM both provides us with an ideal tool for understanding and analyzing the process of multisensor fusion and allows us to define the space-varying optimal scale for reconstruction as a function of the nature (resolution, quality, and coverage) of the available data. Examples of our multiscale maximum a posteriori inversion algorithm are demonstrated using a two channel deconvolution problem.

DTIC

*Estimating; Wavelet Analysis*

**20070001643** Massachusetts Inst. of Tech., Lexington, MA USA

**Computational Workloads for Commonly Used Signal Processing Kernels**

Arakawa, M; Nov 30, 2006; 79 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-0002; Proj-2222

Report No.(s): AD-A458534; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458534>; Avail.:

CASI: **A05**, Hardcopy

In the course of designing or evaluating signal processing algorithms, one often must determine the computational workload needed to implement the algorithms on a digital computer. The floating-point operation (flop) counts for real versions of the most common signal processing kernels are well documented. However, the flop counts for kernels operating on complex inputs are not as readily found. This report collects the flop count expressions for both real and complex kernels and also presents brief outlines of the derivations for the flop count expressions. Specifically, the following computational kernels are addressed: (1) the dimensions of the two multiplicands ( $m \times n$  and  $n \times p$ ) for the matrix-matrix multiplication; (2) the length of the vector  $n$  for the fast Fourier transform; (3) the size of the triangular system  $n$  for forward and back

substitutions; (4) the dimensions of the input matrix  $m \times n$  for the Householder QR decomposition, eigenvalue decomposition, and singular value decomposition.

DTIC

*Algorithms; Counting; Digital Computers; Floating Point Arithmetic; Signal Processing; Workloads (Psychophysiology)*

**20070001645** Carnegie-Mellon Univ., Pittsburgh, PA USA

**BitValue Inference: Detecting and Exploiting Narrow Bitwidth Computations**

Budiu, Mihai; Goldstein, Seth C; Jun 2000; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DABT63-96-C-0083

Report No.(s): AD-A458537; CMU-CS-00-141; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458537>; Avail.:

CASI: **A03**, Hardcopy

The authors present a compiler algorithm called BitValue, which can discover unused and constant bits in dusty-deck C programs. BitValue uses forward and backward dataflow analyses, generalizing constant-folding and dead-code detection at the bit-level. This algorithm enables compiler optimizations targeting special processor architectures for computing on non-standard bitwidths. Using this algorithm, they show that up to 36% of the computed bytes are thrown away. Also, they show that on average 26.8% of the values computed require 16 bits or less (for programs from SpecINT95 and Mediabench). A compiler for reconfigurable hardware uses this algorithm to achieve substantial reductions (up to 20-fold) in the size of the synthesized circuits.

DTIC

*Algorithms; C (Programming Language); Compilers; Detection; Inference*

**20070001664** Massachusetts Inst. of Tech., Cambridge, MA USA

**Expansions for Determinants and for Characteristics Polynomials of Stochastic Matrices**

Delyon, B; Aug 1988; 9 pp.; In English

Contract(s)/Grant(s): DAAL03-86-K-0171

Report No.(s): AD-A458571; LIDS-P-1802; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458571>; Avail.:

CASI: **A02**, Hardcopy

An expansion of the determinant of any matrix in terms of row sums and off-diagonal entries is given and used to obtain expressions for the coefficients of the characteristic polynomial of stochastic matrices.

DTIC

*Determinants; Polynomials; Stochastic Processes*

**20070001665** Massachusetts Inst. of Tech., Cambridge, MA USA

**On the Stability of Bilinear Stochastic Systems**

Delyon, B; Aug 1988; 13 pp.; In English

Contract(s)/Grant(s): DAAL03-86-K-0171

Report No.(s): AD-A458573; LIDS-P-1801; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458573>; Avail.:

CASI: **A03**, Hardcopy

We study the stability with probability one of the stochastic bilinear system  $dX = AX ds + BX dw$ , where A and B are fixed matrices and w is a Brownian motion. Bounds for the Lyapunov numbers associated with this equation are given. Bilinear noise models are, after linear ones, the second simplest case of stochastic systems; they may arise in many problems in which linear noise models are inappropriate (many examples are given in [6]). The aim of this paper is to give a condition for the stability with probability one of the d-dimensional Ito equation which describes the behavior of such a system

DTIC

*Probability Theory; Stability; Stochastic Processes*

**20070001690** Pennsylvania Univ., Philadelphia, PA USA

**One Sense Per Collocation**

Yarowsky, David; Jan 1993; 7 pp.; In English

Contract(s)/Grant(s): N00014-90-J-1863

Report No.(s): AD-A458621; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458621>; Avail.:

CASI: **A02**,  
Hardcopy

Previous work [Gale, Church and Yarowsky, 1992] showed that with high probability a polysemous word has one sense

per discourse. In this paper we show that for certain definitions of collocation, a polysemous word exhibits essentially only one sense per collocation. We test this empirical hypothesis for several definitions of sense and collocation, and discover that it holds with 90-99% accuracy for binary ambiguities. We utilize this property in a disambiguation algorithm that achieves precision of 92% using combined models of very local context.

DTIC

*Algorithms; Collocation*

**20070001752** Massachusetts Inst. of Tech., Cambridge, MA USA

**Differential Methods in Inverse Scattering**

Bruckstein, Alfred M; Levy, Bernard C; Kailath, Thomas; Aug 1983; 48 pp.; In English

Contract(s)/Grant(s): DAAG29-79-C-0215; DAAG29-81-K-0057

Report No.(s): AD-A458729; LIDS-P-1313; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458729>; Avail.:

CASI: **A03**, Hardcopy

This paper presents a new set of differential methods for solving the inverse scattering problem associated to the propagation of waves in an inhomogeneous medium. By writing the medium equations in the form of a two-component system describing the interaction of rightward and leftward propagating waves the causality of the propagation phenomena is exploited in order to identify the medium layer by layer. The recursive procedure that we obtain constitutes a continuous version of an algorithm first derived by Schur in order to test for the boundedness of functions analytic inside the unit circle. It recovers the local reflection coefficient function of the medium. Using similar ideas, some other differential methods are also derived to reconstruct alternative parametrizations of the layered medium in terms of the local impedance or of the potential function. One of these methods is known in the literature as the method of characteristics. The differential inverse scattering methods turn out to be very efficient since, in some sense, they let the medium perform the inversion by itself and thus fully exploit its structure. They provide an alternative to classical methods based on integral equations, which, in order to exploit the structure of the problem, must ultimately resort to differential equations of the same type.

DTIC

*Differential Equations; Inverse Scattering*

**20070001865** Maryland Univ., College Park, MD USA

**Approximating Large Convolutions in Digital Images**

Mount, D M; Kanungo, T; Netanyahu, N S; Piatko, C; Silverman, R; Wu, A Y; May 1999; 19 pp.; In English

Contract(s)/Grant(s): MDA904-96-C-1250

Report No.(s): AD-A458736; LAMP-TR-034; No Copyright; Avail.: CASI: **A03**, Hardcopy

Computing discrete two-dimensional convolutions is an important problem in image processing. In mathematical morphology, an important variant is that of computing binary convolutions, where the kernel of the convolution is a 0-1 valued function. This operation can be quite costly, especially when large kernels are involved. In this paper, we present an algorithm for computing convolutions of this form, where the kernel of the binary convolution is derived from a convex polygon. Because the kernel is a geometric object, we allow the algorithm some flexibility in how it elects to digitize the convex kernel at each placement, as long as the digitization satisfies certain reasonable requirements. We say that such a convolution is valid. Given this flexibility we show that it is possible to compute binary convolutions more efficiently than would normally be possible for large kernels. Our main result is an algorithm which, given an  $m \times n$  image and a  $k$ -sided convex polygonal kernel, computes a valid convolution in  $O(kmn)$  time. Unlike standard algorithms for computing correlations and convolutions, the running time is independent of the area or perimeter of  $K$ , and our techniques do not rely on computing fast Fourier transforms. Our algorithm is based on a novel use of Bresenham's line-drawing algorithm and prefix-sums to update the convolution efficiently as the kernel is moved from one position to another across the image.

DTIC

*Algorithms; Image Processing*

**20070001867** Maryland Univ., College Park, MD USA

**The Analysis of a Simple k-Means Clustering Algorithm**

Kanungo, T; Mount, D M; Netanyahu, N S; Piatko, C; Silverman, R; Wu, A Y; Jan 2000; 21 pp.; In English

Contract(s)/Grant(s): MDA904-96-C-1250

Report No.(s): AD-A458738; LAMP-TR-035; No Copyright; Avail.: CASI: **A03**, Hardcopy

K-means clustering is a very popular clustering technique which is used in numerous applications. Given a set of  $n$  data

points in  $R(\exp d)$  and an integer  $k$ , the problem is to determine a set of  $k$  points  $R(\exp d)$ , called centers, so as to minimize the mean squared distance from each data point to its nearest center. A popular heuristic for  $k$ -means clustering is Lloyd's algorithm. In this paper, we present a simple and efficient implementation of Lloyd's  $k$ -means clustering algorithm, which we call the filtering algorithm. This algorithm is very easy to implement. It differs from most other approaches in that it precomputes a  $kd$ -tree data structure for the data points rather than the center points. We establish the practical efficiency of the filtering algorithm in two ways. First, we present a data-sensitive analysis of the algorithm's running time. Second, we have implemented the algorithm and performed a number of empirical studies, both on synthetically generated data and on real data from applications in color quantization, compression, and segmentation.

DTIC

*Algorithms; Cluster Analysis*

**20070001868** Maryland Univ., College Park, MD USA

**Learning Algorithms for Audio and Video Processing: Independent Component Analysis and Support Vector Machine Based Approaches**

Qi, Yuan; Aug 2000; 53 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA904-96-C-1250

Report No.(s): AD-A458739; LAMP-TR-056; No Copyright; Avail.: CASI: A04, Hardcopy

In this thesis, we propose two new machine learning schemes, a subband-based Independent Component Analysis scheme and a hybrid Independent Component Analysis/Support Vector Machine scheme, and apply them to the problems of blind acoustic signal separation and face detection. Based on a linear model, classical Independent Component Analysis (ICA) provides a method of representing data as independent components. In contrast to Principal Component Analysis (PCA), which decorrelates the data based on its covariance matrix, ICA uses higher-order statistics of the data to minimize the dependence between the components of the system output. An important application of ICA is blind source separation. However, classical ICA algorithms do not work well for separation in the presence of noise or when performed on-line. Inspired by the psychoacoustic discovery that humans perceive and process acoustic signals in different frequency bands independently, we propose a new algorithm, subband-based ICA, that integrates ICA with time-frequency analysis to separate mixed signals. In subband-based ICA, the separations are performed in parallel in several frequency bands. Wavelet decomposition and best basis selection in wavelet/DCT packets can be incorporated into this algorithm.

DTIC

*Algorithms; Factor Analysis; Machine Learning*

**20070001869** Maryland Univ., College Park, MD USA

**A New MERIT Version for MPEG-2 Encoded Files**

Pagani, Alain; Sep 2000; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA904-96-C-1250

Report No.(s): AD-A458740; LAMP-TR-057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The MPEG Encoded Retrieval and Indexation Toolkit (MERIT) performs video segmentation of MPEG files in the compressed domain, using an algorithm based on macroblock type statistics. It was written in C by V. Kobla in 1995 for his doctoral work at the University of Maryland. Kobla's code dealt with MPEG-1 files only. In this report, we update MERIT to analyze MPEG-2 files as well. We modify the file parsing process to account for the MPEG-2 specifications. We account for the new motion compensation modes introduced by MPEG-2 specifications. We account for the new motion compensation modes introduced by MPEG-2 in preliminary computations, generating data structures that allow the original MERIT segmentation algorithm to work properly. A series of tests confirmed the validity of our solutions. The new version 4.0 of MERIT is a superset of MERIT 3.3, insofar as it gives the same results for MPEG-1 files, and is able to analyze MPEG-2 files using almost all the available options. Further improvements could be made to address key-frame storage and higher chrominance formats.

DTIC

*Algorithms; Data Compression; Image Processing; Motion Pictures*

**20070001872** Maryland Univ., College Park, MD USA

**A Point Matching Algorithm for Automatic Groundtruth Generation**

Kim, Doe-Wan; Kanungo, Tapas; Feb 2001; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA0949-6C-1250; N660010028910

Report No.(s): AD-A458743; LAMP-TR-064; CAR-TR-961; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Geometric groundtruth at the character, word, and line levels is crucial for developing and evaluating optical character recognition (OCR) algorithms. Kanungo and Haralick proposed a closed-loop methodology for generating character-level groundtruth for rescanned images. In this paper, we present a robust version of their methodology. We grouped the feature points and used a feature point registration algorithm on the grouped feature point set to estimate the transformation. The Euclidean distance between character centroids was used as the error metric. We performed experiments on the University of Washington data set.

DTIC

*Algorithms; Character Recognition*

**20070001873** Maryland Univ., College Park, MD USA

**Morphological Degradation Models and their Use in Document Image Restoration**

Zheng, Qigong; Kanungo, Tapas; Feb 2001; 20 pp.; In English

Contract(s)/Grant(s): 4400019848; N660010028910

Report No.(s): AD-A458744; LAMP-TR-065; CAR-TR-962; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Document images undergo various degradation processes. Numerous models of these degradation processes have been proposed in the literature. In this paper we propose a model-based restoration algorithm. The restoration algorithm first estimates the parameters of a degradation model and then uses the estimated parameters to construct a lookup table for restoring the degraded image. The estimated degradation model is used to estimate the probability of an ideal binary pattern, given the noisy observed pattern. This probability is estimated by degrading noise-free document images and then computing the frequency of corresponding noise-free and noisy pattern pairs. This conditional probability is then used to construct a lookup table to restore the noisy images. The impact of the restoration process is then quantified by computing the decrease in OCR word and character error rate. We find that given the estimated degradation model parameter values, the restoration algorithm decreases the character error rate by 16.1% and the word error rate by 7.35%. In some categories of degradation (e.g. model parameters that give rise to broken characters) there is a 41.5% reduction in character error rate and a 20.4% reduction in word error rate.

DTIC

*Algorithms; Degradation; Morphology; Numerical Analysis; Restoration*

**20070001874** Maryland Univ., College Park, MD USA

**A Downhill Simplex Algorithm for Estimating Morphological Degradation Model Parameters**

Kanungo, Tapas; Zheng, Qigong; Feb 2001; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 4400019848; N660010028910

Report No.(s): AD-A458745; LAMP-TR-066; CAR-TR-963; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Noise models are crucial for designing image restoration algorithms, generating synthetic training data, and predicting algorithm performance. However, to accomplish any of these tasks, an estimate of the degradation model parameters is essential. In this paper we describe a parameter estimation algorithm for a morphological, binary image degradation model. The inputs to the estimation algorithm are i) the degraded image, and ii) information regarding the font type (italic, bold, serif, sans serif). We simulate degraded images and search for the optimal parameter by looking for a parameter value for which the neighborhood pattern distributions in the simulated image and the given degraded image are most similar. The parameter space is searched using the Nelder-Mead downhill simplex algorithm. We use the p-value of the kolmogorov-Smirnov test for the measure of similarity between the two neighborhood pattern distributions. We show results of our algorithm on degraded document images.

DTIC

*Algorithms; Degradation; Estimating; Independent Variables; Morphology; Restoration*

**20070001880** Maryland Univ., College Park, MD USA

**Detection of Translational Equivalence**

Smith, Noah A; May 2001; 56 pp.; In English

Contract(s)/Grant(s): EIA0130422; MDA9049-C6-1250

Report No.(s): AD-A458755; LAMP-TR-071; CS-TR-4253; No Copyright; Avail.: Defense Technical Information Center (DTIC)

I propose a general algorithm for detecting translational equivalence between text samples in different languages. This algorithm is based on current approaches to duplicate detection, and it relies on information which can be automatically

learned from parallel text. I also show experimental results which support the hypothesis that translational equivalence is empirically observable. In addition, these results suggest profitable directions for improving performance on this recognition task.1.

DTIC

*Detection; Equivalence; Machine Translation*

**20070001888** Air Force Research Lab., Hanscom AFB, MA USA

**Statistical Analysis of the Non-Homogeneity Detector for STAP Applications**

Rangaswamy, Muralidhar; Michaels, James H; Himed, Braham; May 1, 2004; 16 pp.; In English

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

Report No.(s): AD-A458780; AFRL-SN-HS-JA-2001-1438; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We present a statistical analysis of the recently proposed non-homogeneity detector (NHD) for Gaussian interference statistics. Specifically, we show that a formal goodness-of-fit test can be constructed by accounting for the statistics of the generalized inner product (GIP) used as the NHD test statistic. The normalized-GIP follows a central-F distribution and admits a canonical representation in terms of two statistically independent chi-squared distributed random variables. Moments of the GIP can be readily calculated as a result. These facts are used to derive the goodness-of-fit tests, which facilitate intelligent training data selection. We then address the issue of space-time adaptive processing (STAP) algorithm performance using the NHD as a pre-processing step for training data selection. Performance of the adaptive matched filter (AMP) method is reported using simulated as well as measured data.

DTIC

*Detectors; Goodness of Fit; Homogeneity; Space-Time Adaptive Processing; Statistical Analysis; Statistical Tests*

**20070001905** California Univ., Santa Barbara, CA USA

**An Extension of the Argument Principle and Nyquist Criterion to Systems with Unbounded Generators**

Fardad, Makan; Bamieh, Bassam; Apr 17, 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0207; ECS-0323814

Report No.(s): AD-A458806; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The Nyquist Stability Criterion is generalized to systems where the (open-loop) system has infinite-dimensional input/output spaces and a (possibly) unbounded infinitesimal generator. This is done through use of the perturbation determinant and an extension of the Argument Principle to infinitesimal generators with trace-class resolvent.

DTIC

*Criteria; Perturbation Theory*

**20070001908** California Univ., Santa Barbara, CA USA

**A Multiple Time-Step Finite State Projection Algorithm for the Solution to the Chemical Master Equation**

Munsky, Brian; Khammash, Mustafa; Nov 30, 2006; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-D-0004

Report No.(s): AD-A458809; No Copyright; Avail.: CASI: [A03](#), Hardcopy

At the mesoscopic scale, chemical processes have probability distributions that evolve according to an infinite set of linear ordinary differential equations known as the chemical master equation (CME). It is commonly believed that the CME cannot be solved except for the most trivial of cases, but recent work has raised questions regarding validity of this belief. For many cases, Finite State Projection (FSP) techniques can reduce the order of the CME to a solvable system while retaining any prespecified error tolerance. Even when accuracy demands require a projection that is too large to be solved efficiently, the FSP retains the linearity of the CME, and is open to a host of additional model reductions and computational techniques. In this paper, we develop a new algorithm based upon the linearity property of super-positioning, and we illustrate the benefits of this algorithm on a simplified model of the heat shock mechanism in *E. coli*. The new algorithm retains the full accuracy of the original FSP algorithm, but with significantly increased efficiency and a greater range of applicability.

DTIC

*Algorithms; Equations*

**20070002027** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Duality and Auxiliary Functions for Bregman Distances (revised)**

Della Pietra, Stephen; Della Pietra, Vincent; Lafferty, John; Feb 10, 2002; 16 pp.; In English

Contract(s)/Grant(s): MDA904-00-C-2106; NSF CCR-9805366

Report No.(s): AD-A458535; CMU-CS-01-109R; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458535>; Avail.: CASI: [A03](#), Hardcopy

In this paper, the authors formulate and prove a convex duality theorem for minimizing a general class of Bregman distances subject to linear constraints. The duality result is then used to derive iterative algorithms for solving the associated optimization problem. Their presentation is motivated by the recent work of Collins, Schapire, and Singer (2001), who showed how certain boosting algorithms and maximum likelihood logistic regression can be unified within the framework of Bregman distances. In particular, specific instances of the results given here are used by Collins et al. (2001) to show the convergence of a family of iterative algorithms for minimizing the exponential or logistic loss. Following an introduction, Section 2 recalls the standard definitions from convex analysis that will be required, and presents the technical assumptions made on the class of Bregman distances that the authors work with. They also introduce some new terminology, using the terms Legendre-Bregman conjugate and Legendre-Bregman projection to extend the classical notion of the Legendre conjugate and transform to Bregman distances. Section 3 contains the statement and proof of the duality theorem that connects the primal problem with its dual, showing that the solution is characterized in geometrical terms by a Pythagorean equality. Section 4 defines the notion of an auxiliary function, which is used to construct iterative algorithms for solving constrained optimization problems. This section shows how convexity can be used to derive an auxiliary function for Bregman distances based on separable functions. The last section summarizes the main results of the paper.

DTIC

*Algorithms; Convexity; Distance; Duality Theorem; Iteration; Optimization; Theorems*

**20070002029** Carnegie-Mellon Univ., Pittsburgh, PA USA

### **Duality and Auxiliary Functions for Bregman Distances**

Della Pietra, Stephen; Della Pietra, Vincent; Lafferty, John; Oct 8, 2001; 16 pp.; In English

Contract(s)/Grant(s): MDA904-00-C-2106; NSF CCR-9805366

Report No.(s): AD-A458536; CMU-CS-01-109; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458536>; Avail.:

CASI: [A03](#), Hardcopy

In this paper, the authors formulate and prove a convex duality theorem for minimizing a general class of Bregman distances subject to linear constraints. The duality result is then used to derive iterative algorithms for solving the associated optimization problem. Their presentation is motivated by the recent work of Collins, Schapire, and Singer (2001), who showed how certain boosting algorithms and maximum likelihood logistic regression can be unified within the framework of Bregman distances. In particular, specific instances of the results given here are used by Collins et al. (2001) to show the convergence of a family of iterative algorithms for minimizing the exponential or logistic loss. Following an introduction, Section 2 recalls the standard definitions from convex analysis that will be required, and presents the technical assumptions made on the class of Bregman distances that the authors work with. They also introduce some new terminology, using the terms Legendre-Bregman conjugate and Legendre-Bregman projection to extend the classical notion of the Legendre conjugate and transform to Bregman distances. Section 3 contains the statement and proof of the duality theorem that connects the primal problem with its dual, showing that the solution is characterized in geometrical terms by a Pythagorean equality. Section 4 defines the notion of an auxiliary function, which is used to construct iterative algorithms for solving constrained optimization problems. This section shows how convexity can be used to derive an auxiliary function for Bregman distances based on separable functions. The last section summarizes the main results of the paper.

DTIC

*Algorithms; Convexity; Distance; Duality Theorem; Iteration; Optimization; Theorems*

## 65

### STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

**20070000756** California Univ., Berkeley, CA USA

### **Trading Memory for Randomness**

Chatterjee, Krishnendu; de Alfaro, Luca; Henzinger, Thomas A; Jan 2004; 13 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0327; N00014-02-1-0671

Report No.(s): AD-A458138; NSF-CCR-0132780; NSF-CCR-0234690; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Strategies in repeated games can be classified as to whether or not they use memory and/or randomization. We consider Markov decision processes and 2-player graph games, both of the deterministic and probabilistic varieties. We characterize

when memory and/or randomization are required for winning with respect to various classes of - regular objectives, noting particularly when the use of memory can be traded for the use of randomization. In particular, we show that Markov decision processes allow randomized memoryless optimal strategies for all Mueller objectives. Furthermore, we show that 2-player probabilistic graph games allow randomized memoryless strategies for winning with probability 1 those Mueller objectives which are upward-closed. Upward-closure means that if a set of infinitely repeating vertices is winning, then all supersets of alpha are also winning.

DTIC

*Game Theory; Markov Processes*

**20070000840** Library of Congress, Washington, DC USA

**USA Military Casualty Statistics: Operation Iraqi Freedom and Operation Enduring Freedom**

Fischer, Hannah; Jun 8, 2006; 6 pp.; In English

Report No.(s): AD-A458285; CRS-RS22452; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This report presents difficult-to-find statistics regarding U.S. military casualties in Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF, Afghanistan), including those concerning medical evacuations, amputations, and the demographics of casualties. Some of these statistics are publicly available at the Department of Defense's (DoD's) website, while others have been obtained through contact with experts at DoD. Daily updates of total U.S. military casualties in OIF and OEF can be found at the DoD's website, at [<http://www.dior.whs.mil/mmid/casualty/castop.htm>]. In addition, the CRS Report RS21578, 'Iraq: Summary of U.S. Casualties' is updated on a weekly basis. This report will be updated as needed.

DTIC

*Casualties; Defense Program; Demography; Military Operations; Military Personnel; Statistics; United States*

**20070000999** Department of the Navy, Washington, DC USA

**Data Clustering Method for Bayesian Data Reduction**

Lynch, Robert S, Inventor; Mar 20, 2006; 43 pp.; In English

Report No.(s): AD-D020266; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This invention is a method of training a mean-field Bayesian data reduction algorithm (BDRA) based classifier which includes using an initial training for determining the best number of levels. The Mean-Field BDRA is then retrained for each point in a target data set and training errors are calculated for each training operation. Cluster candidates are identified as those with multiple points having a common training error. Utilizing these cluster candidates and previously identified clusters as the identified target data, the clusters can be confirmed by comparing a newly calculated training error with the previously calculated common training error for the cluster. The method can be repeated until all cluster candidates are identified and tested.

DTIC

*Bayes Theorem; Data Reduction; Patent Applications*

**20070001194** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Reconstructing Spectral Scenes Using Statistical Estimation to Enhance Space Situational Awareness**

Dec 2006; 176 pp.; In English

Contract(s)/Grant(s): Proj-ENG06-167

Report No.(s): AD-A458448; AFIT/DS/ENG/06-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Situational Awareness; Statistical Analysis*

**20070001671** Geological Survey, Reston, VA USA, Bureau of Reclamation, Washington, DC, USA, Interior Dept., Washington, DC USA

**Cluster Analysis of Water-Quality Data for Lake Sakakawea, Audubon Lake, and McClusky Canal, Central North Dakota, 1990-2003**

Ryberg, K. R.; January 2006; 47 pp.; In English

Report No.(s): PB2007-102704; USGS-SIR-2006-5202; No Copyright; Avail.: CASI: [A03](#), Hardcopy

As a result of the Dakota Water Resources Act of 2000, the Bureau of Reclamation, U.S. Department of the Interior, identified eight water-supply alternatives (including a no-action alternative) to meet future water needs in portions of the Red River of the North (Red River) Basin. Of those alternatives, four include the interbasin transfer of water from the Missouri



River Basin to the Red River Basin. Three of the interbasin transfer alternatives would use the McClusky Canal, located in central North Dakota, to transport the water. Therefore, the water quality of the McClusky Canal and the sources of its water, Lake Sakakawea and Audubon Lake, is of interest to water-quality stakeholders. The Bureau of Reclamation collected water-quality samples at 23 sites on Lake Sakakawea, Audubon Lake, and the McClusky Canal system from 1990 through 2003. Physical properties and water-quality constituents from these samples were summarized and analyzed by the U.S. Geological Survey using hierarchical agglomerative cluster analysis (HACA). HACA separated the samples into related clusters, or groups. These groups were examined for statistical significance and relation to structure of the McClusky Canal system.

NTIS

*Canals; Cluster Analysis; Lakes; Pollution Monitoring; Water Pollution; Water Quality*

**20070001747** SRI International Corp., Menlo Park, CA USA

**Subjective Bayesian Methods for Rule-Based Inference Systems**

Duda, Richard O; Hart, Peter E; Nilsson, Nils J; Jan 1976; 25 pp.; In English

Contract(s)/Grant(s): DAHC04-75-C-0005

Report No.(s): AD-A458708; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458708>; Avail.: CASI: A03, Hardcopy

The general problem of drawing inferences from uncertain or incomplete evidence has invited a variety of technical approaches, some mathematically rigorous and some largely informal and intuitive. Most current inference systems in artificial intelligence have emphasized intuitive methods because the absence of adequate statistical samples forces a reliance on the subjective judgment of human experts. In this paper, the authors describe a subjective Bayesian inference method that realizes some of the advantages of both formal and informal approaches. Of particular interest are the modifications needed to deal with the inconsistencies usually found in collections of subjective statements.

DTIC

*Bayes Theorem; Inference*

**20070001864** Maryland Univ., College Park, MD USA

**Relevance Ranking of Video Data using Hidden Markov Model Distances and Polygon Simplification**

DeMenthon, Daniel; Latecki, Longin J; Rosenfeld, Azriel; Stueckelberg, Marc V; Mar 2001; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA9049-6C-1250

Report No.(s): AD-A458732; LAMP-TR-067; CAR-TR-964; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A video can be mapped into a multidimensional signal in a non-Euclidean space, in a way that translates the more predictable passages of the video into linear sections of the signal. These linear sections can be filtered out by techniques similar to those used for simplifying planar curves. Different degrees of simplification can be selected. We have refined such a technique so that it can make use of probabilistic distances between statistical image models of the video frames. These models are obtained by applying hidden Markov model techniques to random walks across the images. Using our techniques, a viewer can browse a video at the level of summarization that suits his patience level. Applications include the creation of a smart fast-forward function for digital VCRs, and the automatic creation of short summaries that can be used as previews before videos are downloaded from the Web.

DTIC

*Distance; Markov Processes; Polygons; Ranking; Simplification; Video Data*

**20070001885** Maryland Univ., College Park, MD USA

**Improved Word-Level Alignment: Injecting Knowledge about MT Divergences**

Dorr, Bonnie J; Pearl, Lisa; Hwa, Rebecca; Habash, Nizar; Feb 14, 2002; 11 pp.; In English

Contract(s)/Grant(s): EIA0130422; MDA9049-C6-1250

Report No.(s): AD-A458774; LAMP-TR-082; CS-TR-4333; No Copyright; Avail.: CASI: A03, Hardcopy

Word-level alignments of bilingual text (bitexts) are not an integral part of statistical machine translation models, but also useful for lexical acquisition, treebank construction, and part-of-speech tagging. The frequent occurrence of divergences, structural differences between languages, presents a great challenge to the alignment task. We resolve some of the most prevalent divergence cases by using syntactic parse information to transform the sentence structure of one language to bear

a closer resemblance to that of the other language. In this paper, we show that common divergence types can be found in multiple language pairs (in particular, we focus on English-Spanish and English-Arabic) and systematically identified. We describe our techniques for modifying English parse trees to form resulting sentences that share more similarity with the sentences in the other languages; finally, we present an empirical analysis comparing the complexities of performing word-level alignments with and without divergence handling. Our results suggest that divergence-handling can improve word-level alignment.

DTIC

*Divergence; Machine Translation; Statistical Analysis; Words (Language)*

**20070001892** Defence Science and Technology Organisation, Edinburgh, Australia

**Kinematic and Attribute Fusion Using a Bayesian Belief Network Framework**

Krieg, Mark L; Aug 2006; 50 pp.; In English

Report No.(s): AD-A458785; DSTO-RR-0315; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The focus of tracking applications has traditionally centred on kinematic state estimation. However, attribute information has the potential to not only provide identity and class information, but it may also improve data association and kinematic tracking performance. Bayesian Belief Networks provide a framework for specifying the dependencies between kinematic and attribute states. Algorithms based on this framework are developed for joint kinematic and attribute data association, kinematic tracking, attribute state estimation, and joint kinematic and attribute tracking. The algorithms are demonstrated using simulated tracking scenarios.

DTIC

*Bayes Theorem; Belief Networks; Kinematics*

**20070001895** Massachusetts Inst. of Tech., Cambridge, MA USA

**Decentralized Estimation of Linear Gaussian Systems**

Castanon, David A; Jan 1981; 30 pp.; In English

Contract(s)/Grant(s): AFOSR-80-0229

Report No.(s): AD-A458792; LIDS-P-1167; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper, we propose a framework for the design of linear decentralized estimation schemes based on a team-theoretic approach. We view local estimates as 'decisions' which affect the information received by other decision makers. Using results from team theory, we provide necessary conditions for optimality of the estimates. For fully decentralized structures, these conditions provide a complete closed-form solution of the estimation problem. The complexity of the resulting estimation algorithms is studied as a function of the performance measure, and in the context of some simple examples.

DTIC

*Linear Systems; Linearity*

**20070001900** George Washington Univ., Washington, DC USA

**Model-Based Clustering, Discriminant Analysis, and Density Estimation**

Fraley, Chris; Raftery, Adrian E; Oct 2000; 47 pp.; In English

Contract(s)/Grant(s): N00014-96-1-0192; N00014-96-1-0330

Report No.(s): AD-A458798; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Cluster analysis is the automated search for groups of related observations in a data set. Most clustering done in practice is based largely on heuristic but intuitively reasonable procedures and most clustering methods available in commercial software are also of this type. However, there is little systematic guidance associated with these methods for solving important practical questions that arise in cluster analysis, such as 'How many clusters are there?' 'Which clustering method should be used?' and 'How should outliers be handled?'. We outline a general methodology for model-based clustering that provides a principled statistical approach to these issues. We also show that this can be useful for other problems in multivariate analysis, such as discriminant analysis and multivariate density estimation. We give examples from medical diagnosis, minefield detection, cluster recovery from noisy data, and spatial density estimation. Finally, we mention limitations of the methodology, and discuss recent developments in model-based clustering for non-Gaussian data, high-dimensional datasets, large datasets, and Bayesian estimation.

DTIC

*Discriminant Analysis (Statistics)*

**20070001911** California Univ., Santa Barbara, CA USA

**Model Reduction Using Multiple Time Scales in Stochastic Gene Regulatory Networks**

Peles, Slaven; Munsky, Brian; Khammash, Mustafa; Aug 28, 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-D-0004

Report No.(s): AD-A458845; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Gene network dynamics often involves processes that take place on widely differing time scales -- from the order of nanoseconds to the order of several days. Multiple time scales in mathematical models often lead to serious computational difficulties, such as numerical stiffness in the case of differential equations or excessively redundant Monte Carlo simulations in the case of stochastic processes. We present a method that takes advantage of multiple time scales and dramatically reduces the computational time for a broad class of problems arising in stochastic gene regulatory networks. We illustrate the efficiency of our method in two gene network examples, which describe two substantially different biological processes -- cellular heat shock response and expression of the pap gene in Escherichia coli bacteria.

DTIC

*Genes; Mathematical Models; Networks; Regulators; Stochastic Processes*

66

**SYSTEMS ANALYSIS AND OPERATIONS RESEARCH**

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

**20070000700** Army Engineer Research and Development Center, Vicksburg, MS USA

**How to User CGWAVE with SMS: An Example for Tedious Creek Small Craft Harbor**

Briggs, Michael J; Donnell, Barbara P; Demirbilek, Zeki; Mar 2004; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458022; ERDC/CHL-CHETN-I-68; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This Coastal and Hydraulics Engineering Technical Note (CHETN) presents an example of how to use the numerical model CGWAVE within the Surface Water Modeling System (SMS) Version 8.0 environment. Updates of SMS are frequent and may result in different control options. This CHETN was completed as part of the Tedious Creek, MD, work unit of the Monitoring Completed Navigation Projects program. The SMS is a comprehensive graphical user interface (GUI) for model conceptualization, mesh generation, statistical interpretation, and visual examination of surface-water model simulation results. The version described herein is SMS Version 8.1. It is the main model delivery system with pre- and post-processor capabilities for all the CHL numerical models including ADCIRC, TABS (RMA2, RMA4, SED2D), ADH, HiVEL, M2D, STWAVE, BOUSS2D, and CGWAVE. These integrated or interconnected models provide circulation and/or wave climate from a range of coastal processes including waves and currents, sediment transport and morphology change, channel infilling and inlet morphology, and dredged material fate. SMS provides the tools and macros for editing and display for mesh development, coordinate conversion, model connectivity, animations, and comparisons.

DTIC

*Graphical User Interface; Harbors; Mathematical Models*

**20070000705** Air Force Research Lab., Rome, NY USA

**Scenario Technology for Planning C2 Exercises**

Burns, Carla; Jan 1999; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-96-C-0050

Report No.(s): AD-A458036; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Over the years, military exercises have proven to increase our country's effectiveness in actual missions. However, the exercise planning process is a time consuming activity that can span anywhere from months to years. Scenarios are often used during C2 exercise planning and execution to portray training tasks in the context of real-world situations. Exercise scenarios typically originate as a few high level paragraphs or pages of textual and/or graphical information and evolve into very detailed events as the exercise planning process progresses. The development of a detailed scenario to support an exercise is a time consuming process that often accounts for a large portion of the exercise planning cycle. Thus, there is a need for technology that enhances the exercise planning process by shortening the amount of time it takes to create and validate detailed exercise scenarios against training tasks and available resources. This paper discusses the capabilities of the Air Defense Exercise Planning Tool (ADEPT). The goal of the ADEPT technology is to shorten the exercise planning cycle by providing automated scenario development, analysis and generation capabilities. In addition, the paper addresses current limitations of existing

scenario technology, the results of small pilot project and future capabilities for ADEPT.  
DTIC

*Planning; Technological Forecasting*

**20070000715** Carnegie-Mellon Univ., Pittsburgh, PA USA

**On Generating Hypotheses Using Computer Simulations**

Carley, Kathleen M; Jan 1999; 7 pp.; In English

Contract(s)/Grant(s): N00014-97-1-0037

Report No.(s): AD-A458065; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Computational models of complex systems, such as teams, task forces, and organizations can be used to reason about the behavior of those systems under diverse conditions. The large number of integrated processes and variables, and the non-linearities inherent in the underlying processes make it difficult for humans, unassisted by computer simulations, to effectively reason about the consequences of any one action. Computer simulation becomes an important tool for generating hypotheses about the behavior of these systems that can then be tested in the lab and field.

DTIC

*Computerized Simulation; Hypotheses*

**20070000749** General Electric Co., Cincinnati, OH USA

**Shipbuilder/Supplier Design Process (The National Shipbuilding Research Program)**

Condon, Richard C; Sep 1992; 11 pp.; In English

Report No.(s): AD-A458125; NSRP 0383; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The cost of warships has increased dramatically in recent years. Much of this increase is certainly justifiable in terms of enhanced capability -- but not all. A sizable portion can also be attributed to a design process for major equipment that does not pass a cost/value-added screen. There was a time when this process was less complicated, less controlled, and much less costly. Depending on the type of warship, up to 2/3 of the total cost of a lead ship can be attributed to components that are designed and manufactured by the non-shipbuilder supplier base. As such a large part of the total cost, any serious effort to reduce the cost of warship production must include a rigorous review of the process that produces these components. One way to reduce the cost of designing prototype equipment is to better define the roles and responsibilities of the participants. This simple step would go a long way in preventing overlapping activities with their ensuing duplication of effort and non-value added work that has become common in recent years. But in order to provide a clear and concise definition of responsibility and accountability for each participant in the process, it is first necessary to define the total process. As Dr. Deming teaches it is only in the context of the total process that meaningful improvements can be achieved. This paper presents one approach to reducing shipbuilding costs by utilizing the equipment specification to define and optimize the machinery design process. To the extent that the design process of major Hull, Mechanical, and Electrical equipment (HM&E) is similar to other shipboard equipment, the conclusions and recommendations may be applicable. Since the writer's experience is limited to a prime contractor of HK&E equipment, applicability to other equipment is left to the reader.

DTIC

*Design Analysis; Marine Technology; Prototypes; Ships*

**20070000755** Massachusetts Inst. of Tech., Cambridge, MA USA

**Early Pragmatic Language Development for an Infant Robot**

Varchavskaia, Paulina; Feb 2002; 116 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DABT63-00-C-10102

Report No.(s): AD-A458137; No Copyright; Avail.: CASI: [A06](#), Hardcopy

Recent years have seen the growth of the idea in AI that machines can be designed as sociable creatures: that interacting with a robot could and should be as natural as talking to a fellow human and that machine learning could be achieved in a benevolent environment with a human teacher in ways that similar to children's learning. The two components of the future natural teaching of robots are a maximally natural interface and fast learning of categories and tasks from few examples. A natural interface lets humans intuitively use all the discourse cues and displays normally present in conversation. Sociable machines are embodied creatures which encourage natural interaction from humans and pick up on those cues and displays for the development of their own abilities, such as learning to perform new tasks, or learning to express themselves. This thesis describes a system that engages in such interactions and grounds its vocalizations in a manner inspired by the way human infants establish a communicative basis with their teachers and learn the meaning of words by engaging in functionally,

pragmatically meaningful communication. It is a module of proto-linguistics behaviors designed and implemented on a robotic head that was already developed in the Artificial Intelligence Laboratory.

DTIC

*Artificial Intelligence; Natural Language (Computers); Robots*

**20070000821** Society of Naval Architects and Marine Engineers, Jersey City, NJ USA

**Standardized Designs Within a Shipyard - Basing Decisions on Costs Versus Returns**

Soik, Tom; Sep 1992; 13 pp.; In English

Report No.(s): AD-A458243; No Copyright; Avail.: CASI: [A03](#), Hardcopy

While the US. shipbuilding industry strives to establish a program of standards on national level the concept of internal (company) design standards is often neglected as a basic principle of industrial economics. Most shipyard executives will readily agree with the basic concepts is standardization. but open closer examination it appears that with a few exceptions the level of implemented standardization within U.S. shipyards lags significantly behind that of other industries and shipyards in competing nations. The initial reasons for this are many and varied but it is usually reduced to the problem of identifying specific opportunities for standardization of design and quantifying potential savings. This paper will define the principles of design standardization as they apply to the internal functions of a shipyard and examine the economic factors that drive their implementation. Within its limited length and scope it attempts to provide vision of basic economic principle applied to its optimum effectiveness in U.S. shipbuilding.

DTIC

*Costs; Design Analysis; Marine Technology; Ships; Shipyards; Standardization*

**20070000865** Mitre Corp., McLean, VA USA

**Object-Oriented Analysis of a DII COE Simulation Product Line Architecture**

Sprinkle, Ronald B; Sudnikovich, William P; Carr, Francis H; Jan 2001; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458348; PAPER-01F-SIW-026; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Army has articulated a vision in which simulations will support C4ISR systems through the integration of simulation infrastructure into the Defense Information Infrastructure Common Operating Environment (DII COE) software architecture. Identification of a specific simulation infrastructure product set is the key to developing the technical steps required to achieve this vision. Integrating simulation into the DII COE in a systematic fashion requires the following: (1) reuse by the simulation infrastructure of existing DII COE C4ISR software segments (2) identification of new segments required to provide DII COE-based simulation capability, and (3) identification of new simulation-enhanced C4ISR functionality not available today in either C4ISR or simulation domains through new DII COE segments. As simulation-enhanced C4ISR systems will use intelligent agent software, there are relevant Future Combat Systems (FCS) implications. FCS C2 systems will need to interact with intelligent agent-based robotic forces and will encounter similar challenges identified for future simulation-enhanced C4ISR systems. This paper describes a general Object-Oriented Analysis based approach, which identifies DII COE segments as software products in a Product Line Architecture. The paper concludes with recommendations for use of the DII COE Simulation Product Line Architecture in achieving the Army simulation to C4ISR interoperability vision.

DTIC

*Command and Control; Computer Programming; Computerized Simulation; Defense Program; Interoperability; Object-Oriented Programming; Requirements; Simulation; Software Engineering*

**20070001149** Office of the Assistant Secretary of Defense, Washington, DC USA

**Confrontation Analysis: How to Win Operations Other Than War**

Howard, Nigel; Aug 1999; 316 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458371; No Copyright; Avail.: CASI: [A14](#), Hardcopy

This book is based on research commissioned by the UK's Defence Evaluation and Research Agency (DERA) in 1997 into how Confrontation Analysis might be applied to Peace Support Operations. The book presents a simple idea: a Peace Operations campaign (or Operation Other Than War) should be seen as a linked sequence of confrontations in contrast to a traditional, warfighting campaign, which is a linked sequence of battles. The objective in each confrontation is to bring about certain 'compliant' behavior on the part of other parties, until in the end the campaign objective is reached. This is a state of sufficient compliance to enable the military to leave the theater. If this simple idea is accepted, one can show how the new technique of Confrontation Analysis (derived from Game Theory) can be applied to win an Operation Other Than War. Since

this book was written, further research carried out in the Bosnia theater has clearly revealed that Special Forces commanders are already doing it. They are winning confrontations, or campaigns, made up of linked sequences of confrontations on a day-to-day basis. But they are doing it without a clear, uniform system of concepts specifically designed for a confrontational campaign. Using practical good sense, they are instead taking doctrinal concepts developed primarily for warfighting, and adapting them for use in confrontations. For example, they are using concepts of artillery targeting to plan how to 'target' noncompliant parties (e.g., a local Mayor and police chief who are refusing to provide security for returning refugees from a different ethnic group). Such common-sensical adaptation of standard warfighting systems and concepts is admirable, and it works. The author believes, however, that a system that treats confrontations as confrontations, distinguishing them from battles both conceptually and in terms of planning procedures, will make British forces still more effective.

DTIC

*Game Theory; Military Operations; Strategy; System Effectiveness; Warfare*

**20070001592** Army Communications-Electronics Command, Fort Belvoir, VA USA

**Performance Characterization of LEXFOAM from Hand-Held Systems**

Jan 2006; 9 pp.; In English

Report No.(s): AD-A458400; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Performance Tests; Computer Systems Performance; Specifications*

**20070001723** Carnegie-Mellon Univ., Pittsburgh, PA USA

**CMMI(Trademark) Acquisition Module (CMMI-AM) Version 1.0**

Bernard, Tom; Gallagher, Brian; Bate, Roger; Wilson, Hal; Feb 2004; 48 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A458667; CMU/SEI-20040TR-001; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458667>;

Avail.: CASI: [A03](#), Hardcopy

Building on relevant best practices extracted from the Capability Maturity Model Integration (CMMI) Framework, this report defines effective and efficient practices for government acquisition organizations. Acquisition best practices are focused inside the acquisition organization to ensure the acquisition is conducted effectively, and outside the acquisition organization as it conducts project monitoring and control of its suppliers. These best practices provide a foundation for acquisition process discipline and rigor that enables product and service development to be repeatedly executed with high levels of ultimate acquisition success. This report contains the acquisition practices that should be performed by government acquisition organizations acquiring systems and/or services. These practices, however, can also be used by non-government organizations to improve their acquisition practices. This report does not contain prescribed implementation approaches for achieving acquisition best practices. Instead, the proven content of the CMMI Framework is used as a base and amplifications specific to the acquisition process are added. Questions related to CMMI process areas are provided in the appendix to help managers and executives understand the acquisition organization's documented acquisition practices and the consistent application of those practices. Descriptions of implementation details can be found in the source documents listed in the bibliography.

DTIC

*Acquisition; Management Planning; Mathematical Models; Modules*

**20070001863** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Existence of Multiagent Equilibria with Limited Agents**

Bowling, Michael; Veloso, Manuela; Jan 2002; 18 pp.; In English

Contract(s)/Grant(s): F30602-00-2-0549; F30602-98-2-0135

Report No.(s): AD-A458507; CMU-CS-02-104; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Multiagent learning is a necessary yet challenging problem as multiagent systems become more prevalent and environments become more dynamic. Much of the groundbreaking work in this area draws on notable results from the game theory community. Nash Equilibria, in particular, is a very important concept to multiagent learning. Learners that directly learn equilibria obviously rely on their existence. Learners that instead seek to play optimally with respect to the other players also depend upon equilibria since equilibria are, and are the only, learning fixed points. From another perspective, agents with limitations are real and common, both agents with undesired physical limitations as well as self-imposed rational limitations. This paper explores the interactions of these two important concepts, examining whether equilibria continue to exist when agents have limitations. The authors look at the general effects limitations can have on agent behavior, and define a natural

extension of equilibria that accounts for these limitations. They show that existence cannot be guaranteed in general, but prove existence under certain classes of domains and agent limitations. These results have wide applicability, as they are not tied to any particular learning algorithm or specific instance of agent limitations. The authors then present empirical results from a specific multiagent learner applied to a specific instance of limited agents. These results demonstrate that learning with limitations is possible, and that their theoretical analysis of equilibria under limitations is relevant.

DTIC

*Artificial Intelligence; Computer Programming; Game Theory; Machine Learning; Robotics; Software Engineering*

**20070001881** Human Resources Research Organization, Alexandria, VA USA

**Modeling Army Applicants' Job Choices: The Enlisted Personnel Allocation System (EPAS) Simulation Job Choice Model (JCM)**

Diaz, Tirso; Ingerick, Michael; Sticha, Paul; Nov 2006; 78 pp.; In English

Contract(s)/Grant(s): GS07T00BGD0057; Proj-D730

Report No.(s): AD-A458765; HUMRRO-IR-04-65; No Copyright; Avail.: CASI: [A05](#), Hardcopy

To ensure that the EPAS Field Test Simulation provides a realistic and unbiased evaluation of the optimization potential of EPAS, a model simulating Army applicants' job choice decisions is needed. This report summarizes development and evaluation of an empirically-grounded Job Choice Model (JCM), which relates applicants' aptitude scores, demographic characteristics, and job opportunity attributes (including monetary incentives) to their actual choices. As with real-world applicant decisions, it will be possible under the JCM for a given applicant to decide not to join the Army (not access). Similarly, if the applicant elects to join the Army (access), the JCM can simulate the applicant's choice of one of the many MOS reception-station date (job) opportunities from their job list. By sequentially modeling actual applicants' choice behavior, the JCM provides a realistic approximation of applicants' decision-making processes for simulation purposes. Evaluation of the JCM demonstrates that the model effectively simulates applicants' job choice decisions.

DTIC

*Decision Making; Mathematical Models; Military Personnel; Personnel; Selection; Simulation; Tasks*

**20070001884** Knowledge Analysis Technologies, Boulder, CO USA

**The Software Therapist: Usability Problem Diagnosis Through Latent Semantic Analysis**

Sparks, Randall; Hartson, Rex; Jun 14, 2006; 103 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-C-0057

Report No.(s): AD-A458771; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The work we report on here addresses the problem of low return on investment in software usability engineering and offers support for usability practitioners in identifying, understanding, documenting, and fixing usability problems. It does this by (1) validating and extending a structured knowledge framework of usability concepts for organizing and relating usability data to design flaws and solutions, (2) specifying a usability data management cycle to support a diagnosis process that is iteratively interleaved with data collection, and (3) developing a software system for usability engineering practitioners that includes components to support the activities of usability data collection, organization, and problem analysis and reporting, as well as automated support for usability problem diagnosis using a sophisticated statistical technique for the analysis of text. In this report, we briefly review the motivations and background for this work and describe the User Action Framework (UAF) and Latent Semantic Analysis (LSA); describe the design, development, and use of the Software Therapist system; discuss the research done on applying LSA to usability engineering; describe the usability content library collected as part of the project; and discuss the evaluation of the system as well as some lessons learned and possible future directions resulting from the project.

DTIC

*Computer Programming; Diagnosis; Semantics*

**20070002067** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Selected Systems Engineering Process Deficiencies and Their Consequences**

Thomas, Lawrence Dale; [2006]; 18 pp.; In English; International Astronautical Congress/International Astronautical Federation, 2-6 Oct. 2006, Valencia, Spain; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070002067>; Avail.:

CASI: [A03](#), Hardcopy

The systems engineering process is well established and well understood. While this statement could be argued in the light of the many systems engineering guidelines and that have been developed, comparative review of these respective descriptions

reveal that they differ primarily in the number of discrete steps or other nuances, and are at their core essentially common. Likewise, the systems engineering textbooks differ primarily in the context for application of systems engineering or in the utilization of evolved tools and techniques, not in the basic method. Thus, failures in systems engineering cannot credibly be attributed to implementation of the wrong systems engineering process among alternatives. However, numerous systems failures can be attributed to deficient implementation of the systems engineering process. What may clearly be perceived as a system engineering deficiency in retrospect can appear to be a well considered system engineering efficiency in real time - an efficiency taken to reduce cost or meet a schedule, or more often both. Typically these efficiencies are grounded on apparently solid rationale, such as reuse of heritage hardware or software. Over time, unintended consequences of a systems engineering process deficiency may begin to be realized, and unfortunately often the consequence is system failure. This paper describes several actual cases of system failures that resulted from deficiencies in their systems engineering process implementation, including the Ariane 5 and the Hubble Space Telescope.

Author

*Systems Engineering; Real Time Operation; Hubble Space Telescope; Ariane 5 Launch Vehicle; Computer Programs; System Failures*

**20070002076** Army Command and General Staff Coll., Fort Leavenworth, KS USA

**Systemic Operational Design (SOD): Gaining and Maintaining the Cognitive Initiative**

May 25, 2006; 85 pp.; In English

Report No.(s): AD-A458361; No Copyright; Avail.: CASI: [A05](#), Hardcopy

No abstract available

*Systems Analysis; Operations Research; Cognition*

## 67

### THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

**20070000690** Maryland Univ., College Park, MD USA

**High Resolution Methods for Time Dependent Problems With Piecewise Smooth Solutions**

Tadmor, Eitan; May 2003; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-91-J-1076

Report No.(s): AD-A458000; CSCAMM-03-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A trademark of nonlinear, time-dependent, convection-dominated problems is the spontaneous formation of non-smooth macro-scale features, like shock discontinuities and non-differentiable kinks, which pose a challenge for high-resolution computations. We overview recent developments of modern computational methods for the approximate solution of such problems. In these computations, one seeks piecewise smooth solutions which are realized by finite dimensional projections. Computational methods in this context can be classified into two main categories, of local and global methods. Local methods are expressed in terms of point-values (negative Hamilton-Jacobi equations), cell averages (negative nonlinear conservation laws), or higher localized moments. Global methods are expressed in terms of global basis functions. High resolution central schemes will be discussed as a prototype example for local methods. The family of central schemes offers high-resolution black-box-solvers to an impressive range of such nonlinear problems. The main ingredients here are detection of spurious extreme values, non-oscillatory reconstruction in the directions of smoothness, numerical dissipation and quadrature rules. Adaptive spectral viscosity will be discussed as an example for high-resolution global methods. The main ingredients here are detection of edges in spectral data, separation of scales, adaptive reconstruction, and spectral viscosity.

DTIC

*Algebra; High Resolution; Nonlinear Equations; Time Dependence*

**20070000745** Massachusetts Inst. of Tech., Cambridge, MA USA

**Estimation for Boundary-Value Descriptor Systems**

Nikoukhah, Ramine; Adams, Milton B; Willsky, Alan S; Levy, Bernard C; Aug 1986; 49 pp.; In English

Contract(s)/Grant(s): AFOSR-82-0258; ECS-8312921

Report No.(s): AD-A458119; LIDS-P-1600; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper we consider models for noncausal processes consisting of discrete-time descriptor dynamics and boundary conditions on the values of the process at the two ends of the interval on which the process is defined. We discuss the general



solution and well-posedness of systems of this type and then apply the method of complementary processes to obtain a specification of the optimal smoother in terms of a boundary-value descriptor Hamiltonian system. We then study the implementation of the optimal smoother. Motivated by the Hamiltonian diagonalization results for non-descriptor systems, we show how the descriptor Hamiltonian dynamics can be transformed to two lower-order systems by the use of transformation matrices involving the solution of two generalized Riccati equations. We present several examples illustrating our results and the nature of the smoothing solution and also present equations for covariance analysis of boundary-value descriptor processes including the smoothing error. In addition we discuss several open problems and connections with other related results.

DTIC

*Boundaries; Boundary Value Problems*

**20070001646** Naval Postgraduate School, Monterey, CA USA

**A Diagnostic Approach to Building Collaborative Capacity in an Interagency Context**

Thomas, Gail F; Hocevar, Susan P; Jansen, Erik; Sep 25, 2006; 65 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A458540; NPS-GSBPP-06-013; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458540>; Avail.: CASI: **A04**, Hardcopy

Federal Acquisition Reform has consistently called for more and better collaboration among participating organizations. Experience shows, however, that inter-organizational collaboration can be difficult at best. Our research focuses on imperatives of successful collaboration and aims to assist organizations in diagnosing their collaborative capacity. Based on prior research with homeland security organizations, we offer a model of inter-organizational collaborative capacity grounded in a systems perspective. We then identify enablers and barriers that contribute to collaborative capacity. A diagnostic process based on the established practices of organization development is offered to guide the design of tailored assessments of collaborative capacity. We present a comprehensive set of both interview and survey questions, based on our model, which can be used in creating a collaborative capacity audit. The ability to diagnose collaborative capacity encourages literacy around collaboration and assists leaders in determining mechanisms for developing their organization's collaborative capacity. Finally, we describe the future plans for validating these assessment tools.

DTIC

*Organizations; Security*

**20070001678** SRI International Corp., Menlo Park, CA USA

**Automatic Deduction for Commonsense Reasoning: An Overview**

Moore, Robert C; Apr 1981; 21 pp.; In English  
Contract(s)/Grant(s): N00014-80-C-0296; N00039-79-C-0118  
Report No.(s): AD-A458595; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458595>; Avail.: CASI: **A03**, Hardcopy

Knowing how to enable computers to draw conclusions automatically from bodies of facts has long been recognized as a central problem in artificial intelligence (AI) research. Any attempt to address this problem requires choosing an application (or type of application), a representation for bodies of facts, and methods for deriving conclusions. This article provides an overview of the issues involved in drawing conclusions by means of deductive inference from bodies of commonsense knowledge represented by logical formulas. The authors first briefly review the history of this enterprise: its origins, its fall into disfavor, and its recent revival. They show why applications involving certain types of incomplete information resist solution by other techniques, and how supplying domain-specific control information seems to offer a solution to the difficulties that previously led to disillusionment with automatic deduction. Finally, they discuss the relationship of automatic deduction to the new field of 'logic programming' and then survey some of the issues that arise in extending automatic-deduction techniques to nonstandard logic.

DTIC

*Artificial Intelligence; Computer Programming; Inference; Machine Learning*

**20070001904** Massachusetts Inst. of Tech., Cambridge, MA USA

**Successive Projection under a Quasi-Cyclic Order**

Tseng, Paul; Jan 6, 1990; 12 pp.; In English  
Contract(s)/Grant(s): DAAL03-86-K-0171  
Report No.(s): AD-A458804; LIDS-P-1938; No Copyright; Avail.: CASI: **A03**, Hardcopy

A classical method for finding a point in the intersection of a finite collection of closed convex sets is the successive

projection method. It is well-known that this method is convergent if each convex sets is chosen for projection in a cyclical manner. In this note we show that this method is still convergent if the length of the cycle grows without bound, provided that the growth is not too fast. Our argument is based on an interesting application of the Cauchy-Schwartz inequality.

DTIC

*Probability Theory; Set Theory*

## 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*.

**2007000010** Thomas Jefferson National Accelerator Facility, Newport News, VA, USA

#### **Fiducialization of Superconducting Radio Frequency Cryomodules at Jefferson Lab**

Curtis, C. J.; Dahlberg, J.; Oren, W.; Preble, J.; Tremblay, K.; January 2006; 8 pp.; In English

Report No.(s): DE2006-891882; No Copyright; Avail.: National Technical Information Service (NTIS)

During the early 1990s the Continuous Electron Beam Accelerator Facility (CEBAF), was under construction in Newport News, Virginia. The facility was to be the first of its kind in that it was to provide a continuous beam of electrons for experimental physics at energies of several GeV. One of the key elements of this unique machine was the 338 superconducting radio frequency (SRF) cavities built into 42 cryomodules and arranged in two linacs. These were linked by arcs of conventional magnets which allowed recirculation through the linacs up to five times, in order to achieve the design energy of 4GeV. Within each cryomodule the cavities were aligned and referenced to external fiducials allowing alignment on the design beam path. This paper describes the process developed to achieve this, how it evolved with improving instrumentation, and the results obtained. Suggestions for alternative methods which may prove useful for future projects are also discussed.

NTIS

*Cryogenics; Radio Frequencies; Superconducting Cavity Resonators; Superconductivity; Electron Beams*

**2007000016** Brookhaven National Lab., Upton, NY USA

#### **Transverse Echo Measurements in RHIC**

Fischer, W.; January 2006; 7 pp.; In English

Report No.(s): DE2006-891912; BNL-85035-2005; No Copyright; Avail.: Department of Energy Information Bridge

Diffusion counteracts cooling and the knowledge of diffusion rates is important for the calculation of cooling times and equilibrium beam sizes. Echo measurements are a potentially sensitive method to determine diffusion rates, and longitudinal measurements were done in a number of machines. We report on transverse echo measurements in RHIC and the observed dependence of echo amplitudes on a number of parameters for beams of gold and copper ions, and protons. In particular we examine the echo amplitudes of gold and copper ion bunches of varying intensity, which exhibit different diffusion rates from intrabeam scattering.

NTIS

*Echoes; Amplitudes; Diffusion; Metal Ions*

**2007000017** Stanford Linear Accelerator Center, CA, USA

#### **SEY and Surface Analysis Measurements on FNAL Main Injector Ring S/S Beam Chamber Material**

Kirby, R. E.; Sep. 2006; 9 pp.; In English

Report No.(s): DE2006-891857; SLAC-TN-06-031-REV; No Copyright; Avail.: Department of Energy Information Bridge

Surface chemistry was measured using x-ray photoelectron spectroscopy (sometimes called ESCA). With this technique, soft x-rays (1486 eV) illuminate the sample, penetrating into the surface ten microns. Photoelectrons are generated from energy levels of the constituent compounds/elements present. Those electrons, within 5 nm or so of the surface, escape without energy loss and preserve valence information about the atomic levels from which they were generated. An electron energy analyzer, of good energy resolution, measures the photoelectron energy, thereby yielding both valence (chemical) information and relative atomic abundances in the top 5 nm of surface. Using appropriate sensitivity factors, these intensities are converted to a semi-quantitative (surface atom %) concentration in the analyzed layer. As a benchmark, the limit for carbon

contamination on vacuum components for UHV use at SLAC is 50 at percent. That corresponds to about 8-10 monolayers of elemental carbon.

NTIS

*Electrons; Injectors; Chemical Analysis; Electron Spectroscopy; Photoelectron Spectroscopy; Photoelectrons*

**2007000025** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Preliminary Parameter Set and Initial Studies. The FERMI(at sign)Elettra Technical Optimization Study**

Byrd, J.; Corlett, J.; Doolittle, L.; Fawley, W.; Lidia, S.; Aug. 01, 2005; 30 pp.; In English

Report No.(s): DE2006-885243; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of the FERMI (at) Elettra Technical Optimization Study is to produce a machine design and layout consistent with user needs for radiation in the approximate ranges 100 nm to 40 nm, and 40 nm to 10 nm, using seeded FEL's. The study will involve collaboration between Italian and USA physicists and engineers, and will form the basis for the engineering design and the cost estimation.

NTIS

*Particle Accelerators; Structural Design*

**2007000026** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**General Layout and Parameters and Physics Studies of Longitudinal Space Charge, the Spreader, the Injector, and Preliminary FEL Performance**

Byrd, J.; Corlett, J.; Doolittle, L.; Fawley, W.; Lidia, S.; Sep. 01, 2005; 42 pp.; In English

Report No.(s): DE2006-885244; No Copyright; Avail.: National Technical Information Service (NTIS)

The FERMI (at) Elettra facility will make use of the existing GeV linac at Sincrotrone Elettra, which will become available for dedicated FEL applications following the completion of construction of a new injector booster complex for the storage ring. With a new rf photocathode injector, and some additional accelerating sections, this linac will be capable of providing high brightness bunches at 1.2 GeV and up to 50 Hz repetition rates.

NTIS

*Free Electron Lasers; Injectors; Layouts; Particle Accelerators; Space Charge; Linear Accelerators*

**20070000468** Stanford Linear Accelerator Center, CA, USA

**Dynamical GUT breaking and mu-term Driver Supersymmetry Breaking**

Kitano, R.; Jun. 2006; 26 pp.; In English

Report No.(s): DE2006-885274; SLAC-PUB-11897; No Copyright; Avail.: National Technical Information Service (NTIS)

Models for dynamical breaking of supersymmetric grand unified theories are presented. The doublet-triplet splitting problem is absent since the Higgs doublet superfields can be identified with the massless mesons of the strong gauge group whereas there are no massless states corresponding to the colored Higgs fields. Various strong gauge groups  $SU(N(\text{sub } c))$ ,  $Sp(N(\text{sub } c))$  and  $SO(N(\text{sub } c))$  are examined. In a model with  $SO(9)$  strong gauge group, adding the  $(\mu)$ -term for the Higgs fields triggers to break supersymmetry in a meta-stable vacuum. The pattern of the supersymmetry breaking parameters is predicted to be the gauge-mediation type with modifications in the Higgs sector.

NTIS

*Mesons; Supersymmetry*

**20070000470** Stanford Linear Accelerator Center, CA, USA

**Supersymmetry with Small  $\mu$ : Connections between Naturalness, Dark Matter, and (Possibly) Flavor**

Kitano, R.; Nomura, Y.; Jun. 2006; 32 pp.; In English

Report No.(s): DE2006-885275; SLAC-PUB-11892; LBNL-60363; No Copyright; Avail.: National Technical Information Service (NTIS)

Weak scale supersymmetric theories often suffer from several naturalness problems: the problems of reproducing the correct scale for electroweak symmetry breaking, the correct abundance for dark matter, and small rates for flavor violating processes. We argue that the first two problems point to particular regions of parameter space in models with weak scale supersymmetry: those with a small  $(\mu)$  term. This has an interesting implication on direct dark matter detection experiments. We find that, if the signs of the three gaugino mass parameters are all equal, we can obtain a solid lower bound on the spin-independent neutralino-nucleon cross section,  $(\sigma)_{\text{sub SI}}$ . In the case that the gaugino masses satisfy the unified mass relations, we obtain  $(\sigma)_{\text{sub SI}}$  (approx.)  $g \times 10^{\text{(sup -46)}} \text{ cm}^{\text{(sup 2)}} (1 \times 10^{\text{(sup -46)}} \text{ cm}^{\text{(sup 2)}})$  for fine-tuning

in electroweak symmetry breaking no worse than 10% (5%). We also discuss a possibility that the three problems listed above are all connected to the hierarchy of fermion masses. This occurs if supersymmetry breaking and electroweak symmetry breaking (the Higgs fields) are coupled to matter fields with similar hierarchical structures. The discovery of  $(\mu)$  (yields)  $e$  transition processes in near future experiments is predicted in such a framework.

NTIS

*Dark Matter; Fermions; Supersymmetry*

**20070000475** National Science and Technology Council, Washington, DC, USA

**Nanotechnology: Shaping the World Atom by Atom**

January 2006; 12 pp.; In English

Report No.(s): PB2007-102111; No Copyright; Avail.: National Technical Information Service (NTIS)

The emerging fields of nanoscience and nanoengineering are leading to unprecedented understanding and control over the fundamental building blocks of all physical things. This is likely to change the way almost everything-from vaccines to computers to automobile tires to objects not yet imagined-is designed and made.

NTIS

*Nanotechnology; Atoms*

**20070000476** Stanford Linear Accelerator Center, CA, USA

**Precision Measurement and Improvement of  $e^+$ ,  $e^-$  Storage Rings**

Yan, Y. T.; Cai, Y.; Colocho, W.; Decker, F. J.; Turner, J.; Jun. 2006; 8 pp.; In English

Report No.(s): DE2006-885276; SLAC-PUB-11925; No Copyright; Avail.: National Technical Information Service (NTIS)

Through horizontal and vertical excitations, we have been able to make a precision measurement of linear geometric optics parameters with a Model-Independent Analysis (MIA). We have also been able to build up a computer model that matches the real accelerator in linear geometric optics with an SVD-enhanced Least-square fitting process. Recently, with the addition of longitudinal excitation, we are able to build up a computer virtual machine that matches the real accelerators in linear optics including dispersion without additional fitting variables. With this optics-matched virtual machine, we are able to find solutions that make changes of selected normal and skew quadrupoles for machine optics improvement. It has made major contributions to improve PEP-II optics and luminosity. Examples from application to PEP-II machines will be presented.

NTIS

*Precision; Storage Rings (Particle Accelerators)*

**20070000478** Stanford Linear Accelerator Center, CA, USA

**Reflectivity Measurements for Copper and Aluminum in the Far Infrared and the Resistive Wall Impedance in the LCLS Undulator**

Jun. 2006; 8 pp.; In English

Report No.(s): DE2006-885277; SLAC-PUB-11924; No Copyright; Avail.: National Technical Information Service (NTIS)

Reflectivity measurements in the far infrared, performed on aluminum and copper samples, are presented and analyzed. Over a frequency range of interest for the LCLS bunch, the data is fit to the free-electron model, and to one including the anomalous skin effect. The models fit well, yielding parameters dc conductivity and relaxation times that are within 30-40% of expected values. We show that the induced energy in the LCLS undulator region is relatively insensitive to variations on this order, and thus we can have confidence that the wake effect will be close to what is expected.

NTIS

*Aluminum; Copper; Far Infrared Radiation; Impedance; Reflectance; Walls*

**20070000480** Stanford Linear Accelerator Center, CA, USA

**Search for the Decay of a  $B_0$  or  $B_0$ bar Meson to  $K^*0$ bar  $K_0$  or  $K^*0$   $K_0$ bar**

Aubert, B.; Barate, R.; Bona, M.; Boutigny, D.; Couderc, F.; Jun. 2006; 18 pp.; In English

Report No.(s): DE2006-885279; SLAC-PUB-11915; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a search for the decay of a  $B_0$  or overbar  $B_0$  meson to a overbar  $K^*0$  or  $K^*0$  overbar  $0$  final state, using a sample of approximately 232 million BB events collected with the BABAR detector at the PEP-II asymmetric energy  $e^+e^-$  collider at SLAC.

NTIS

*Mesons; Decay*

**20070000482** Stanford Linear Accelerator Center, Stanford, CA, USA, State Univ. of New York, Stony Brook, NY, USA  
**Two-loop Anomalous Dimension Matrix for soft Gluon Exchange**

Aybat, S. M.; Dixon, L. J.; Sterman, G.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885280; SLAC-PUB-1907; No Copyright; Avail.: Department of Energy Information Bridge

The resummation of soft gluon exchange for QCD hard scattering requires a matrix of anomalous dimensions. We compute this matrix directly for arbitrary 2 (yields) n massless processes for the first time at two loops. Using color generator notation, we show that it is proportional to the one-loop matrix. This result reproduces all pole terms in dimensional regularization of the explicit calculations of massless 2 (yields) 2 amplitudes in the literature, and it predicts all poles at next-to-leading order in any 2 (yields) n process that has been computed at next-to-leading order. The proportionality of the one- and two-loop matrices makes possible the resummation in closed form of the next-to-next-to-leading logarithms and poles in dimensional regularization for the 2 (yields) n processes.

NTIS

*Gluons; Quantum Chromodynamics*

**20070000486** Stanford Linear Accelerator Center, CA, USA, Louisiana State Univ., Baton Rouge, LA USA, Lawrence Livermore National Lab., Livermore, CA USA

**Realistic Two-body Interactions in Many-nucleon Systems: Correlated Motion beyond Single-particle Behavior**

Sviratcheva, K. D.; Draayer, J. P.; Vary, J. P.; Jun. 2006; 16 pp.; In English

Report No.(s): DE2006-885281; SLAC-PUB-11903; No Copyright; Avail.: National Technical Information Service (NTIS)

In the framework of the theory of spectral distributions we perform an overall comparison of three modern realistic interactions, CD-Bonn, CD-Bonn+3terms, and GXPF1 in a broad range of nuclei in the upper fp shell and study their ability to account for the development of isovector pairing correlations and collective rotational motion in many-particle nuclear systems. The findings reveal a close similarity between CD-Bonn and CD-Bonn+3terms, while both interactions possess features different from the ones of GXPF1. The GXPF1 interaction is used to determine the strength parameter of a quadrupole term that augments an isovector-pairing model interaction with Sp(4) dynamical symmetry, which in turn is shown to yield a reasonable agreement with the experimental low-lying energy spectra of (sup 58)Ni and (sup 58)Cu.

NTIS

*Nucleons; Particle Interactions*

**20070000502** Lawrence Livermore National Lab., Livermore, CA USA

**Improved Algorithms Speed It Up for Codes**

Hazi, A.; Sep. 28, 2005; 10 pp.; In English

Report No.(s): DE2006-883730; UCRL-TR-215720; No Copyright; Avail.: Department of Energy Information Bridge

Huge computers, huge codes, complex problems to solve. The longer it takes to run a code, the more it costs. One way to speed things up and save time and money is through hardware improvements--faster processors, different system designs, bigger computers. But another side of supercomputing can reap savings in time and speed: software improvements to make codes--particularly the mathematical algorithms that form them--run faster and more efficiently. Speed up math. Is that really possible. According to Livermore physicist Eugene Brooks, the answer is a resounding yes. 'Sure, you get great speed-ups by improving hardware,' says Brooks, the deputy leader for Computational Physics in N Division, which is part of Livermore's Physics and Advanced Technologies (PAT) Directorate. 'But the real bonus comes on the software side, where improvements in software can lead to orders of magnitude improvement in run times.'

NTIS

*Algorithms; Radiation Transport*

**20070000504** Lawrence Livermore National Lab., Livermore, CA USA

**Isentropic Compression for TATB Based HE Samples, Numerical Simulations and Comparison with Experiments**

Lefrancois, A.; Vandersall, K.; L'Eplattenier, P.; Burger, M.; Feb. 15, 2006; 10 pp.; In English

Report No.(s): DE2006-883731; UCRL-TR-219023; No Copyright; Avail.: Department of Energy Information Bridge

Isentropic compression experiments and numerical simulations on TATB based HE were performed respectively at Z accelerator facility from Sandia National Laboratory and at Lawrence Livermore National Laboratory in order to study the isentrope and associated Hugoniot of this HE. 3D configurations have been calculated here to test the new beta version of the

electromagnetism package coupled with the dynamics in Ls-Dyna and compared with the ICE Z shot 1967.

NTIS

*TATB; Isentrope*

**20070000509** Lawrence Livermore National Lab., Livermore, CA USA

**Science & Technology Review, December 2005. Modeling the Future Stockpile**

Dec. 2005; 32 pp.; In English

Report No.(s): DE2006-883733; No Copyright; Avail.: National Technical Information Service (NTIS)

A few of the articles in this issue include: Modeling the Future Stockpile; Understanding How Stars Form; Research on Food Mutagens and Cancer; and Better Protection in Lightning Storms

NTIS

*Stockpiling; Physics; Research and Development*

**20070000512** Oregon State Univ., Corvallis, OR, USA

**Hadronic tau Decay at BaBar**

January 2006; 8 pp.; In English

Report No.(s): DE2006-881117; SLAC-PUB-11810; No Copyright; Avail.: National Technical Information Service (NTIS)

Tau lepton decays provide very clean environment to test Standard Model, to study QCD and hadronization process as they probe the matrix element of the left-handed current between vacuum and the hadronic state. Many interesting results such as measurements of tau and tau neutrino masses, observation of low mass resonances, test of CP violation in lepton sector, searches for physics beyond Standard Model were obtained with tau decays into one and three charged hadrons in the final state. In this paper we present a study of five prong tau decays which reveals underlying resonance structure and a search for seven prong tau decays done by BaBar experiment.

NTIS

*Hadrons; Particle Decay*

**20070000513** Fermi National Accelerator Lab., Batavia, IL, USA, Rockefeller Univ., New York, NY, USA

**New Diffractive Results From the Tevatron**

Gallinaro, M.; May 2005; 8 pp.; In English

Report No.(s): DE2006-15017175; FERMILAB-CONF-05-201-E; No Copyright; Avail.: National Technical Information Service (NTIS)

Experimental results in diffractive processes are summarized and a few notable characteristics described in terms of Quantum Chromodynamics, Exclusive dijet production is used to establish a benchmark for future experiments in the quest for diffractive Higgs production at the large hadron collider. Using new data from the Tevatron and dedicated diffractive triggers, no excess over a smooth falling distribution for exclusive dijet events could be found. Stringent upper limits on the exclusive dijet production cross section are presented. The quark/gluon composition of dijet final states is used to provide additional hints on exclusive dijet production.

NTIS

*Diffraction; Particle Accelerators; Quantum Chromodynamics*

**20070000515** Lawrence Livermore National Lab., Livermore, CA USA

**LLNL Experiments at OMEGA in FY 05**

Turner, R. E.; Oct. 17, 2006; 18 pp.; In English

Report No.(s): DE2006-883749; UCRL-TR-216229; No Copyright; Avail.: National Technical Information Service (NTIS)

During FY05, LLNL was scheduled for 372 shots on Omega. These were distributed into 191 planned shots for the Inertial Confinement Fusion (ICF) program, and 181 planned shots for the High Energy Density Sciences (HEDS) program. The actual Omega performance averaged 6% more shots than scheduled. A brief summary of the various campaigns follows, starting with HEDS experiments.

NTIS

*Inertial Confinement Fusion; Plasmas (Physics); High Energy Interactions*

**20070000523** Brookhaven National Lab., Upton, NY USA

**B(sup s) Lifetime Difference Measurements from the Tevatron**

Yip, K.; Aug. 2006; 7 pp.; In English

Report No.(s): DE2006-891915; BNL-77028-2006; No Copyright; Avail.: Department of Energy Information Bridge

The two collider experiments at the Tevatron, CDF and D0, have made a lot of progress in B(sup s) lifetime difference measurements.

NTIS

*Mesons; Particle Accelerators*

**20070000544** Michigan Univ., Ann Arbor, MI, USA

**X-Ray Studies of Materials Dynamics at MHATT-CAT- Sector 7, Advanced Photon Source**

Clarke, R.; January 2006; 22 pp.; In English

Report No.(s): DE2006-881589; No Copyright; Avail.: National Technical Information Service (NTIS)

This final report describes the scientific accomplishments that have been achieved with support from grant DE-FG02-03ER46023 during the period 12/01/02 --11/30/05. The funding supported a vigorous scientific program allowing the PI to achieve leadership in a number of important areas. In particular, research carried out during this period has opened way to ultrafast dynamics studies of materials by combining the capabilities of synchrotron radiation with those of ultrafast lasers. This enables the initiation of laser-induced excitations and studies of their subsequent dynamics using laser-pump/x-ray probe techniques. Examples of such excitations include phonons, shock waves, excitons, spin-waves, and polaritons. The breadth of phenomena that can now be studied in the time-domain is very broad, revealing new phenomena and mechanisms that are critical to many applications of materials.

NTIS

*Photons; X Rays*

**20070000545** Fermi National Accelerator Lab., Batavia, IL, USA, Nebraska Univ., Lincoln, NE, USA

**W/Z Production Cross Section and Asymmetries at E(sub cm) Equals 2TEV**

Jun. 2005; 14 pp.; In English

Report No.(s): DE2006-15017129; FERMILAB-CONF-05-235; No Copyright; Avail.: National Technical Information Service (NTIS)

The most recent results for W and Z boson production cross sections and asymmetries are presented from the CDF and D0 collaborations using Run II data taken at the Fermi National Accelerator Laboratory (FNAL) Tevatron. Data set sizes range from 72 pb(sup -1) to 226 pb(sup -1), and results range from published to preliminary. Results presented agree with the Standard Model and world averages within errors.

NTIS

*Asymmetry; Bosons*

**20070000546** Fermi National Accelerator Lab., Batavia, IL, USA

**DO Top Quark Results and Their Dependence on Successful Grid Computing**

Wicke, D.; January 2006; 14 pp.; In English

Report No.(s): DE2006-15017045; FERMILAB-CONF-05-326; No Copyright; Avail.: National Technical Information Service (NTIS)

The heaviest known Fermion particle--the top quark--was discovered at Fermilab in the first run of the Tevatron in 1995. However, besides its mere existence one needs to study its properties precisely in order to verify or falsify the predictions of the Standard Model. With the top quarks extremely high mass and short lifetime such measurements probe yet unexplored regions of the theory and bring us closer to solving the open fundamental questions of our universe of elementary particles such as why three families of quarks and leptons exist and why their masses differ so dramatically. To perform these measurements hundreds of millions of recorded proton-antiproton collisions must be reconstructed and filtered to extract the few top quarks produced. Simulated background and signal events with full detector response need to be generated and reconstructed to validate and understand the results. Since the start of the second run of the Tevatron the D0 collaboration has brought Grid computing to its aid for the production of simulated events.

NTIS

*Grid Computing (Computer Networks); Quarks*

**20070000547** Fermi National Accelerator Lab., Batavia, IL, USA, Duke Univ., Durham, NC, USA

**W Boson Mass Measurement at the Tevatron**

Hay, C. P.; May 20, 2005; 8 pp.; In English

Report No.(s): DE2006-15017172; FERMILAB-CONF-05-210-E; No Copyright; Avail.: Department of Energy Information Bridge

The W boson mass ( $m(\text{sub } w)$ ) is a key parameter of the standard model (SM), containing the mass of the unobserved Higgs boson. Using Tevatron  $p(\bar{p})$  collision data from 1992-1995, the CDF and D0 collaborations measured  $m(\text{sub } w)$  to  $m(\text{sub } w) = 59$  MeV. The ongoing Tevatron Run 2 has produced a factor of 5 more collisions, promising a significant reduction in  $m(\text{sup } w)$ . CDF has analyzed the first approximately (nearly) equal to 200 pb( $\text{sub } -1$ ) of Run 2 data and determined its  $m(\text{sup } w)$  to be 76 MeV.

NTIS

*Bosons; Particle Accelerators; Higgs Bosons*

**20070000548** Fermi National Accelerator Lab., Batavia, IL, USA, Rockefeller Univ., New York, NY, USA

**Update of CDF Results on Diffraction**

Goulianos, K.; January 2006; 8 pp.; In English

Report No.(s): DE2006-15017048; No Copyright; Avail.: National Technical Information Service (NTIS)

The diffractive program of the Collider Detector at Fermilab (CDF) Collaboration at the Fermilab Tevatron ( $p\bar{p}$ ) Collider is reviewed with emphasis on recent results from Run-II and future prospects.

NTIS

*Diffraction; Particle Accelerators*

**20070000550** Fermi National Accelerator Lab., Batavia, IL, USA, Pittsburgh Univ., PA, USA

**Nu TeV Structure Function Measurement**

Tzanov, M.; Jul. 09, 2005; 8 pp.; In English

Report No.(s): DE2006-15017054; No Copyright; Avail.: National Technical Information Service (NTIS)

The NuTeV experiment obtained high statistics samples of neutrino and antineutrino charged current events during the 1996-1997 Fermilab fixed target run. The experiment combines sign-selected neutrino and antineutrino beams and the upgraded CCFR iron-scintillator neutrino detector. A precision continuous calibration beam was used to determine the muon and hadron energy scales to a precision of 0.7% and 0.43% respectively. The structure functions  $F(\text{sub } 2)(x, Q(\text{sup } 2))$  and  $xF(\text{sub } 3)(x, Q(\text{sup } 2))$  obtained by fitting the y-dependence of the sum and the difference of the  $\nu$  and ( $\bar{\nu}$ ) differential cross sections are presented.

NTIS

*Neutrinos; Neutrino Beams; Precision*

**20070000552** Fermi National Accelerator Lab., Batavia, IL, USA, Minnesota Univ., Duluth, MN, USA

**MINOS Detectors**

Habig, A.; Grashorn, E. W.; January 2006; 8 pp.; In English

Report No.(s): DE2006-15017071; FERMILAB-CONF-05-264-E; No Copyright; Avail.: Department of Energy Information Bridge

The Main Injector Neutrino Oscillation Search (MINOS) experiments primary goal is the precision measurement of the neutrino oscillation parameters in the atmospheric neutrino sector. This long-baseline experiment uses Fermilab's NuMI beam, measured with a Near Detector at Fermilab, and again 735 km later using a Far Detector in the Soudan Mine Underground Lab in northern Minnesota. The detectors are magnetized iron/scintillator calorimeters. The Far Detector has been operational for cosmic ray and atmospheric neutrino data from July of 2003, the Near Detector from September 2004, and the NuMI beam started in early 2005. This poster presents details of the two detectors.

NTIS

*Neutrinos; Oscillations*

**20070000553** Fermi National Accelerator Lab., Batavia, IL, USA, Minnesota Univ., Duluth, MN, USA

**Neutrino-Induced Muons Observed with MINOS**

Habig, A.; January 2006; 8 pp.; In English

Report No.(s): DE2006-15017072; FERMILAB-CONF-05-263-E; No Copyright; Avail.: National Technical Information Service (NTIS)



The Main Injector Neutrino Oscillation Search (MINOS) experiment's Far Detector has been operational since July 2003, taking cosmic ray and atmospheric neutrino data from its location in the Soudan Mine Underground Lab. Numerous neutrino-induced muons have been observed. The detector's magnetic field allows the first determination by a large underground detector of muon charge and thus neutrino versus anti-neutrino on an event by event basis.

NTIS

*Muons; Neutrinos*

**20070000554** Glasgow Univ., UK

**b-Physics Measurements at the Tevatron:  $m$  and  $\Delta m$**

D'Auria, S.; January 2006; 12 pp.; In English

Report No.(s): DE2006-15017087; No Copyright; Avail.: National Technical Information Service (NTIS)

We present experimental results on b-hadron mass measurements and b-meson oscillations based on integrated luminosity of 250 to 450 pb (sup -1) of p(bar p) collisions at  $\sqrt{s} = 1.98$  TeV by the CDF and D0 collaborations at the Tevatron. The masses of b-hadrons have been measured precisely by the CDF collaboration in decays containing a  $J/\psi$ . A blind search of the decay mode  $B_c$  (yields)  $J/\psi(\pi)$  (sup +) resulted in a peak of 18.9 (+-) 5.4 candidates at a mass value of 6287.0 (+-) 4.5 (+-) 1.1 MeV/c (sup 2). A new limit has been set to the decay  $B_{d,s}$  (yields)  $(\mu)$  (sup +)( $\mu$ ) (sup -). Both the CDF and D0 collaborations are in the position to put a limit on the frequency of the  $B_s$  oscillations. D0 reports  $(\Delta m_s) \leq 5.0$  ps (sup -1).

NTIS

*Hadrons; Particle Accelerators*

**20070000555** Fermi National Accelerator Lab., Batavia, IL, USA

**Top Quark Results From D0**

Greenlee, H. B.; January 2006; 12 pp.; In English

Report No.(s): DE2006-15017128; FERMILAB-CONF-05-232; No Copyright; Avail.: National Technical Information Service (NTIS)

In this talk this author will present recent preliminary results from the D0 experiment from Tevatron Run II (p(bar p) collisions at  $\sqrt{s} = 1.96$  TeV). The results presented in this talk include top quark pair production cross section, top quark mass, and upper limits on single top quark production.

NTIS

*Quarks; Collisions*

**20070000557** Brookhaven National Lab., Upton, NY USA

**Electron Amplification in Diamond**

Smedley, J.; Ben-Zvi, I.; Burrill, A.; Chang, X.; Grimes, J.; Jul. 2006; 7 pp.; In English

Report No.(s): DE2006-891917; BNL-77030-2006; No Copyright; Avail.: Department of Energy Information Bridge

We report on recent progress toward development of secondary emission 'amplifiers' for photocathodes. Secondary emission gain of over 300 has been achieved in transmission mode and emission mode for a variety of diamond samples. Techniques of sample preparation, including hydrogenation to achieve negative electron affinity (NEA), have been adapted to this application.

NTIS

*Amplification; Diamonds; Electron Beams*

**20070000748** Iowa Univ., Iowa City, IA USA

**Ice Forces on Two-Dimensional Sloping Structures**

Yean, J S; Tatinclaux, J C; Cook, A G; Jun 1981; 81 pp.; In English

Contract(s)/Grant(s): CME-77-12176-AO1; N00014-79-C-0411

Report No.(s): AD-A458124; IIHR-TR-230; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Analytical expressions for the horizontal and vertical forces exerted by a floating ice sheet against a two-dimensional sloping structure are derived under the assumption that ice is an elastic, homogeneous material. The specific conditions investigated are 1. Quasi-steady form of the governing equation. a. The free end of the semi-infinite ice sheet is subjected to a horizontal force, a vertical force, and a bending moment. Failure of the ice sheet occurs before its free edge becomes fully emerged from or submerged into the water. b. The free end of a semi-infinite ice sheet is subjected only to a vertical force,

but failure occurs after the free end has fully emerged from or submerged into the water. c. Finite ice sheet subjected only to a vertical force at one free end which remains at the water surface until failure occurs. 2. Unsteady form of the governing equation for a semi-infinite sheet subjected to only a vertical force at its free end which remains at the water surface until failure occurs. It appears that, for practical applications, the effect of the horizontal force and bending moment at the free end of the ice sheet on the sheet deformation is negligible. It is shown that a finite ice sheet of length at least three times a characteristic length expressed in terms of the ice mechanical properties can be treated as a semi-infinite ice sheet. Also it is shown that when the ice thickness is smaller than a critical value which depends upon the ice mechanical properties and the direction (upward or downward) of the vertical force exerted at the sheet free end, the failure force of the ice sheet is independent of the ice elastic modulus. The analytical results have been verified experimentally, and used in the experimental determination of the bending strength and strain modulus of urea-doped ice.

DTIC

*Elastic Properties; Floating; Ice; Ice Formation; Slopes*

**20070000789** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Copper Metallic Substrates for High Temperature Superconducting Coated Conductors**

Yust, Nicholas A; Nekkanti, Rama; Brunke, Lyle B; Srinivasan, Raghavan; Barnes, Paul N; Apr 2006; 7 pp.; In English  
Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A458182; AFRL-PR-WP-TP-2006-215; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Biaxially cube textured polycrystalline Cu(200) substrate tapes were produced for high temperature superconducting (HTS) coated conductor applications. A comparison is made between Cu substrates fabricated by reverse cold rolling followed by recrystallization, from stock materials that were obtained in the form of extruded rod and rolled plate. Detailed x-ray diffraction (XRD) studies and orientation imaging microscopy (OIM) were performed to measure the in-plane alignment, out-of-plane alignment, and microtexture at various deformation levels and annealing temperatures. The rod starting geometry proved to have superior biaxial alignment with a predominant (220) deformation texture after rolling.

DTIC

*Coatings; Conductors; Copper; High Temperature; High Temperature Superconductors; Substrates; Superconductivity*

**20070000845** Air Force Academy, Colorado Springs, CO USA

**Round Robin Fatigue Crack Growth Testing Results**

Avram, Jason; Nov 2006; 18 pp.; In English

Contract(s)/Grant(s): F05611-03-D-003

Report No.(s): AD-A458296; USAFA-TR-2006-10; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The purpose of this report is to document the fatigue crack growth (FCG) testing that was accomplished in conjunction with various other labs to meet the objectives of the ASTM E647 FCG Round Robin Testing. Three M(T) panels each of 2024-T351 and 7075-T6 aluminum were tested. with a different configuration for each-thick panels (0.375") for 2024-T351 and thin panels (0.125") for 7075-T6. The goal of the testing was to develop da/dN vs. Delta k curves for low load ratio testing (R= 0.1), focusing on DeltaK  $\sqrt{10}$  ksi(square root of)in.

DTIC

*Crack Propagation; Fatigue (Materials)*

**20070000869** Air Force Research Lab., Hanscom AFB, MA USA

**Traveling Waves on Two- and Three-Dimensional Periodic Arrays of Lossless Acoustic Monopoles, Electric Dipoles, and Magnetodielectric Spheres**

Shore, Robert A; Yaghjian, Arthur D; Nov 8, 2006; 215 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A458358; No Copyright; Avail.: CASI: [A10](#), Hardcopy

Traveling waves on 2D and 3D infinite periodic arrays of small lossless acoustic monopoles, electric dipoles, and magnetodielectric spheres are investigated. The waves are assumed to propagate along the axis of the arrays. The focus is on obtaining the kd-BETAd equations (diagrams) characterizing the traveling waves. Initial forms of the kd-BETAd equations are obtained by summing the fields scattered from all the array elements incident on a reference element of the array located at the origin of the coordinate system. These initial forms of the kd-BETAd equations are, however, useless for computational purposes since the summations converge extremely slowly. The core of the investigation is, therefore, to convert the slowly

convergent summations to forms that can be used for efficient calculation of the kd-BETAd curves. These conversions are performed by first using either the Poisson summation formula or a method based on the use of Floquet mode expansions. Expressions for the efficient summation of Schloemilch series are then used to obtain the final forms of the kd-BETAd equations. Exact computable expressions for the fields of 3D acoustic monopole, electric dipole, and magnetodielectric sphere arrays that are finite in the direction of the array axis, illuminated by a plane wave parallel to the array axis, are obtained from the analyses performed to obtain the kd-BETAd curves for the corresponding infinite arrays.

DTIC

*Electric Dipoles; Monopoles; Spheres; Traveling Waves*

**20070001150** Mitre Corp., McLean, VA USA

**Spectrum 101: An Introduction to Spectrum Management**

Stine, John A; Portigal, David L; Mar 2004; 220 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAB07-03-C-N206

Report No.(s): AD-A458175; MTR-04W0000048; No Copyright; Avail.: CASI: [A10](#), Hardcopy

In the past, the availability of spectrum was a minor issue for the Department of Defense (DoD), as there was ample spectrum access to meet its needs. However, today, new technologies, the needs of other users, and the proliferation of wireless technologies worldwide have made maintaining even current spectrum allocations difficult. New, exciting wireless communication products are creating a large demand for spectrum. Wireless subscriber services are growing rapidly worldwide. Emerging countries are choosing to deploy wireless infrastructure in lieu of wired infrastructure since it costs less. All of these factors make a more competitive environment for worldwide spectrum access. As the recent operations in Afghanistan and Iraq can attest, the DoD achieves much of its military capability from exploiting technology, especially information technology. Military capability is dependent on spectrum availability and the current military transformation will make it more dependent in the future. Unless the DoD manages spectrum smartly it will forfeit its potential capability. This paper has been written to provide an introduction to Spectrum Management with a DoD perspective. It assumes an audience that is unfamiliar with radio communications theory, with the current allocation and use of spectrum, and with the processes involved in managing spectrum. It begins by providing an introduction to basic concepts in radio communications theory to build the novice's intuition so that he/she might subsequently understand the rationale for the current allocations and the methods for managing spectrum. It attempts to give a historical record of how these processes and allocations came to be. It describes the current spectrum management process to include the major players and the procedures they use to make decisions. Finally, it gives a brief introduction to some new technologies that are being introduced and their ramifications on the spectrum management process.

DTIC

*Allocations; Bandwidth; Defense Program; Management Planning; Radio Frequencies; Spectra; Wireless Communication*

**20070001409** Brookhaven National Lab., Upton, NY USA

**Experimental Proposal to Study Heavy-Ion Cooling in the AGS Due to Beam Gas or the Intrabeam Scattering**

Trbojevic, D.; Aherns, L.; Roser, T.; MacKay, W.; Brennan, J.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885015; BNL-75473-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Low emittance of not-fully-stripped gold ( $Z=79$ ) Au(<sup>sup</sup>+77) Helium-like ion beams from the AGS (Alternating Gradient Synchrotron) injector to the Relativistic Heavy Ion Collider (RHIC) could be attributed to the cooling phenomenon due to inelastic intrabeam scattering or due to electron de-excitations from collisions with the residual gas. The low emittance gold beams have always been observed at injection in the Relativistic Heavy Ion Collider (RHIC). There have been previous attempts to attribute the low emittance to a cooling due to the exchange of energy between ions during the inelastic intrabeam scattering. The Fano-Lichten theory of electron promotion might be applied during inelastic collisions between helium like gold ions in the AGS. The two K-shell electrons in gold Au(<sup>sup</sup>+77) could get promoted if the ions reach the critical distance of the closest approach during intra-beam scattering or collisions with the residual gas. During collisions if the ion energy is large enough, a quasi-molecule could be formed, and electron excitation could occur. During de-excitations of electrons, photons are emitted and a loss of total bunch energy could occur. This would lead to smaller beam size. We propose to inject gold ions with two missing electrons into RHIC, at injection energy, and study the beam behavior with bunched and de-bunched beam, varying the RF voltage and the beam intensity. If the 'cooling' is observed additional X-ray detectors could be installed to observe emitted photons.

NTIS

*Cooling; Heavy Ions; Scattering*

**20070001412** Brookhaven National Lab., Upton, NY USA

**Dramatically Reduced Size in the Gantry Design for the Proton-Carbon Therapy**

Trbojevic, D.; Gupta, R.; Parker, B.; Keil, E.; Sessler, A. M.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885014; BNL-75471-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Gantries in the proton/carbon cancer therapy machines represent the major cost and are of the largest size. This report explains a new way to the gantry design. The size and cost of the gantries are reduced and their use is simplified by using the fixed magnetic field. The 'new' gantry is made of a very large momentum acceptance non-scaling Fixed Field Alternating Gradient (FFAG) quarter and half arc beam lines. The gantry is made of combined function magnets with a very strong focusing and small dispersion function. Additional magnets with a fast response are required to allow adjustments of the beam position for different energies at the beginning of the gantry. Additional strong focusing magnets following the gantry have also to be. adjustable to provide required spot size and radial scanning above the patients. The fixed field combined function magnets could be made of small permanent magnets for the proton machine, or of the high temperature superconductors or superconductors for the carbon machine, reducing dramatically the size.

NTIS

*Carbon; Gantry Cranes; Protons; Therapy*

**20070001414** Brookhaven National Lab., Upton, NY USA

**Crystalline Beams at High Energies**

Wei, J.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885013; BNL-75482-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Previously it was shown that by crystallizing each of the two counter-circulating beams, a much larger beam-beam tune shift can be tolerated during the beam-beam collisions; thus a higher luminosity can be reached for colliding beams. On the other hand, crystalline beams can only be formed at energies below the transition energy ( $(\gamma)_{(sub T)}$ ) of the accelerators. In this paper, we investigate the formation of crystals in a high- $(\gamma)_{(sub T)}$  lattice that also satisfies the maintenance condition for a crystalline beam.

NTIS

*Crystallinity; Beams (Radiation)*

**20070001415** Brookhaven National Lab., Upton, NY USA

**Injection System Design for the BSNS/RCS**

Wei, J.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885011; BNL-75479-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

The BSNS injection system is designed to take one uninterrupted long drift in one of the four dispersion-free straight sections to host all the injection devices. Painting bumper magnets are used for both horizontal and vertical phase space painting. Closed-orbit bumper magnets are used for facilitating the installation of the injection septa and decreasing proton traversal in the stripping foil. Even with large beam emittance of about 300 (pi)mm.mrad used, BSNS/RCS still approaches the space charge limit during the injection/trapping phase for the accumulated particles of  $1.9 \times 10^{13}$  and at the low injection energy of 80 MeV. Uniform-like beam distribution by well-designed painting scheme is then obtained to decrease the tune shift/spread. ORBIT code is used for the 3D simulations. Upgrading to higher injection energy has also been considered.

NTIS

*Emittance; Injection; Systems Engineering*

**20070001416** Brookhaven National Lab., Upton, NY USA

**Anti-Symmetric Lattice for High-Intensity Rapid Cycling Synchrotrons**

Wei, J.; Wang, S.; Fang, S. X.; Lee, Y. Y.; Machida, S.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885012; BNL-75481-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Rapid cycling synchrotrons (RCSs) are used in many high power facilities like spallation neutron sources and proton drivers to accumulate and accelerate proton beams. In such accelerators, beam collimation plays a crucial role in reducing the uncontrolled beam loss. Furthermore, injection and extraction sections often need to reside in dispersion-free regions to avoid couplings; sizeable drift space is needed to house the RF accelerating cavities; long, uninterrupted straights are desired to ease injection tuning and to raise collimation efficiency. Finally, the machine circumference needs to be small to reduce construction costs. In this paper, we present a lattice satisfying these needs. The lattice contains a drift created by a missing

dipole near the peak dispersion to facilitate longitudinal collimation. The compact FODO arc allows easy orbit, tune, coupling, and chromatic correction. The doublets provide long uninterrupted straights. The four-fold lattice symmetry separates injection, extraction, and collimation to different straights. This lattice is adopted for the China Spallation Neutron Source (CSNS) synchrotron.

NTIS

*Cycles; Synchrotrons*

**20070001417** Brookhaven National Lab., Upton, NY USA

**Extraction System Design for the BSNS/RCS**

Wei, J.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885010; BNL-75477-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

The BSNS extraction system takes use one of the four dispersion-free straight sections. Five vertical kickers and one Lambertson septum magnet are used for the one-turn extraction. The rise time of less 250 ns and the total kicking angle of 20 mrad are required for the kickers that are grouped into two tanks. The design for the kicker magnets and the PFN is also given. To reduce the low beam loss in the extraction channels due to large halo emittance, large apertures are used for both the kickers and septum. Stray magnetic field inside and at the two ends of the circulating path of the Lambertson magnet and its effect to the beam has been studied.

NTIS

*Extraction; Systems Engineering*

**20070001418** Brookhaven National Lab., Upton, NY USA

**Spin Transport from AGS to RHIC with Two Partial Snakes in AGS**

MacKay, W. W.; Luccio, A. U.; Tsoupas, N.; Takano, J.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885009; BNL-75462-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

The stable spin direction in the RHIC rings is vertical. With one or two partial helical Siberian snakes in the AGS, the stable spin direction at extraction is not vertical. Interleaved vertical and horizontal bends in the transport line between AGS and the RHIC rings also tend to tip the spin away from the vertical. In order to maximize polarization in RHIC, we examined several options to improve the matching of the stable spin direction during beam transfer from the AGS to each of the RHIC rings. While the matching is not perfect, the most economical method appears to be a lowering of the injection energy by one unit of G( $\gamma$ ) from 46.5 to 45.5.

NTIS

*Accelerators; Spin*

**20070001419** Brookhaven National Lab., Upton, NY USA

**Comment on the Healy's Symplectification Algorithm**

MacKay, W. W.; Jun. 2006; 10 pp.; In English

Report No.(s): DE2006-885008; BNL-75461-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

For long-term tracking, it is important to have symplectic maps for the various electromagnetic elements in an accelerator ring. While many standard elements are handled well by modern tracking programs, new magnet configurations (e.g., a helical dipole with a superimposed solenoid) are being used in real accelerators. Transport matrices and higher terms may be calculated by numerical integration through model-generated or measured field maps. The resulting matrices are most likely not quite symplectic due to numerical errors in the integrators as well as the field maps. In his thesis, Healy presented a simple algorithm to symplectify a matrix. While the method is quite robust, this paper presents a discussion of its limitations.

NTIS

*Algorithms; Accelerators*

**20070001420** Brookhaven National Lab., Upton, NY USA

**Feasibility of Polarized Heavy Ions in RHIC**

MacKay, W. W.; January 2005; 10 pp.; In English

Report No.(s): DE2006-885007; BNL-75460-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Heavy nonspherical ions such as uranium have been proposed for collisions in RHIC. When two such ions collide with their long axes aligned parallel to the beams (large helicities), then the plasma density might be as much as 60% higher. Since the collisions might have any orientation of the two nuclei, the alignment of the nuclei must be inferred from a complicated

unfolding of multiplicity distributions. Instead, if it would be possible to polarize the ions and control the orientation in RHIC, then a much better sensitivity might be obtained. This paper investigates the manipulation of such polarized ions with highly distorted shapes in RHIC. A number of ion species are considered as possibilities with either full or partial Siberian snakes in RHIC.

NTIS

*Heavy Ions; Accelerators*

**20070001448** California Univ., Santa Cruz, CA USA

**Conservation of Lateral Momentum in Heterostructure Integrated Thermionic Coolers**

Jan 2006; 16 pp.; In English

Report No.(s): AD-A458422; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Coolers; Momentum*

**20070001540** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Diffusion of Hydrogen and Helium in Inconel 625**

Palosz, W.; Gillies, D.; Lehoczy, S.; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Diffusion parameters for hydrogen and helium in Inconel 625 were investigated. The dependence of permeability of hydrogen in the temperature range 310 - 750 C is given. Solubility of hydrogen at 1 atm in the range 640 - 860 C was determined and diffusivity of the gas was calculated. Experiments with diffusion and solubility at 0.09 atm suggest a molecular mechanism of solution of hydrogen in the material. Diffusivity of helium was estimated at less than  $10(\exp -18)$  sq cm/s (at 1040 C).

Author

*Hydrogen Isotopes; Helium; Diffusion; Inconel (Trademark); Permeability; Solubility; Hydrogen*

**20070001551** NASA Marshall Space Flight Center, Huntsville, AL, USA

**3-D RPIC Simulations of Relativistic Jets: Particle Acceleration, Magnetic Field Generation, and Emission**

Nishikawa, K.-I.; Mizuno, Y.; Hardee, P.; Hededal, C. B.; Fishman, G. J.; [2006]; 1 pp.; In English; Microquasars and Beyond, 18-22 Sep. 2006, Como, Italy; Copyright; Avail.: Other Sources; Abstract Only

Recent PIC simulations using injected relativistic electron-ion (electro-positron) jets into ambient plasmas show that acceleration occurs in relativistic shocks. The Weibel instability created in shocks is responsible for particle acceleration, and generation and amplification of highly inhomogeneous, small-scale magnetic fields. These magnetic fields contribute to the electron's transverse deflection in relativistic jets. The 'jitter' radiation from deflected electrons has different properties than the synchrotron radiation which is calculated in a uniform magnetic field. This jitter radiation may be important to understand the complex time evolution and spectral structure in relativistic jets and gamma-ray bursts. We will present recent PIC simulations which show particle acceleration and magnetic field generation. We will also calculate associated self-consistent emission from relativistic shocks.

Author

*Particle Acceleration; Relativistic Particles; Nonuniform Magnetic Fields; Gamma Ray Bursts; Field Emission; Amplification; Synchrotron Radiation*

**20070001580** Lawrence Livermore National Lab., Livermore, CA USA

**Initial Self-Consistent 3D Electron-Cloud Simulations of the LHC Beam with the Code WARP+POINST**

Vay, J. L.; Furman, M. A.; Cohen, R. H.; Friedman, A.; Grote, D. P.; Oct. 12, 2005; 10 pp.; In English

Report No.(s): DE2006-885375; No Copyright; Avail.: National Technical Information Service (NTIS)

We present initial results for the self-consistent beamcloud dynamics simulations for a sample LHC beam, using a newly developed set of modeling capability based on a merge of the three-dimensional parallel Particle-In-Cell (PIC) accelerator code WARP and the electron-cloud code POSINST. Although the storage ring model we use as a test bed to contain the beam is much simpler and shorter than the LHC, its lattice elements are realistically modeled, as is the beam and the electron cloud dynamics. The simulated mechanisms for generation and absorption of the electrons at the walls are based on previously validated models available in POSINST.

NTIS

*Electron Clouds; Simulation; Self Consistent Fields; Three Dimensional Models*

**20070001639** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Motion Inference During +Gz Acceleration**

Tripp, Jr, Lloyd D; McKinley, Richard A; Esken, Robert L; Sep 2006; 13 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A458529; AFRL-HE-WP-TP-2006-0091; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458529>; Avail.: CASI: A03, Hardcopy

In the combat setting there are times when the pilot's attention is drawn away from the target momentarily and then redirected back to the target. In this scenario the pilot must infer the target's new position based on information about its previous position. This study measured the effect of +Gz on the pilot's ability to make inferences about aircraft position. Methods: Seven subjects (5 male; 2 female) participated. Ages ranged from 24 to 35 years. Acceleration profiles included 3, 5, and 7 Gz, for 15 sec and a 7 G simulated aerial combat maneuver. The psychomotor task involved a target light that traversed the curved path from left to right at a constant velocity and then disappeared. The observer stopped the target by estimating when the target would intersect a fixed point. A secondary task consisted of four letters inside a box; subjects responded to sets containing a vowel. Results: A repeated measures ANOVA was performed for the mean angle error change from baseline performance metric. A significant difference among the 3, 5, and 7 Gz plateaus, and SACM 7 Gz plateau ( $p=0.0013$ : Greenhouse-Geisser epsilon=0.69, adjusted  $p=0.0053$ ). Two-tailed t-tests using the subject means revealed that the 5 Gz ( $p=0.0274$ ), 7 Gz ( $p=0.0037$ ), and SACM 7 Gz ( $p=0.0005$ ) plateau means to be significantly different from zero. Conclusions: A pilot's perception of dynamic target position may be compromised during exposure to low and moderate +Gz acceleration.

DTIC

*Acceleration (Physics); Inference; Motion; Pilots; Targets*

**20070001713** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Activity Detection for Information Access to Oral Communication**

Ries, Klaus; Waibel, Alex; Jan 2001; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458656; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458656>; Avail.: Defense Technical Information Center (DTIC)

Oral communication is ubiquitous and carries important information yet it is also time consuming to document. Given the development of storage media and networks one could just record and store a conversation for documentation. The question is, however, how an interesting information piece would be found in a large database. Traditional information retrieval techniques use a histogram of keywords as the document representation but oral communication may offer additional indices such as the time and place of the rejoinder and the attendance. An alternative index could be the activity such as discussing, planning, informing, story-telling, etc. This paper addresses the problem of the automatic detection of those activities in meeting situation and everyday rejoinders. Several extensions of this basic idea are being discussed and/or evaluated: Similar to activities one can define subsets of larger database and detect those automatically which is shown on a large database of TV shows. Emotions and other indices such as the dominance distribution of speakers might be available on the surface and could be used directly. Despite the small size of the databases used some results about the effectiveness of these indices can be obtained.

DTIC

*Detection; Information Retrieval; Signal Processing; Speech Recognition; Voice Communication*

**20070001883** California Univ., Santa Cruz, CA USA

**Measurement of Seebeck Coefficient Perpendicular to SiGe Superlattice**

Zhang, Yan; Zeng, Gehang; Singh, Rajeev; Christofferson, James; Croke, Edward; Bowers, John E; Shakouri, Ali; Aug 2002; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458768; No Copyright; Avail.: CASI: A01, Hardcopy

Seebeck coefficient is one of the key parameters to evaluate the performance of thermoelectric coolers. However, it is very difficult to directly measure Seebeck coefficient perpendicular to thin film devices because of the difficulty of creating a temperature gradient and measuring localized temperature and voltage change simultaneously. In this paper, a novel method is described and it is used to measure the Seebeck coefficient of SiGe superlattice material perpendicular to the layers. Successful measurement was achieved by integrating a thin film metal wire as a temperature sensor and heat source on top of the SiGe superlattice micro coolers. Extensive thermoreflectance imaging characterization was performed to ensure uniform temperature distribution on top of the thin film device. Details of the experimental set-up and measurement technique are discussed. By analyzing the measured thermoelectric voltage for various device sizes and superlattice thickness, Seebeck

coefficient of the superlattice material perpendicular to the layers is deduced.

DTIC

*Microelectronics; Superlattices; Thermoelectric Cooling*

**20070001890** California Univ., Santa Cruz, CA USA

**Transient Harman Measurement of the Cross-plane ZT of InGaAs/InGaAlAs Superlattices with Embedded ErAs Nanoparticles**

Singh, Rajeev; Bian, Zhixi; Zeng, Gehong; Zide, Joshua; Christofferson, James; Chou, Hsu-Feng; Gossard, Art; Bowers, John; Shakouri, Ali; Nov 2005; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458783; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The transient Harman technique is used to characterize the cross-plane ZT of InGaAs/InGaAlAs superlattice structures with embedded ErAs nanoparticles in the well layers. ErAs nanoparticles have proven to substantially reduce the thermal conductivity while slightly increasing the electrical conductivity of bulk InGaAs. The InGaAs/InGaAlAs superlattice structure was designed to have a barrier height of approximately 200meV. Although ErAs nanoparticles provide free carriers inside the semiconductor matrix, additional doping with Si increased the Fermi energy to just below the barrier height. The bipolar transient Harman technique was used to measure device ZT of samples with different superlattice thicknesses in order to extract the intrinsic cross-plane ZT of the superlattice by eliminating the effects of device Joule heating and parasitics. High-speed packaging is used to reduce signal ringing due to electrical impedance mismatch and achieve a short time resolution of roughly 100ns in transient Seebeck voltage measurement. The measured intrinsic cross-plane ZT of the superlattice structure is 0.13 at room temperature. This value agrees with calculations based on the Boltzmann transport equation and direct measurements of specific film properties. Theoretical calculations predict cross-plane ZT of the superlattice to be greater than 1 at temperatures greater than 700K.

DTIC

*Embedding; Figure of Merit; Indium Gallium Arsenides; Measurement; Nanoparticles; Superlattices; Thermoelectricity*

**20070001999** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Cascaded Photoenhancement: Implications for Photonic Chemical and Biological Sensors**

Fuller, Kirk A.; Smith, David D.; [2006]; 8 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Our analysis shows that coupling of gold nanoparticles to microspheres will evoke a cascading effect from the respective photoenhancement mechanisms. We refer to this amplification process as cascaded photoenhancement, and the resulting cavity amplification of surface-enhanced Raman scattering (SERS) and fluorescence as CASERS and CAF, respectively. Calculations, based on modal analysis of scattering and absorption by compound spheres, presented herein indicate that the absorption cross sections of metal nanoparticles immobilized onto dielectric microspheres can be greatly enhanced by cavity resonances in the microspheres without significant degradation of the resonators. Gain factors associated with CSP of  $10(\exp 3) - 10(\exp 4)$  are predicted for realistic experimental conditions using homogenous microspheres. Cascaded surface photoenhancement thus has the potential of dramatically increasing the sensitivities of fluorescence and vibrational spectroscopies.

Author

*Cavity Resonators; Amplification; Cavities; Nanoparticles; Raman Spectra; Fluorescence*

## 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*.

**20070000767** Mitre Corp., McLean, VA USA

**Reconstruction of Acoustic Collection Missions against Three Cruise Missiles**

Lowen, Daniel J; Oct 1999; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAB07-99-C-C201

Report No.(s): AD-A458155; MP-99W0000241; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Between July 1996 and June 1997, The MITRE Corporation planned and directed the collection of acoustic data on cruise missile flights as part of a corporate Mission-Oriented Investigation and Experimentation (MOIE) study examining the



feasibility of using off-board sensors for over-the-horizon detection of low flying cruise missiles. The Offboard Sensing Initiative (OSI) MOIE proposed to identify and develop methods for exploiting nontraditional signatures associated with low-flying, anti-ship cruise missiles. The concept envisioned an improved detection capability against these increasingly stealthy threats using deployed sensors to provide early cueing, longer detection timelines, and an extended depth-of-fire. While many different sensor types were considered, MITRE and government resources limited the collection of information to acoustic signatures. The MOIE was performed under the auspices of the Program Executive Officer, Theater Air Defense PEO(TAD), with the support of the Office of the Chief of Naval Operations for Air Warfare (Opnav N88) and the Commander, Patrol Wings U.S. Pacific Fleet. Each of the three missions targeted a different cruise missile. Two August 1996 missions collected acoustic data on the MQM-8G Extended-Extended Range (EER) VANDAL and the Russian-built MA-31. A June 1997 mission collected acoustic data on a Navy Special Engineering Test Target (SETT) SETT-8A. This report presents a reconstruction of the acoustic collection missions.

DTIC

*Acoustics; Antiship Missiles; Cruise Missiles; Low Altitude; Over-the-Horizon Radar; Sonobuoys; Sound Detecting and Ranging; Tracking (Position)*

**20070000782** Omni Technologies, Inc., Stennis Space Center, MS USA

**Parametric Sub-Bottom Profiler for AUVs**

Griffin, Sean R; Kuhn, Stephen C; Benjamin, Kim; Jul 2006; 5 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A458173; No Copyright; Avail.: CASI: [A01](#), Hardcopy

Autonomous underwater vehicles (AUV) are fast becoming viable survey platforms. With this growth, new survey tools have emerged. The Naval Oceanographic Office's (NAVOCEANO) profiler for the Subsurface Autonomous Mapping System (SAMS) AUV (PFRS) was developed by Omni Technologies Inc. (OTI) to provide high-resolution, sub-bottom imagery (data). AUVs have stringent requirements in electrical power budget, size and weight requiring survey sensors that are smaller, lighter, autonomous and more energy efficient than typical survey tools. However, AUVs are excellent survey platforms due to their stability and ability to operate close to the target. Sub-bottom profilers are used by surveyors to obtain information on surficial marine sediments in cable route surveys, for pipeline route surveys, piling installations, pipeline burial and scour surveys, salvaging operations or any operation where knowledge of bottom and sub-bottom sediments is critical.

DTIC

*Mapping; Sonar*

**20070001121** Naval Postgraduate School, Monterey, CA USA

**Acoustic Rapid COTS Insertion: A Case Study in Spiral Development**

Oct 30, 2006; 87 pp.; In English

Report No.(s): AD-A458431; NPS-GSBPP-06-016; No Copyright; Avail.: CASI: [A05](#), Hardcopy

No abstract available

*Acoustics; Military Operations*

**20070001186** Missouri Univ., Columbia, MO USA

**Ultrasonic Detection Using Correlation Images (Preprint)**

Aug 2006; 10 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-PE62112F

Report No.(s): AD-A458450; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Ultrasonic Flaw Detection; Ultrasonics; Imaging Techniques; Acoustic Imaging*

**20070001662** Naval Research Lab., Washington, DC USA

**Development of a Broadband Underwater Sound Projector**

Howarth, Thomas R; Ting, Robert Y; Jan 1997; 8 pp.; In English

Report No.(s): AD-A458566; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458566>; Avail.: CASI: [A02](#),

Hardcopy

Abstract - An underwater sound projector has been recently developed for operation over a decade long frequency range. The output of the projector has been designed for 10 kHz to 100 kHz operation on an autonomous underwater vehicle (AUV). The transducer is resonant at 100 kHz but has been designed to deliver high sound pressure levels without impedance or phase

instabilities. The transducer features the first successful stacking of 1-3 piezocomposite materials. The selection of the 1-3 piezocomposite materials has resulted in the mode-free sound output while the stacking arrangement permits acoustic operation with twice the sound output at half the resonance frequency of a single layer. The stacking is done mechanically in series and electrically in parallel with the center electrode as the positive plane. Furthermore, the center electrode has been segmented into four individual elements such that combinations of the sectors offer the ability to access nine different apertures.

DTIC

*Broadband; Projectors; Underwater Acoustics; Underwater Vehicles*

**20070001689** Army Tank-Automotive and Armaments Command, Warren, MI USA

**Using the TARDEC Acoustic Ground Array to Determine the Characteristics of the Band Track**

Shalis, Edward; Freese, Douglas; Aug 19, 1999; 16 pp.; In English

Report No.(s): AD-A458620; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458620>; Avail.: CASI: [A03](#),  
Hardcopy

Introduction: Input forces for flexible composite Band Track are reduced. This leads to lower vibration amplitudes inside the hull. Significant reduction in acoustic signature was expected.

DTIC

*Personnel; Sound Detecting and Ranging*

**20070001712** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Acoustical Pre-Processing for Robust Speech Recognition**

Stern, Richard M; Acero, Alejandro; Jan 1989; 9 pp.; In English

Contract(s)/Grant(s): N00039-85-C-0163

Report No.(s): AD-A458654; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458654>; Avail.: CASI: [A02](#),  
Hardcopy

In this paper we describe our initial efforts to make SPHINX, the CMU continuous speech recognition system, environmentally robust. Our work has two major goals: to enable SPHINX to adapt to changes in microphone and acoustical environment, and to improve the performance of SPHINX when it is trained and tested using a desk-top microphone. This talk will describe some of our work in acoustical pre-processing techniques, specifically spectral normalization and spectral subtraction performed using an efficient pair of algorithms that operate primarily in the cepstral domain. The effects of these signal processing algorithms on the recognition accuracy of the Sphinx speech recognition system was compared using speech simultaneously recorded from two types of microphones: the standard close-talking Sennheiser HMD224 microphone and the desk-top Crown PZM6fs microphone. A naturally-elicited alphanumeric speech database was used. In initial results using the stereo alphanumeric database, we found that both the spectral subtraction and spectral normalization algorithms were able to provide very substantial improvements in recognition accuracy when the system was trained on the close-talking microphone and tested on the desk-top microphone, or vice versa. Improving the recognition accuracy of the system when trained and tested on the desk-top microphone remains a difficult problem requiring more sophisticated noise suppression techniques.

DTIC

*Acoustics; Signal Processing; Speech Recognition*

**20070001716** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Efficient CEPSTRAL Normalization for Robust Speech Recognition**

Liu, Fu-Hua; Stern, Richard M; Huang, Xuedong; Acero, Alejandro; Jan 1993; 7 pp.; In English

Contract(s)/Grant(s): N00014-93-2005

Report No.(s): AD-A458659; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458659>; Avail.: CASI: [A02](#),  
Hardcopy

In this paper we describe and compare the performance of a series of cepstrum-based procedures that enable the CMU SPHINX-II speech recognition system to maintain a high level of recognition accuracy over a wide variety of acoustical environments. We describe the MFDCDN algorithm, an environment-independent extension of the efficient SDCN and FCDCN algorithms developed previously. We compare the performance of these algorithms with the very simple RASTA and cepstral mean normalization procedures, describing the performance of these algorithms in the context of the 1992 DARPA

CSR evaluation using secondary microphones, and in the DARPA stress-test evaluation.

DTIC

*Acoustics; Cepstral Analysis; Speech Recognition; Telephones*

**20070001893** Florida Agricultural and Mechanical Univ., Tallahassee, FL USA

**Numerical Solutions for Optimal Control Problems Under SPDE Constraints**

Cao, Yanzhao; Oct 5, 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0234

Report No.(s): AD-A458787; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary source of aircraft noise is the fan noise from the engines; natural approaches to reducing this noise involve acoustic shape optimization of the inlet and impedance optimization of the liner. This project will use optimal control to systematically determine the inlet shape and the linear material impedance factor that minimize the fan noise. A novel feature of this approach is that we automatically incorporate uncertainty and data measurement errors. Specifically we assume that the acoustic wave number is a random variable/field instead of a constant. This means that the computed answers are valid, not merely for a single configuration, but for a wide range. Our numerical results show significant noise reduction with the optimal impedance factor. Since the wave number is random, the underlying partial differential equation-Helmholtz equation in our case, is a stochastic partial differential equation. In this project, we have constructed efficient Monte Carlo methods as well as stochastic finite element methods to solve stochastic partial differential equations. Rigorous error estimates are obtained and numerical simulations are conducted to support the error analysis.

DTIC

*Aircraft Noise; Monte Carlo Method; Noise Reduction; Numerical Analysis; Optimal Control; Sound Waves*

**20070002006** NASA Langley Research Center, Hampton, VA, USA

**Tracking Energy Flow Using a Volumetric Acoustic Intensity Imager (VAIM)**

Klos, Jacob; Williams, Earl G.; Valdivia, Nicolas P.; [2006]; 10 pp.; In English; INTER-NOISE 2006 - 35th International Congress and Exposition on Noise Control Engineering, 3-6 Dec. 2006, Honolulu, HI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 581.02.08.07; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070002006>; Avail.: CASI: A02, Hardcopy

A new measurement device has been invented at the Naval Research Laboratory which images instantaneously the intensity vector throughout a three-dimensional volume nearly a meter on a side. The measurement device consists of a nearly transparent spherical array of 50 inexpensive microphones optimally positioned on an imaginary spherical surface of radius 0.2m. Front-end signal processing uses coherence analysis to produce multiple, phase-coherent holograms in the frequency domain each related to references located on suspect sound sources in an aircraft cabin. The analysis uses either SVD or Cholesky decomposition methods using ensemble averages of the cross-spectral density with the fixed references. The holograms are mathematically processed using spherical NAH (nearfield acoustical holography) to convert the measured pressure field into a vector intensity field in the volume of maximum radius 0.4 m centered on the sphere origin. The utility of this probe is evaluated in a detailed analysis of a recent in-flight experiment in cooperation with Boeing and NASA on NASA's Aries 757 aircraft. In this experiment the trim panels and insulation were removed over a section of the aircraft and the bare panels and windows were instrumented with accelerometers to use as references for the VAIM. Results show excellent success at locating and identifying the sources of interior noise in-flight in the frequency range of 0 to 1400 Hz. This work was supported by NASA and the Office of Naval Research.

Author

*Acoustical Holography; Frequency Ranges; Near Fields; Identifying; Cholesky Factorization; Signal Processing*

**20070002009** NASA Langley Research Center, Hampton, VA, USA

**Reconstruction of the Acoustic Field Using a Conformal Array**

Valdivia, Nicholas P.; Williams, Earl G.; Klos, Jacob; [2006]; 9 pp.; In English; INTER-NOISE 2006 - 35th International Congress and Exposition on Noise Control Engineering, 3-6 Dec. 2006, Honolulu, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 581.02.08.07; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070002009>; Avail.: CASI: A02, Hardcopy

Near-field acoustical holography (NAH) requires the measurement of the near-field pressure field over a conformal and

closed surface in order to recover the acoustic field on a nearby surface. We are interested in the reconstruction of the acoustic field over the fuselage of a Boeing 757 airplane when pressure data is available over an array of microphones that are conformal to the fuselage surface. In this case the strict NAH theory does not hold, but still there are techniques used to overcome this difficulty. The best known is patch NAH, which has been used for planar surfaces. In this work we will discuss two new techniques used for surfaces with an arbitrarily shape: patch inverse boundary element methods (IBEM) and patch equivalent sources method (ESM). We will discuss the theoretical justification of the method and show reconstructions for in-flight data taken inside a Boeing 757 airplane.

Author

*Acoustical Holography; Pressure Measurement; Sound Fields; Boundary Element Method; Acoustics*

**20070002014** NASA Langley Research Center, Hampton, VA, USA

**A Landing Gear Noise Reduction Study Based on Computational Simulations**

Khorrami, Mehdi R.; Lockard, David P.; [2006]; 11 pp.; In English; INTER-NOISE 2006 - 35th International Congress and Exposition on Noise Control Engineering, 3-6 Dec. 2006, Honolulu, HI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 581.02.08; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070002014>; Avail.: CASI: A03, Hardcopy

Landing gear is one of the more prominent airframe noise sources. Techniques that diminish gear noise and suppress its radiation to the ground are highly desirable. Using a hybrid computational approach, this paper investigates the noise reduction potential of devices added to a simplified main landing gear model without small scale geometric details. The Ffowcs Williams and Hawkings equation is used to predict the noise at far-field observer locations from surface pressure data provided by unsteady CFD calculations. Because of the simplified nature of the model, most of the flow unsteadiness is restricted to low frequencies. The wheels, gear boxes, and oleo appear to be the primary sources of unsteadiness at these frequencies. The addition of fairings around the gear boxes and wheels, and the attachment of a splitter plate on the downstream side of the oleo significantly reduces the noise over a wide range of frequencies, but a dramatic increase in noise is observed at one frequency. The increased flow velocities, a consequence of the more streamlined bodies, appear to generate extra unsteadiness around other parts giving rise to the additional noise. Nonetheless, the calculations demonstrate the capability of the devices to improve overall landing gear noise.

Author

*Landing Gear; Aircraft Noise; Noise Reduction; Airframes; Aerodynamic Noise; Computational Fluid Dynamics*

**20070002084** Missouri Univ., Columbia, MO USA

**Statistical Analysis and Computer Generation of Spatially Correlated Acoustic Noise (Preprint)**

May 2006; 42 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2510

Report No.(s): AD-A458340; No Copyright; Avail.: CASI: A03, Hardcopy

No abstract available

*Computer Techniques; Noise (Sound); Statistical Analysis; Correlation*

## 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*.

**20070000018** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Optimization of Superconducting Focusing Quadrupoles for the High Current Experiment**

Sabbi, G. L.; Gourlay, S.; Gung, C.; Hafalia, R.; Lietzke, A.; Sep. 2005; 8 pp.; In English

Report No.(s): DE2006-885234; No Copyright; Avail.: Department of Energy Information Bridge

The Heavy Ion Fusion (HIF) program is progressing through a series of physics and technology demonstrations leading to an inertial fusion power plant. The High Current Experiment (HCX) at Lawrence Berkeley National Laboratory is exploring the physics of intense beams with high line-charge density. Superconducting focusing quadrupoles have been developed for the HCX magnetic transport studies. A baseline design was selected following several pre-series models. Optimization of the

baseline design led to the development of a first prototype that achieved a conductor-limited gradient of 132 T/m in a 70 mm bore, without training, with measured field errors at the 0.1% level. Based on these results, the magnet geometry and fabrication procedures were adjusted to improve the field quality. These modifications were implemented in a second prototype. In this paper, the optimized design is presented and comparisons between the design harmonics and magnetic measurements performed on the new prototype are discussed.

NTIS

*High Current; Quadrupoles; Superconductivity; Nuclear Fusion*

**20070000494** Bettis Atomic Power Lab., West Mifflin, PA, USA

### **Carbon-Carbon Composites as Recuperator Materials for Direct Gas Brayton Systems**

Wolf, R. A.; Jul. 19, 2006; 26 pp.; In English

Report No.(s): DE2006-884666; No Copyright; Avail.: Department of Energy Information Bridge

Of the numerous energy conversion options available for a space nuclear power plant (SNPP), one that shows promise in attaining reliable operation and high efficiency is the direct gas Brayton (GB) system. In order to increase efficiency, the GB system incorporates a recuperator that accounts for nearly half the weight of the energy conversion system (ECS). Therefore, development of a recuperator that is lighter and provides better performance than current heat exchangers could prove to be advantageous. The feasibility of a carbon-carbon (CIC) composite recuperator core has been assessed and a mass savings of 60% and volume penalty of 20% were projected. The excellent thermal properties, high-temperature capabilities, and low density of carbon-carbon materials make them attractive in the GB system, but development issues such as material compatibility with other structural materials in the system, such as refractory metals and superalloys, permeability, corrosion, joining, and fabrication must be addressed.

NTIS

*Brayton Cycle; Carbon-Carbon Composites; Nuclear Power Plants; Regenerators*

**20070000496** Bettis Atomic Power Lab., West Mifflin, PA, USA

### **Metallic and Non Metallic Materials for the Primary Support Structure**

Wolf, R. A.; Corson, R.; Feb. 2006; 28 pp.; In English

Report No.(s): DE2006-884667; No Copyright; Avail.: Department of Energy Information Bridge

The primary support structure (PSS) is required for mechanical support of reactor module (RM) components and mounting of the RM to the spacecraft. The PSS would provide support and accept all loads associated with dynamic (e. g., launch and maneuvering) or thermally induced loading. Prior to termination of NRPCT involvement in Project Prometheus, the NRPCT Mechanical Systems team developed preliminary finite element models to gain a basic understanding of the behavior of the structure, but optimization of the models, specification of the final design, and materials selection were not completed. The Space Plant Materials team had evaluated several materials for potential use in the primary support structure, namely titanium alloys, beryllium, aluminum alloys and carbon-carbon composites. The feasibility of application of each material system was compared based on mass, stiffness, thermal expansion, and ease of fabrication. Due to insufficient data on environmental factors, such as temperatures and radiation, and limited modeling support, a final materials selection was not made.

NTIS

*Aluminum Alloys; Beryllium Alloys; Titanium Alloys*

**20070000499** Bettis Atomic Power Lab., West Mifflin, PA, USA

### **Barrier Coatings for Refractory Metals and Superalloys**

Sabol, S. M.; Edington, J.; Randall, B.; Larkin, C.; Close, B.; Feb. 23, 2006; 32 pp.; In English

Report No.(s): DE2006-884669; No Copyright; Avail.: Department of Energy Information Bridge

In the closed working fluid loop of the proposed Prometheus space nuclear power plant (SNPP), there is the potential for reaction of core and plant structural materials with gas phase impurities and gas phase transport of interstitial elements between superalloy and refractory metal alloy components during service. Primary concerns are surface oxidation, interstitial embrittlement of refractory metals and decarburization of superalloys. In parallel with kinetic investigations, this letter evaluates the ability of potential coatings to prevent or impede communication between reactor and plant components. Key coating requirements are identified and current technology coating materials are reviewed relative to these requirements. Candidate coatings are identified for future evaluation based on current knowledge of design parameters and anticipated environment. Coatings were identified for superalloys and refractory metals to provide diffusion barriers to interstitial

transport and act as reactive barriers to potential oxidation. Due to their high stability at low oxygen potential, alumina formers are most promising for oxidation protection given the anticipated coolant gas chemistry. A sublayer of iridium is recommended to provide inherent diffusion resistance to interstitials. Based on specific base metal selection, a thin film substrate--coating interdiffusion barrier layer may be necessary to meet mission life.

NTIS

*Diffusion; Heat Resistant Alloys; Nuclear Power Plants; Protective Coatings; Refractory Metals*

**20070000500** Bettis Atomic Power Lab., West Mifflin, PA, USA

**Double Retort System for Materials Compatibility Testing (U)**

Munne, V.; Carelli, E. V.; Feb. 23, 2006; 24 pp.; In English

Report No.(s): DE2006-884670; No Copyright; Avail.: Department of Energy Information Bridge

With Naval Reactors (NR) approval of the Naval Reactors Prime Contractor Team (NRPCT) recommendation to develop a gas cooled reactor directly coupled to a Brayton power conversion system as the Space Nuclear Power Plant (SNPP) for Project Prometheus (References a and b) there was a need to investigate compatibility between the various materials to be used throughout the SNPP. Of particular interest was the transport of interstitial impurities from the nickel-base superalloys, which were leading candidates for most of the piping and turbine components to the refractory metal alloys planned for use in the reactor core. This kind of contamination has the potential to affect the lifetime of the core materials. This letter provides technical information regarding the assembly and operation of a double retort materials compatibility testing system and initial experimental results. The use of a double retort system to test materials compatibility through the transfer of impurities from a source to a sink material is described here. The system has independent temperature control for both materials and is far less complex than closed loops. The system is described in detail and the results of three experiments are presented.

NTIS

*Compatibility; Marine Propulsion; Nuclear Power Plants; Refractory Metals; Ships*

**20070001582** Oak Ridge National Lab., TN USA

**Minimum Critical Values Study**

Fox, P. B.; Petrie, L. M.; Hopper, C. M.; Jul. 2005; 102 pp.; In English

Report No.(s): DE2006-886003; No Copyright; Avail.: Department of Energy Information Bridge

This report provides minimum critical values for various 30-cm water-reflected uranium and plutonium oxide and nitrate aqueous mixtures as calculated by the SCALE CSAS1X sequence using the 238-group ENDF/B-V neutron cross-section library. The minimum values were determined through parametric searches in one-dimensional geometry.

NTIS

*Critical Mass; Plutonium Compounds; Uranium Compounds*

## 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*.

**20070000011** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA

**FERMI(at sign)Elettra FEL Design Technical Optimization Final Report**

Fawley, W.; Penn, G.; Allaria, E.; De Ninno, G.; Graves, W.; Aug. 2006; 91 pp.; In English

Report No.(s): DE2006-891827; LBNL-61333; No Copyright; Avail.: National Technical Information Service (NTIS)

This project is based on the principle of harmonic upshifting of an initial seed signal in a single pass, FEL amplifier employing multiple undulators. There are a number of FEL physics principles which underlie this approach to obtaining short wavelength output: (1) the energy modulation of the electron beam via the resonant interaction with an external laser seed (2) the use of a chromatic dispersive section to then develop a strong density modulation with large harmonic overtones (3) the production of coherent radiation by the microbunched beam in a downstream radiator. Within the context of the FERMI project, we discuss each of these elements in turn.

NTIS

*Design Optimization; Free Electron Lasers; Harmonics*

**20070000726** Air Force Research Lab., Hanscom AFB, MA USA

**Negative Index Metamaterial for Selective Angular Separation of Microwaves by Polarization**

Derov, J; Turchinets, B; Crisman, E; Drehman, A; Wing, R; Jun 21, 2004; 5 pp.; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A458083; AFRL-SN-HS-JA-04-0059; No Copyright; Avail.: CASI: [A01](#), Hardcopy

We have demonstrated that an anisotropic metamaterial prism comprises both positive and negative indices. Such a prism can split an incident beam refractively. The values of the positive and negative index and the apex angle of the prism determine the separation angle of the output beams. The positive and negative indices are accessible by the choice of polarization of the incident radiation. Using linearly polarized radiation with the electric field vector parallel to the posts in the prism, negative refraction is observed. Rotating the polarized beam 90° yields a positively refracted signal. Intermediate angles of polarization can achieve refraction in both negative and positive directions simultaneously.

DTIC

*Microwaves; Refractivity*

**20070000762** Massachusetts Inst. of Tech., Cambridge, MA USA

**Crosstalk in Direct-Detection Optical Fiber FDMA Networks**

Hamdy, Walid M; Humblet, Pierre A; Aug 1991; 12 pp.; In English

Contract(s)/Grant(s): DAAL03-86-K-0171; F19628-90-C-0002

Report No.(s): AD-A458150; LIDS-P-2054; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Direct-detection (DD) optical fiber frequency division multiple access (FDMA) is a simple and practical alternative to optical heterodyne FDMA. Previous works on estimating the performance of DD optical FDMA networks have usually focused only on the (linear) crosstalk degradation, typically relying on simplifying approximations such as the dominance of the adjacent channel interference [1], [4]. Other sources of performance degradation such as signal loss due to optical (predetection) and electrical (postdetection) filtering, intersymbol interference (ISI) due to the optical filtering, and channel beats (or nonlinear crosstalk) are usually ignored. This paper presents a more precise analysis that takes into account the effect of optical and electrical filtering, ISI, and linear crosstalk [3]. The model used here is valid for arbitrary optical filter transfer functions and received pulse shapes. We consider in this paper only On-Off-Keyed (OOK) modulation; extending the analysis to Frequency-Shift-Keyed (FSK) modulation is straightforward, but is not discussed here.

DTIC

*Crosstalk; Fiber Optics; Frequency Division Multiple Access; Optical Fibers*

**20070001543** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Rapid Fabrication of Lightweight SiC Optics using Reactive Atom Plasma (RAP) Processing**

Fiske, Peter S.; [2006]; 1 pp.; In English; NASA Technology Days in the Government, 17-20 Sep. 2006, Albuquerque, NM, USA

Contract(s)/Grant(s): NNM06AA11L; No Copyright; Avail.: Other Sources; Abstract Only

Reactive Atom Plasma (RAP) processing is a non-contact, plasma-based processing technology that can be used to generate damage-free optical surfaces. We have developed tools and processes using RAP that allow us to shape extremely lightweight mirror surfaces made from extremely hard-to-machine materials (e.g. SiC). We will describe our latest results using RAP in combination with other technologies to produce finished lightweight SiC mirrors and also discuss applications for RAP in the rapid fabrication of mirror segments for reflective and grazing incidence telescopes.

Author

*Plasmas (Physics); Grazing Incidence Telescopes; Reactivity; Fabrication; Silicon Carbides*

**20070001548** Bennett Optical Research, Inc., Ridgecrest, CA, USA

**Ultra-lightweight, Low Scatter, Large Mirror Technology**

Bennett, H. E.; [2006]; 1 pp.; In English; NASA Mirror Technology Days in the Government, 20 Sep. 2006, Albuquerque, NM, USA; No Copyright; Avail.: Other Sources; Abstract Only

A technique is being developed to fabricate a prototype lightweight composite mirror one meter in diameter. The mandrel, on which the composite mirror will be laid up, is an ultra low expansion quartz glass, TSG, whose thermal expansion coefficient,  $10(\exp -7)/\text{degC}$  or less, is similar to that for the composite material itself. The mandrel surface will be super-polished to 6-8 Å rms or better, resulting in ten times less scattered light in the visible region than is found in typical astronomical mirrors. We have shown experimentally that mandrel micro-roughnesses of this order can be successfully

replicated on composite faceplates. The faceplate is very tough, and does not fracture like a thin glass faceplate. It will be supported by actuators alone, not by the edge of the mirror mount, to avoid non-uniform or non-symmetric influence functions. BOR developed actuators are designed for atmospheric correction, maintenance of optical figure, and minor tip tilt. They have a throw of a centimeter, can be controlled remotely, and have a response time of 1/2 msec. The piezoelectric part of the actuator operates in the 30-70 V range and the differential screw portion has a linearity of about +/-0.1 microns.

Author

*Mirrors; Fabrication; Composite Materials; Attitude (Inclination); Quartz; Glass*

**20070001549** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Highly Engineered Materials Program**

Carter, James M.; [2006]; 1 pp.; In English; NASA Mirror Technology Days in the Government, 17-20 Sep. 2006, Albuquerque, NM, USA; No Copyright; Avail.: Other Sources; Abstract Only

Industry partners and the MSFC have entered into a joint program for characterization studies of various materials which may be viable candidates for future optical systems. We will present the current status of this program. The two phase testing scenario will be discussed including the various tests to be done in each of the test phases. Phase one of the test program has all partners involved while phase two may involve a down-selection of partners based on phase one results.

Author

*Characterization; Optical Materials*

**20070001550** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Status of MSFC X-ray Shell Optics Fabrication Capability**

Sthal, H. Philip; Gubarev, Mikhail; Ramsey, Brian; Englehaupt, Darell; Speegle, Chet; [2006]; 1 pp.; In English; NASA Mirror Technology Days in the Government, 18-19 Sep. 2006, Albuquerque, NM, USA; No Copyright; Avail.: Other Sources; Abstract Only

We present details of an MSFC development program of electroformed-nickel replicated grazing incidence optics for x-ray imaging. To date a wide variety of mirrors has been produced with diameters ranging from 2.5 cm, for small animal imaging, up to 112 meter, for x-ray astronomy. Around 100 intermediate size shells are currently aboard the HERO x-ray astronomy balloon payload awaiting launch in Fort Sumner, New Mexico. Details of the program are presented together with developments currently underway to improve mirror-shell quality from the current approx. 15 arcsec resolution to below 10 arcsec for future x-ray astronomy missions.

Author

*Fabrication; X Ray Optics; Imaging Techniques; Electroforming; X Ray Astronomy; X Ray Imagery*

**20070001553** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Flexensional Single Crystal Piezoelectric Actuators for Membrane Deformable Mirrors**

Jiang, Xiaoning; Sahul, Raffi; Hackenberger, Wesley S.; [2006]; 1 pp.; In English; NASA Tech Days in the Government, 18-19 Sep. 2006, Albuquerque, NM, USA; No Copyright; Avail.: Other Sources; Abstract Only

Large aperture and light weight space telescopes requires adaptive optics with deformable mirrors capable of large amplitude aberration corrections at a broad temperature range for space applications including NASA missions such as SAFIR, TPF, Con-X, etc. The single crystal piezoelectric actuators produced at TRS offer large stroke, low hysteresis, and an excellent cryogenic strain response. Specifically, the recently developed low profile, low voltage flexensional single crystal piezoelectric actuators with dimensions of 18 x 5 x 1 mm showed stroke larger than 95 microns under 300 V. Furthermore, flexensional actuator retained approx. 40-50% of its room temperature strain at liquid Nitrogen environment. In this paper, ATILA FEM design of flexensional actuators, actuator fabrication, and characterization results will be presented for the future work on membrane deformable mirror.

Author

*Apertures; X Ray Astronomy; Deformable Mirrors; Adaptive Optics; Piezoelectric Actuators*

**20070001652** Massachusetts Inst. of Tech., Cambridge, MA USA

**Distribution, Patchiness, and Behavior of Antarctic Zooplankton, Assessed Using Multi-Frequency Acoustic Techniques**

Lawson, Gareth L; Sep 2006; 313 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): N00014-03-1-0212; OPP-9910307



Report No.(s): AD-A458552; MIT/WHOI-2006-13; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458552>;  
Avail.: CASI: A14, Hardcopy

The physical and biological forces that drive zooplankton distribution and patchiness on the antarctic continental shelf were examined, with particular emphasis on the Antarctic krill, *Euphausia superba*. Acoustic, video, and environmental data were collected during fall and winter surveys of the Marguerite Bay region in 2001 and 2002. Improved parameterization of a theoretical model of krill target strength was achieved through direct measurement of all model parameters. Methods were developed and verified for acoustically distinguishing krill aggregations from other zooplankton, and estimating krill length, abundance, and biomass. Application of these methods to multi-frequency survey data demonstrated strong seasonal, inter-annual, and spatial variability in the distribution of both krill and overall zooplankton biomass. Highest krill biomass was consistently associated with regions close to land where temperatures at depth were cool. The vertical position and density of individual krill aggregations varied with time of day, food availability, and the occurrence of predators, suggesting that aggregation and die vertical migration represent a balance between avoiding visual predators and accessing shallowly distributed food resources. These findings have important implications to the fields of zooplankton acoustics and Antarctic krill ecology, especially in relation to the interactions of the krill with its predators.

DTIC

*Acoustics; Antarctic Regions; Bioconversion; Biomass Energy Production; Ecology; Zooplankton*

**20070002102** Maryland Univ., College Park, MD USA

### **An Automatic Closed-Loop Methodology for Generating Character Groundtruth for Scanned Documents**

Kanungo, Tapas; Dec 1998; 20 pp.; In English

Contract(s)/Grant(s): MDA904-96-C-1250

Report No.(s): AD-A458674; LAMP-TR-026; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458674>; Avail.:

CASI: A03, Hardcopy

Character groundtruth for real, scanned document images is crucial for evaluating the performance of OCR systems, training OCR algorithms, and validating document degradation models. Unfortunately, manual collections of accurate groundtruth for characters in a real (scanned) document image is not practical because (1) accuracy in delineating groundtruth character bounding boxes is not high enough, (2) it is extremely laborious and time consuming, and (3) the manual labor required for this task is prohibitively expensive. In this paper we describe a closed-loop methodology for collecting very accurate groundtruth for scanned documents. We first create ideal documents using a typesetting language. Next we create the groundtruth for the ideal document. The ideal document is then printed, photocopied and scanned. A registration algorithm estimates the global geometric transformation and then performs a robust local bitmap match to register the ideal document image to the scanned document image. Finally, groundtruth associated with the ideal document image is transformed using the estimated geometric transformation to create the groundtruth for the scanned document image. This methodology is very general and can be used for creating groundtruth for typeset documents in any language, layout, font, and style.

DTIC

*Feedback Control; Methodology*

## 75

### PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**20070001576** Lawrence Livermore National Lab., Livermore, CA USA

### **Shot Automation for the National Ignition Facility**

Lagin, L. J.; Bettenhausen, R. C.; Beeler, R. G.; Bowers, G. A.; Carey, R.; Sep. 22, 2005; 14 pp.; In English

Report No.(s): DE2006-885137; No Copyright; Avail.: Department of Energy Information Bridge

A shot automation framework has been developed and deployed during the past year to automate shots performed on the National Ignition Facility (NIF) using the Integrated Computer Control System. This framework automates a 4-8 hour shot sequence, that includes inputting shot goals from a physics model, set up of the laser and diagnostics, automatic alignment of laser beams and verification of status. This sequence consists of set of preparatory verification shots, leading to amplified system shots using a 4-minute countdown, triggering during the last 2 seconds using a high-precision timing system, followed by post-shot analysis and archiving. The framework provides for a flexible, model-based execution driven of scriptable automation called macro steps. The framework is driven by high-level shot director software that provides a restricted set of

shot life cycle state transitions to 25 collaboration supervisors that automate 8-laser beams (bundles) and a common set of shared resources. Each collaboration supervisor commands approximately 10 subsystem shot supervisors that perform automated control and status verification. Collaboration supervisors translate shot life cycle state commands from the shot director into sequences of macro steps to be distributed to each of its shot supervisors. Each Shot supervisor maintains order of macro steps for each subsystem and supports collaboration between macro steps. They also manage failure, restarts and rejoining into the shot cycle (if necessary) and manage auto/manual macro step execution and collaborations between other collaboration supervisors. Shot supervisors execute macro step shot functions commanded by collaborations supervisors. Each macro step has database-driven verification phases and a scripted perform phase.

NTIS

*Alignment; Ignition*

**20070001578** Lawrence Livermore National Lab., Livermore, CA USA

**Status of the National Ignition Facility and Control System**

Van Arsdall, P. J.; Bryant, R. M.; Carey, R. W.; Casavant, D. D.; Lakin, L. J.; Sep. 22, 2005; 12 pp.; In English

Report No.(s): DE2006-885139; UCRL-CONF-215580; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is a stadium-sized facility under construction that will contain a 192-beam, 1.8-Megajoule, 500-Terawatt, ultraviolet laser system together with a 10-meter diameter target chamber with room for multiple experimental diagnostics. NIF will be the world's largest and most energetic laser experimental system, providing a scientific center to study inertial confinement fusion (ICF) and matter at extreme energy densities and pressures. NIF's laser beams are designed to compress fusion targets to conditions required for thermonuclear burn, liberating more energy than required to initiate the fusion reactions. NIF is comprised of 24 independent bundles of 8 beams each using laser hardware that is modularized into line replaceable units such as optical assemblies, amplifiers, and multi-function sensor packages containing thousands of adjusting motors and diagnostic points. NIF is operated by the Integrated Computer Control System (ICCS) in an architecture partitioned by bundle and distributed among over 750 front-end processors and supervisory servers. Bundle control system partitions are replicated and commissioned by configuring the control database for each new bundle. NIF's automated control subsystems are built from a common object-oriented software framework based on CORBA distribution that deploys the software across the computer network and achieves interoperation between different languages and target architectures.

NTIS

*Ignition Systems; Control Systems Design*

## 76

### SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 *Electronics and Electrical Engineering*; and 36 *Lasers and Masers*.

**20070000490** Johns Hopkins Univ., Baltimore, MD, USA

**Pulsed Neutron Scattering Studies of Strongly Fluctuating Solids**

January 2006; 40 pp.; In English

Report No.(s): DE2006-884756; No Copyright; Avail.: National Technical Information Service (NTIS)

The conventional description of a solid is based on a static atomic structure with small amplitude so-called harmonic fluctuations about it. This is a final technical report for a project that has explored materials where fluctuations are sufficiently strong to severely challenge this approach and lead to unexpected and potentially useful materials properties. Fluctuations are enhanced when a large number of configurations share the same energy. We used pulsed spallation source neutron scattering to obtain detailed microscopic information about structure and fluctuations in such materials. The results enhance our understanding of strongly fluctuating solids and their potential for technical applications. Because new materials require new experimental techniques, the project has also developed new techniques for probing strongly fluctuating solids. Examples of material that were studied are ZrW<sub>2</sub>O<sub>8</sub> with large amplitude molecular motion that leads to negative thermal expansion, NiGa<sub>2</sub>S<sub>4</sub> where competing interactions lead to an anomalous short range ordered magnet, Pr<sub>1-x</sub>BixRu<sub>2</sub>O<sub>7</sub> where a partially

filled electron shell (Pr) in a weakly disordered environment produces anomalous metallic properties, and TbMnO<sub>3</sub> where competing interactions lead to a magneto-electric phase.

NTIS

*Neutron Scattering; Solids*

**20070000520** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**R&D Requirements, RF Gun Mode Studies, FEL-2 Steady-State Studies, Preliminary FEL-1 Time-Dependent Studies, and Preliminary Layout Investigation**

Byrd, J.; Corlett, J.; Doolittle, L.; Fawley, W.; Lidia, S.; Oct. 01, 2005; 38 pp.; In English

Report No.(s): DE2006-883785; No Copyright; Avail.: National Technical Information Service (NTIS)

This report constitutes the third deliverable of LBNLs contracted role in the FERMI (at) Elettra Technical Optimization study. It describes proposed R&D activities for the baseline design of the Technical Optimization Study, initial studies of the RF gun mode-coupling and potential effects on beam dynamics, steady-state studies of FEL-2 performance to 10 nm, preliminary studies of time-dependent FEL-1 performance using electron bunch distribution from the start-to-end studies, and a preliminary investigation of a configuration with FEL inclined at a small angle from the line of the linac.

NTIS

*Free Electron Lasers; Layouts; Particle Accelerators; Radio Frequencies; Steady State; Time Dependence*

**20070000521** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Approach Towards a Long-Life, Microwave-Assisted H Ion Source for Proton Drivers**

Keller, R.; Regis, M.; Wallig, J.; Hahto, S.; Monroy, M.; January 2006; 8 pp.; In English

Report No.(s): DE2006-883788; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper reports on experiments aimed at developing a new high-intensity H(sup -) ion source with long lifetime whose concept had recently been introduced. Starting from the motivation for this effort, several steps of the earlier development work are recapitulated, and the performance of the latest design variant is discussed in detail. The basic concept consists in coupling an ECR ion source to a standard SNS multi-cusp H(sup -) ion source that is driven by pulsed dc, rather than rf, power. As a key result, an electron beam of 1.5 A current has been extracted from the ECR discharge operating at 1.9 kW c. w. power, and a maximum discharge current of 17.5 A was achieved in the H(sup -) ion source. Production of H(sup -) ions, however could not yet been demonstrated in the one, preliminary, experiment conducted so far. The paper concludes by outlining further envisaged development steps for the plasma generator and an expansion towards a novel extraction system.

NTIS

*Ion Sources; Microwaves; Particle Accelerators; Protons*

**20070000769** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Nd-Doped YBa(2)Cu(3)O(7-x) Films Deposited by Pulsed Laser Ablation (Postprint)**

Varanasi, C V; Tolliver, J C; Haugan, T J; Sathiraju, Srinivas; Maartense, I; Barnes, P N; Jun 2005; 6 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A458157; AFRL-PR-WP-TP-2006-212; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Nd doped YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> targets (Nd<sub>x</sub>Y<sub>1-x</sub>Ba<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>; x = 0, 0.2, 0.4, 1) were prepared in-house and were used to deposit films by pulsed laser ablation in 300 mTorr of oxygen to study the Nd substitution effects on the film properties. Film composition was found to match very closely to the composition of the targets as determined from X-ray photoelectron spectroscopy. The critical transition temperature (T<sub>c</sub>) was found to be reduced as the Nd substitutions were increased in the films. Raman spectra taken from the films indicate that c-axis misalignment and some cation disorder may be present in the films with poor T<sub>c</sub>. Transport critical current density (J<sub>c</sub>) of 3 x 10<sup>6</sup> A/cm<sup>2</sup> was measured in Nd<sub>0.4</sub>Y<sub>0.6</sub>Ba<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> films.

DTIC

*Additives; Doped Crystals; Laser Ablation; Neodymium; Pulsed Lasers; Thin Films*

**20070001513** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Flux Pinning Behavior of Incomplete Multilayered Lattice Structures in YBa(2)Cu(3)O(7-d)**

Nov 2004; 5 pp.; In English

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

Report No.(s): AD-A458376; AFRL-PR-WP-TP-2006-225; No Copyright; Avail.: CASI: [A01](#), Hardcopy

No abstract available

*Flux Pinning; Yttrium Compounds; Copper Oxides; Crystal Lattices*

**20070001515** Air Force Research Lab., Wright-Patterson AFB, OH USA  
**Deposition of (Y(2)BaCuO(5)/YBa(2)Cu(3)O(7-x)) x N Multilayer Films on Ni-Based Textured Substrates**  
Jan 2005; 8 pp.; In English  
Contract(s)/Grant(s): Proj-3145  
Report No.(s): AD-A458375; AFRL-PR-WP-TP-2006-202; No Copyright; Avail.: CASI: [A02](#), Hardcopy  
No abstract available  
*Deposition; Substrates; Nickel; YBCO Superconductors*

**20070001644** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA  
**Ignition X-Ray Imager for Laser-Fusion Research at the National Ignition Facility**  
Tommasini, R.; Phillips, T. W.; Koch, J. A.; Oct. 13, 2005; 5 pp.; In English  
Report No.(s): DE2006-883534; UCRL-PROC-216152; No Copyright; Avail.: National Technical Information Service (NTIS)

X-ray imaging will be an important diagnostic tool for inertial confinement fusion (ICF) research at the National Ignition Facility (NIF). However, high neutron yields will make x-ray imaging much more difficult than it is at current smaller facilities. We analyze the feasibility and performance of an Ignition X-Ray Imager to be used on cryogenic DT implosions at NIF. The system is intended to provide time-integrated, broadband, moderate-energy x-ray core images of imploding ICF capsules. Highly magnified, spectrally-filtered images created using an array of pinholes placed close to the target will be projected onto a scintillator placed at the target chamber wall. A telescope will be used to relay the scintillator emission to a distant optical detector that is time-gated in order to minimize backgrounds, in particular from neutrons. The system is optimized with respect to spatial-resolution, signal-to-background and signal-to-noise ratios.

NTIS

*Ignition; Laser Fusion; X Ray Lasers; X Rays*

**20070001987** NASA Marshall Space Flight Center, Huntsville, AL, USA  
**The Effects of a Magnetic Field on the Crystallization of a Fluorozirconate Glass**  
Tucker, Dennis S.; Lapointe, Michael R.; Jia, Zhiyong; [2006]; 14 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

An axial magnetic field of 0.1T was applied to ZrF<sub>4</sub>-BaF<sub>2</sub>-LaF<sub>3</sub>-AlF<sub>3</sub>-NaF (ZBLAN) fibers during heating to the glass crystallization temperature. Scanning electron microscopy and x-ray diffraction were used to identify crystal phases. It was shown that fibers exposed to the magnetic field did not crystallize while fibers not exposed to the field did crystallize. A hypothesis based on magnetic work was proposed to explain the results and tested by measuring the magnetic susceptibilities of the glass and crystal.

Author

*Crystallization; Glass; Magnetic Effects; Zirconates; Fluorine Compounds*

## 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*.

**20070000002** Stanford Linear Accelerator Center, CA, USA, Stanford Univ., Stanford, CA USA  
**BootStrapping One-Loop QCD Amplitudes**

Berger, C. R.; Aug. 01, 2006; 18 pp.; In English

Report No.(s): DE2006-891859; SLAC-PUB-12034; No Copyright; Avail.: Department of Energy Information Bridge

We review the recently developed bootstrap method for the computation of high-multiplicity QCD amplitudes at one loop. We illustrate the general algorithm step by step with a six-point example. The method combines (generalized) unitarity with on-shell recursion relations to determine the not cut-constructible, rational terms of these amplitudes. Our bootstrap approach works for arbitrary configurations of gluon helicities and arbitrary numbers of external legs.

NTIS

*Quantum Chromodynamics; Algorithms; Particle Interactions*

**2007000004** Stanford Linear Accelerator Center, CA, USA

**Measurements of Branching Ratios and Search for CP Violation in the Modes B<sub>0</sub> to Rho Pi, Rho K**

January 2006; 286 pp.; In English

Report No.(s): DE2006-891863; SLAC-R-835; No Copyright; Avail.: National Technical Information Service (NTIS)

The BABAR experiment, at the PEP-II collider at SLAC, has been studying CP violation in the B meson system since 1999.

NTIS

*CP Violation; Invariance*

**2007000006** Stanford Linear Accelerator Center, CA, USA

**Amplitude Analysis of the Charmless Decays of Charged B Mesons to the Final States K<sup>+</sup>-Pi<sup>+</sup>-Pi<sup>+</sup>- Using the BABAR Detector**

Latham, T. E.; January 2006; 214 pp.; In English

Report No.(s): DE2006-891864; SLAC-R-834; No Copyright; Avail.: National Technical Information Service (NTIS)

The data used in this analysis were recorded by the BABAR detector run by the BABAR collaboration. The author contributed to the running of the detector through the taking of general shifts and being the Commissioner of the Electromagnetic Calorimeter Trigger for 15 months. The event reconstruction process described in Chapters 3 and 4 makes use of code developed centrally within BABAR as well as more specific pre-selection code developed by the charmless three-body analysis working group with some input from the author. The code for the final selection described in Section 4.3.3 was developed by the author and that for the calculation of the Fisher coefficients (Section 3.5.3) was developed by the author and John Back. The code used for the amplitude analysis was developed by the author, Paul Harrison, John Back and Sian Morgan.

NTIS

*Mesons; Particle Decay; Charm (Particle Physics)*

**2007000013** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Partonic EoS in High-Energy Nuclear Collisions at RHIC**

Xu, N.; January 2006; 4 pp.; In English

Report No.(s): DE2006-891828; No Copyright; Avail.: Department of Energy Information Bridge

The purpose of the heavy ion program at Brookhaven National Laboratory is to probe strongly interacting matter under extreme conditions, i.e. at high densities and temperatures. Naturally the search for the existence of a new form of matter--the quark-gluon plasma (QGP)--is the experimental focus of the program.

NTIS

*High Energy Interactions; Partons; High Temperature; Plasmas (Physics); Particle Interactions; Plasma-Particle Interactions*

**2007000015** Colorado State Univ., Fort Collins, CO, USA

**Measurement of CP Parameters in B<sup>0</sup>→D<sup>0</sup>(π<sup>+</sup>π<sup>0</sup>)K<sup>+</sup> and Study of the X(3872) in B<sup>0</sup>→D<sup>0</sup>/ψ π<sup>+</sup>π<sup>0</sup>K with BABAR Detector**

Winklmeier, F.; Aug. 2006; 219 pp.; In English

Report No.(s): DE2006-891856; No Copyright; Avail.: National Technical Information Service (NTIS)

This dissertation describes part of the research that the author conducted during his PhD studies within the Colorado State University (CSU) High Energy Physics group working on the BABAR experiment at the Stanford Linear Accelerator Center (SLAC). It described two analysis in separate areas of the BABAR physics program: CP violation and rare decays. Unavoidably, the dissertation is therefore split into two more or less independent parts.

NTIS

*Invariance; High Energy Interactions; Particle Decay*

**20070001687** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Bradley A3 (Block 1) DVE FLIR Enhancement Project Thermal Load Analysis**

Perez, J; Rogers, P; Sep 2003; 11 pp.; In English

Report No.(s): AD-A458617; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458617>; Avail.: CASI: A03,

Hardcopy

Virtual modeling plays an important role in design of systems and subsystems. It is emphasized throughout the acquisition process and lifecycle. Modeling decreases prototype and testing costs and allows the designer to compare several options or solutions. The tools available for thermal modeling provide the capability to evaluate a design concept in a virtual thermal environment taking into account environment and vehicle induced conditions. MuSES (Multi-Service Electro-optic Signature) greatly simplifies the modeling process and makes it possible to model the complete vehicle system. MuSES obtains the model's thermal solution using a finite difference approach (This solution) technique reduces computing resource requirements and operator expertise as compared to Computational Fluid Dynamics. Resulting system models can now incorporate electronics and crew thermal footprints in conjunction with power train and environmental sources.

DTIC

*Augmentation; FLIR Detectors; Housings; Loads (Forces); Thermal Analysis*

## 81

### ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**20070001141** National Archives and Records Service, Washington, DC USA

**Uniformed Services Employment and Remployment Rights Act of 1994, As Amended**

Dec 19, 2005; 70 pp.; In English

Report No.(s): AD-A458435; 38 U.S.C. 4301-4334; No Copyright; Avail.: CASI: [A04](#), Hardcopy

No abstract available

*Employment; Law (Jurisprudence)*

**20070002003** Alabama Univ., Huntsville, AL, USA

**Factors Influencing the Selection of the Systems Integration Organizational Model Type for Planning and Implementing Government High-Technology Programs**

Thomas, Leann; Utley, Dawn; [2006]; 8 pp.; In English; 27th Annual ASEM National Conference 2006, 25-28 Oct. 2006, Huntsville, AL, USA; Copyright; Avail.: CASI: [A02](#), Hardcopy

While there has been extensive research in defining project organizational structures for traditional projects, little research exists to support high technology government projects organizational structure definition. High-Technology Government projects differ from traditional projects in that they are non-profit, span across Government-Industry organizations, typically require significant integration effort, and are strongly susceptible to a volatile external environment. Systems Integration implementation has been identified as a major contributor to both project success and failure. The literature research bridges program management organizational planning, systems integration, organizational theory, and independent project reports, in order to assess Systems Integration (SI) organizational structure selection for improving the high-technology government projects probability of success. This paper will describe the methodology used to 1) Identify and assess SI organizational structures and their success rate, and 2) Identify key factors to be used in the selection of these SI organizational structures during the acquisition strategy process.

Author

*Systems Integration; Technology Utilization; Governments; Project Management; Organizations; Models*

## 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*.

**20070000483** National Center for Education Statistics, Washington, DC, USA, Bureau of the Census, Washington, DC, USA

**State Library Agencies, Fiscal Year 2005: First Look**

Holton, B.; Kroe, E.; O'Shea, P.; Sheckells, C.; Freeman, M.; Dec. 2006; 56 pp.; In English

Report No.(s): PB2007-103532; NCES-2007-300; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This report contains data on state library agencies in the 50 states and the District of Columbia for state fiscal year (FY) 2005.1 The data were collected through the State Library Agencies (StLA) Survey, the product of a cooperative effort between the Chief Officers of State Library Agencies (COSLA), the U.S. National Commission on Libraries and Information Science

(NCLIS), the National Center for Education Statistics (NCES), and the U.S. Census Bureau. This cooperative effort makes possible the 100 percent response rate achieved for this survey. The frame or source of the list of respondents for this survey is based on the list that COSLA maintains of state library agencies. The FY 2005 survey is the twelfth in the StLA series.

NTIS

*Education; Libraries; Surveys*

**20070000485** Texas Univ., Austin, TX, USA

**Conversion of Volunteer-Collected GPS Diary Data to Travel Time Performance Measures, Project Summary**

Bhat, C.; Bricka, S.; Parmenter, B.; Srinivasan, S.; Dec. 31, 2005; 2 pp.; In English

Report No.(s): PB2007-103698; RTI-PS-0-5176; No Copyright; Avail.: CASI: [A01](#), Hardcopy

Texas is one of the leaders in the nation in the use of GPS technology for travel-data collection. In an effort to fully realize the strengths of this new approach and to efficiently generate the required data for travel modeling, the objectives of this project were to develop a prototype software that (1) automates the process of converting data collected by in-vehicle GPS devices into an electronic travel diary (i.e., a sequence of vehicle trips, with each trip characterized in terms of attributes such as trip-end location, trip purpose, time of day, duration, distance, and speed), and (2) aggregates the derived trip diaries to produce inter-zonal vehicle trip tables and network performance measures.

NTIS

*Data Acquisition; Global Positioning System*

**20070000660** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Generalized Feature Extraction for Structural Pattern Recognition in Time-Series Data**

Olszewski, Robert T; Feb 2001; 120 pp.; In English

Contract(s)/Grant(s): F30602-96-1-0349; NSF-IRI-9224544

Report No.(s): AD-A457624; CMU-CS-01-108; No Copyright; Avail.: CASI: [A06](#), Hardcopy

Pattern recognition encompasses two fundamental tasks: description and classification. Given an object to analyze, a pattern recognition system first generates a description of it (i.e., the pattern) and then classifies the object based on that description (i.e., the recognition). Two general approaches for implementing pattern recognition systems, statistical and structural, employ different techniques for description and classification. Statistical approaches to pattern recognition use decision-theoretic concepts to discriminate among objects belonging to different groups based upon their quantitative features. Structural approaches to pattern recognition use syntactic grammars to discriminate among objects belonging to different groups based upon the arrangement of their morphological features. Hybrid approaches to pattern recognition combine aspects of both statistical and structural pattern recognition. Structural pattern recognition systems are difficult to apply to new domains because implementation of both the description and classification tasks requires domain knowledge. Knowledge acquisition techniques necessary to obtain domain knowledge from experts are tedious and often fail to produce a complete and accurate knowledge base. Consequently, applications of structural pattern recognition have been primarily restricted to domains in which the set of useful morphological features has been established in the literature and the syntactic grammars can be composed by hand (e.g., electrocardiogram diagnosis). To overcome this limitation, a domain-independent approach to structural pattern recognition is needed that is capable of extracting morphological features and performing classification without relying on domain knowledge. This thesis presents a suite of structure detectors that effectively performs generalized feature extraction for structural pattern recognition in time-series data.

DTIC

*Classifications; Morphology; Pattern Recognition; Structural Analysis; Time Series Analysis*

**20070000666** Naval Research Lab., Stennis Space Center, MS USA

**Coastal Benthic Boundary Layer (CBBL) Research Program**

Richardson, Michael D; Sep 1, 1998; 375 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-R3103

Report No.(s): AD-A457963; NRL/MR/7430--98-8213; No Copyright; Avail.: CASI: [A16](#), Hardcopy

The Coastal Benthic Boundary Layer (CBBL) Special Research Program is a 5-year Office of Naval Research study that addressed the physical characterization and modeling of benthic boundary layer processes and the impact these processes have on seafloor structure, properties and behavior. This final report is a summary of the results compiled and published from FY92 through FY98. Quantitative physical models of the benthic boundary layer were tested in a series of experiments at coastal locations where differing environmental processes determine sediment structure. The sites were Eckernforde Bay, Baltic Sea;

the West Florida Sand Sheet off Panama City, Florida; the lower Florida Keys; and the shallow continental shelf off Northern California. Predictive models developed through this program should enhance MCM technological capabilities in several important areas including acoustic and magnetic detection, classification, and neutralization of proud and buried mines; shock wave propagation; prediction of mine burial; and sediment classification. This report includes an introduction to the program, a summary of the results of those experiments, a list of publications that have resulted from CBBL research, and final reports from 24 of the 30 groups supported by the CBBL.

DTIC

*Boundary Layers; Coasts; Models; Ocean Bottom; Wave Propagation*

**2007000667** Armed Forces Staff Coll., Norfolk, VA USA

**Information Management Functions of Joint Command: Six Enduring Keys to Mission Success in a Changing World Environment**

Ballard, John R; Jan 1999; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A457964; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Data Management; Information Management; Information Systems*

**2007000671** Naval Research Lab., Stennis Space Center, MS USA

**Coastal Benthic Boundary Layer (CBBL) Research Program: A review of the fourth year**

Richardson, Michael D; Sep 1, 1998; 175 pp.; In English; Original contains color illustrations

Report No.(s): AD-A457968; NRL/MR/743--98-8214; No Copyright; Avail.: CASI: [A08](#), Hardcopy

The Coastal Benthic Boundary Layer (CBBL) Special Research program is a 5-year Office of Naval Research study that addressed the physical characterization and modeling of benthic boundary layer processes and the impact these processes have on seafloor structure, properties and behavior. The report is a summary of the results compiled and published during the fourth year of the program. Quantitative physical models of the benthic boundary layer are being tested in a series of experiments at coastal locations where differing environmental processes determine sediment structure. The sites were Eckernforde Bay, Baltic Sea; the West Florida Sand Sheet off Panama City, Florida; the lower Florida Keys; and the shallow continental shelf off Northern California. Predictive models developed through this program should enhance MCM technological capabilities in several important areas including acoustic and magnetic detection, classification, and neutralization of proud and buried mines; shock wave propagation; prediction of mine burial; and sediment classification. This report includes an introduction to the program, a list of publications that have resulted from CBBL research to date, and fourth year final reports from 21 groups supported by the CBBL.

DTIC

*Boundary Layers; Coasts; Ocean Bottom; Sediments*

**2007000679** Space and Naval Warfare Systems Center, San Diego, CA USA

**Dynamic Strike Force Asset Reallocation for Time Critical Targeting**

McDonnell, John R; Gizzi, Nicholas; Jan 2002; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A457981; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper describes decision support tools that are being developed to support dynamic reallocation of tactical air assets in particular and the strike force assets in general. Tools that support situation awareness, risk assessment, and weapon-target paring options generation in an integrated architecture are discussed. Preliminary work is presented on each tool and its usage as a decision-aid component.

DTIC

*Decision Support Systems; Time Dependence*

**2007000711** Maryland Univ., College Park, MD USA

**A Comparative Study of Knowledge-Based Approaches for Cross-Language**

Oard, D; Dorr, B; Hackett, P; Katsova, M; Apr 1998; 12 pp.; In English

Contract(s)/Grant(s): MDA9049-C-6-1250; EIA0130422

Report No.(s): AD-A458052; LAMP-TR-014; UMIACS-TR-98-27; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Cross-language retrieval systems seek to use queries in one natural language to guide the retrieval of documents that might be written in another. Acquisition and representation of translation knowledge plays a central role in this process. This



paper explores the utility of two sources of manually encoded translation knowledge, bilingual dictionaries and translation lexicons, for cross-language retrieval. We have implemented six query translation techniques that use bilingual dictionaries, one based on lexical-semantic analysis, and one based on direct use of the translation output from an existing machine translation system; these are compared with a document translation technique that uses output from the same existing translation system. Average precision measures on portions of the TREC collection suggest that arbitrarily selecting a single translation from a bilingual dictionary is typically no less effective than using every translation in the dictionary that query translation using an existing machine translation system can achieve somewhat better effectiveness than simple dictionary-based techniques, and that performing document translation rather than query translation may result in further improvements in retrieval effectiveness under some conditions.

DTIC

*Information Retrieval; Knowledge Based Systems; Natural Language (Computers)*

**20070000728** Aptima, Inc., Woburn, MA USA

**Designing Optimal Organizational Structures for Combat Information Centers in the Next Generation of Navy Ships**

Paley, Michael J; Levchuk, Yuri N; Serfaty, Daniel; MacMillan, Jean; Jan 1999; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458086; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The need exists for a comprehensive methodology for synthesizing adaptive decision making organizations to complete complex missions. Over the years, research in organizational decision making has demonstrated that a strong functional dependency exists between the specific structure of a task environment and the resulting optimal organizational structure and its decision strategy. What is needed is an application of a scientific model of organizational design, used to optimize organizational performance within specific mission parameters and constraints. This model predicts which organizational alternatives would be most likely to result in optimized staffing within the domain of safe and effective command and control operations. This paper describes the application of our team modeling approach to the design of a reduced-manning notional combat information center for future Navy surface ships, using knowledge of future missions, resources available, information networks, and doctrinal rules.

DTIC

*Combat; Command and Control; Information Systems; Navy; Optimization*

**20070000733** Maryland Univ., College Park, MD USA

**The Indexing and Retrieval of Document Images: A Survey**

Doermann, David; Feb 1998; 40 pp.; In English

Contract(s)/Grant(s): MDA9049-6C-1250

Report No.(s): AD-A458104; LAMP-TR-0013; CAR-TR-878; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic feasibility of maintaining large databases of document images has created a tremendous demand for robust ways to access and manipulate the information these images contain. In an attempt to move toward a paper-less office, large quantities of printed documents are often scanned and archived as images, without adequate index information. One way to provide traditional database indexing and retrieval capabilities is to fully convert the document to an electronic representation which can be indexed automatically. Unfortunately, there are many factors which prohibit complete conversion including high cost, low document quality, and the fact that many non-text components cannot be adequately represented in a converted form. In such cases, it can be advantageous to maintain a copy of and use the document in image form. In this paper, we provide a survey of methods developed by researchers to access and manipulate document images without the need for complete and accurate conversion. We briefly discuss traditional text indexing techniques on imperfect data and the retrieval of partially converted documents. This is followed by a more comprehensive review of techniques for the direct characterization, manipulation and retrieval, of images of documents containing text, graphics and scene images.

DTIC

*Images; Indexing (Information Science); Information Retrieval; Surveys*

**20070000734** Maryland Univ., College Park, MD USA

**Speech-Based Information Retrieval for Digital Libraries**

Oard, Douglas W; Mar 1997; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA9049-C6-1250; DAAL01-97-C-0042

Report No.(s): AD-A458105; LAMP-TR-015; UMIACS-TR-97-36; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Libraries and archives collect recorded speech and multimedia objects that contain recorded speech, and such material may comprise a substantial portion of the collection in future digital libraries. Presently, access to most of this material is provided using a combination of manually annotated metadata and linear search. Recent advances in speech processing technology have produced a number of techniques for extracting features from recorded speech that could provide a useful basis for the retrieval of speech or multimedia objects in large digital library collections. Among these features are the semantic content of the speech, the identity of the speaker, and the language in which the speech was spoken. We propose to develop a graphical and auditory user interface for speech-based information retrieval that exploits these features to facilitate selection of recorded speech and multimedia information objects that include recorded speech. We plan to use that interface to evaluate the effectiveness and usability of alternative ways of exploiting those features and as a testbed for the evaluation of advanced retrieval techniques such as cross-language speech retrieval.

DTIC

*Human-Computer Interface; Information Retrieval; Libraries; Multimedia; Speech*

**20070000740** Cranfield Univ., Cranfield, UK

**Database Issues for Intelligence Analysis**

Ayres, Robert; Harris, Ross D; Lee, Graham; Smith, Steve J; Oct 25, 2004; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458112; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Data Bases; Information Retrieval; Intelligence*

**20070000812** Maryland Univ., College Park, MD USA

**Document Understanding - 1996**

Doermann, David; Mar 28, 1997; 49 pp.; In English

Contract(s)/Grant(s): MDA9049-C8-1250; NSF-EIA0130422

Report No.(s): AD-A458228; LAMP-TR-008; CFAR-TR-853; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report contains nearly 340 references which are directly related to the field of document image understanding and appeared in major journals and conferences during 1996 Each reference is classified by major topic. Areas covered included, but are not limited to preprocessing, models and representations, on-line recognition, off-line recognition, graphics recognition and interpretation, page processing, post-processing and special applications.

DTIC

*Data Processing; Information Retrieval; Texts*

**20070000820** General Accounting Office, Washington, DC USA

**Small Business Innovation Research: Agencies Need to Strengthen Efforts to Improve the Completeness, Consistency, and Accuracy of Awards Data**

Mittal, Anu K; Williams, Cheryl; Dawson, Bernice H; Hunt, Vondalee R; Oliver, Marcus L; Crothers, Nancy; Mallie, Grant; Marchand, Gregory; Shea, Rebecca; Oct 2006; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458242; GAO-07-38; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Small Business Innovation Research (SBIR) program was created to increase the use of small businesses to meet federal research needs and commercialize the results of this research. To monitor the program, the Small Business Administration (SBA) requires participating agencies to provide, in a standard format, specific data on all SBIR awards they make. SBA then compiles these data into a database known as Tech-Net. Congress also required SBA to create, by 2001, a restricted and more comprehensive database that would provide information for government agencies to use in evaluating the program. GAO was asked to identify the following: (1) the types of data that agencies report to the SBA for inclusion in the Tech-Net database, (2) the extent to which these data are provided in a standard format, (3) the extent to which the SBA has established the government-use database, and (4) the extent to which SBIR agencies have developed and implemented techniques to track the commercialization of SBIR projects. GAO reviewed 8 of the 11 agencies participating in SBIR. Participating agencies submit most of the information required by SBA, but they are not consistently providing all required data elements, including the number of employees in the firm, and gender and socioeconomic status of the award recipient, resulting in incomplete sections in the database. SBA is 5 years behind schedule in meeting the congressional mandate to implement a restricted government-use database for the SBIR program. SBA had planned to meet this requirement by expanding its Tech-Net database to include a government-restricted section. SBA officials attribute the delay to increased

security requirements, agency management changes, and budgetary constraints. GAO recommends that SBA and SBIR participating agencies work together to improve the quality of the data in SBA's Tech-Net database. SBA and the SBIR participating agencies included in this report generally agreed with GAO's recommendation.

DTIC

*Commerce; Consistency; Data Bases; Data Management; Organizations; Quality Control; Requirements*

**20070000854** Library of Congress, Washington, DC USA

**Sensitive But Unclassified Information and Other Controls: Policy and Options for Scientific and Technical Information**

Knezo, Genevieve J; Nov 14, 2006; 94 pp.; In English

Report No.(s): AD-A458315; CRS-RL33303; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Providing access to scientific and technical information (S&T) for legitimate uses while protecting it from potential terrorists poses difficult policy choices. Federally funded, extramural academic research is to be classified if it poses a security threat; otherwise, it is to be unrestricted. Since the September 11, 2001 terrorist attacks, controls increasingly have been placed on some unclassified research and S&T information, including that used to inform decision making and citizen oversight. These controls include sensitive but unclassified (SBU) labels; restrictive contract clauses; visa controls; controlled laboratories; and wider legal restrictions on access to some federal biological, transportation, critical infrastructure, geospatial, environmental impact, and nuclear information. Some professional groups have supported voluntary controls on the conduct or publication of sensitive research. Federal agencies do not have uniform definitions of SBU or consistent policies to safeguard or release it, raising questions about how to identify SBU information, especially S&T information; how to keep it from terrorists, while allowing access for those who need to use it; and how to develop uniform nondisclosure policies and penalties. On December 16, 2005, President Bush instructed federal agencies to standardize procedures to designate, mark, and handle SBU information, and to forward recommendations for government-wide standards to the Director of National Intelligence (DNI). Final action is pending. Following the 2001 terrorist attacks, the Bush Administration issued guidance that reversed the Clinton Administration's presumption of disclosure approach to releasing information under Freedom of Information Act (FOIA) and cautioned agencies to consider withholding SBU information if there was a sound legal basis to do so.

DTIC

*Law (Jurisprudence); Policies; Security; Sensitivity*

**20070000873** Drexel Univ., Philadelphia, PA USA

**Role-Based Viewing Envelopes for Information Protection in Collaborative Modeling**

Cera, Christopher D; Kim, Taeseong; Han, JungHyun; Regli, William C; Apr 2003; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0618

Report No.(s): AD-A458373; DU-CS-03-XX; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Information security and assurance are new frontiers for collaborative design. In this context, information assurance (IA) refers to methodologies to protect engineering information by ensuring its availability, confidentiality, integrity, nonrepudiation, authentication, and access control. In collaborative design, IA techniques are needed to protect intellectual property, establish security privileges, and create 'need to know' protections for critical features. Aside from 3D watermarking, research on how to provide IA to distributed collaborative engineering teams is largely nonexistent. This paper provides a framework for information assurance within collaborative design that is based on a technique called role-based viewing, in which information security relationships are roles assigned to users based on their permissions and privileges. Role-based viewing is achieved through the integration of multi-resolution geometry with a security model. That is, 3D models are geometrically partitioned, and the partitioning is used to create multi-resolution mesh hierarchies that obscure, obfuscate, or remove sensitive material from the view of users without appropriate permissions. This approach is the basis for the authors' prototype system FACADE (Framework for Access-control in Computer-Aided Design Environments), a synchronous, multi-user collaborative modeling environment. In FACADE, groups of users work in a shared 3D modeling environment in which each user's viewing and modeling privileges are managed by a central access control mechanism. In this manner, individual actors see only the data they are allowed to see, and at the level of detail that they are permitted to see it.

DTIC

*Access Control; Computer Aided Design; Engineering; Numerical Control; Protection; Prototypes; Viewing*

**20070001142** Mitre Corp., McLean, VA USA

**Database and Message Interoperability Using the eXtensible Markup Language (XML)**

Barr, Paul C; Dec 2000; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAB07-01-C-C201

Report No.(s): AD-A458323; WN-00W0000059; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Department of Defense (DoD) is facing significant interoperability issues within the Services as they seek to architect solutions for distributed systems composed of clients and servers of heterogeneous hosts to enable joint service operations. The eXtensible Markup Language (XML) and related technologies offer promise for applying data management technology to documents and also for providing a neutral syntax for interoperability among disparate systems. This paper describes the work performed by Mitre Corp for the Army Systems Engineering Office (ASEO), particularly the results of applying XML and other leading-edge software technologies to enable interoperability among dissimilar databases and message formats. The solution approach taken by Mitre investigated the utility of XML to write translator(s) between message formats and databases to reduce operator burden and to increase interoperability. Further, they investigated other leading-edge software technologies to address the information portability issues associated with distributed systems. The demonstration shows how a U.S. Marine Corps message scenario of battlefield engagement can interoperate with the U.S. Army via automated message translation and database interoperability. The experimental distributed architecture is presented along with the findings of the proof of concept demonstration.

DTIC

*Client Server Systems; Computer Programming; Data Bases; Distributed Processing; Document Markup Languages; Interoperability; Message Processing; Messages; Software Engineering*

**20070001153** State Univ. of New York, Albany, NY USA

**HITIQA: A Data Driven Approach to Interactive Analytical Question Answering**

Small, Sharon; Strzalkowski, Tomek; Jan 2004; 5 pp.; In English

Contract(s)/Grant(s): 2002-H790400-000

Report No.(s): AD-A458114; No Copyright; Avail.: CASI: [A01](#), Hardcopy

In this paper we describe the analytic question answering system HITIQA (High-Quality Interactive Question Answering) which has been developed over the last 2 years as an advanced research tool for information analysts. HITIQA is an interactive open-domain question answering technology designed to allow analysts to pose complex exploratory questions in natural language and obtain relevant information units to prepare their briefing reports. The system uses novel data-driven semantics to conduct a clarification dialogue with the user that explores the scope and the context of the desired answer space. The system has undergone extensive hands-on evaluations by a group of intelligence analysts representing various foreign intelligence services. This evaluation validated the overall approach in HITIQA but also exposed limitations of the current prototype.

DTIC

*Information Retrieval; Natural Language (Computers)*

**20070001475** Mitre Corp., Colorado Springs, CO USA

**Structured Systems Evolution: Employing Dynamic, Executable Architectures**

Beckner, Stanley G; Beamer, Jr, Raymond A; Jan 1999; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458162; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To enhance systems migration planning, including acquisition, implementation, and integration, an approach that injects executable enterprise information technology (IT) architectures into the Department of Defense (DoD) planning and budgeting processes is required. Such an approach is proffered in light of the overarching issue and debate concerning the use and benefit of generating and implementing architectures. The best features of several architectural frameworks are woven into the approach discussed here. Among those frameworks are the John Zachman and Steven Spewak concepts and the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) strategy grounded in the Air Force Horizon, Navy Copernicus, and Army Enterprise architecture methodologies. Basic to these architectural approaches is the development of an enterprise business model, the identification of the tasks and activities performed within the organization. The approach takes the information systems developer from operational requirements (reflected in the operational architecture) to the systems infrastructure (illustrated in the systems architecture) to systems evolution (outlined in the migration plan). By generating both As-Is and To-Be architectures it is possible to create a roadmap or migration plan

from the current information environment to a future end state or objective. The construction of these architectures or blueprints is best accomplished in an architecture studio.

DTIC

*Information Systems; Architecture (Computers)*

**20070001613** Army Research Lab., Aberdeen Proving Ground, MD USA

**A Platoon-Level Model of Communication Flow and the Effects on Operator Performance**

Kilduff, Patricia W; Swoboda, Jennifer C; Katz, Joshua; Nov 2006; 78 pp.; In English

Report No.(s): AD-A458489; ARL-MR-0656; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458489>; Avail.:

CASI: [A05](#), Hardcopy

The Future Combat System (FCS) initiative is at the center of the Army's Objective Force Vision. The Army Vision (2010) states that U.S. forces must have 'information superiority: the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same.' In other words, the Future Force will be empowered by dominant situational understanding. To predict how proposed systems and displays will impact situational understanding and decision making, the U.S. Army Research Laboratory's Human Research and Engineering Directorate used the tool C3TRACE (command, control, and communication: techniques for reliable assessment of concept execution). C3TRACE is a modeling environment in which one can develop multiple concept models for any size organization, staffed by any number of people, using any type of information technology, performing any number of functions and tasks, and under various communication and information loads. Among the performance measures tracked are Soldier utilization; the number of messages received, dropped, and interrupted; and the degree to which the information is available to support Soldier decision making. C3TRACE was used to develop a platoon-level model of an FCS conceptual configuration in support of the situational understanding as an enabler for the unit of action maneuver team Soldiers Army Technology Objective. The platoon model assumed wrist-mounted displays for the dismounted Soldiers and laptop-type displays for the mounted Soldiers. In general, the Soldiers using the laptop-type display were able to fully process more of their incoming messages and made no decisions with poor information quality. On the other hand, the majority of the Soldiers using the personal digital assistant had high utilization, higher numbers of dropped and interrupted messages, and decisions made with poor information quality.

DTIC

*Computers; Decision Making; Information Flow; Microcomputers; Operator Performance; Operators (Personnel); Situational Awareness*

**20070001659** Air Force Research Lab., Rome, NY USA

**Assessing Intelligent Information Systems for C2**

Liuzzi, Raymond A; Cavano, Joseph P; Jan 2000; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458563; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458563>; Avail.:

CASI: [A03](#), Hardcopy

This paper will present a vision for intelligent information processing for Command and Control (C2) in the 21st century. This vision will describe: (1) the role, utilization and impact of knowledge base (KB) technology within an IIS, (2) the need to assess intelligent information system's (IIS), (3) a proposed methodology to assess IIS's, and (4) a model architecture environment, called the Integrated Knowledge Sharing Environment (IKSE) that is designed to integrate, test and evaluate IIS components/tools.

DTIC

*Command and Control; Information Systems*

**20070001667** Massachusetts Univ., Amherst, MA USA

**UMass/Hughes: Description of the Circus System Used for MUC-5**

Lehnert, W; McCarthy, J; Soderland, S; Riloff, E; Cardie, C; Peterson, J; Feng, F; Dolan, C; Goldman, S; Jan 1993; 16 pp.;

In English

Contract(s)/Grant(s): MDA904-92-C-2390

Report No.(s): AD-A458576; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458576>; Avail.:

CASI: [A03](#), Hardcopy

The primary goal of our effort is the development of robust and portable language processing capabilities for information extraction applications. The system under evaluation here is based on language processing components that have demonstrated

strong performance capabilities in previous evaluations [Lehnert et al. 1992a]. Having demonstrated the general viability of these techniques, we are now concentrating on the practicality of our technology by creating trainable system components to replace hand-coded data and manually-engineered software. Our general strategy is to automate the construction of domain-specific dictionaries and other language-related resources so that information extraction can be customized for specific applications with a minimal amount of human assistance. We employ a hybrid system architecture that combines selective concept extraction [Lehnert 1991] technologies developed at UMass with trainable classifier technologies developed at Hughes [Dolan et al. 1991]. Our MUC-5 system incorporates seven trainable language components to handle (1) lexical recognition and part-of-speech tagging, (2) knowledge of semantic/syntactic interactions, (3) semantic feature tagging, (4) noun phrase analysis, (5) limited conference resolution, (6) domain object recognition, and (7) relational link recognition. Our trainable components have been developed so domain experts who have no background in natural language or machine learning can train individual system components in the space of a few hours.

DTIC

*Information Retrieval; Natural Language (Computers)*

**20070001668** Massachusetts Univ., Amherst, MA USA

**Evaluating Question-Answering Techniques in Chinese**

Li, Xiaoyan; Croft, W B; Jan 2001; 7 pp.; In English

Contract(s)/Grant(s): N66001-99-1-8912

Report No.(s): AD-A458581; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458581>; Avail.: CASI: A02,

Hardcopy

An important first step in developing a cross-lingual question answering system is to understand whether techniques developed with English text will also work with other languages, such as Chinese. The Marsha Chinese question answering system described in this paper uses techniques similar to those used in the English systems developed for TREC. Marsha consists of three main components: the query processing module, the Hanquery search engine, and the answer extraction module. It also contains some specific techniques dealing with Chinese language characteristics, such as word segmentation and ordinals processing. Evaluation of the system is done using a method based on the TREC question-answering track. The results of the evaluation show that the performance of Marsha is comparable to some English question answering systems in TREC 8 track. An English language version of Marsha further indicates that the heuristics used are applicable to the English question answering task.

DTIC

*China; Information Retrieval*

**20070001672** Massachusetts Inst. of Tech., Cambridge, MA USA

**Signal Representation, Attribute Extraction and, the Use of Distinctive Features for Phonetic Classification**

Meng, Helen M; Zue, Victor W; Leung, Hong C; Jan 1991; 7 pp.; In English

Contract(s)/Grant(s): N00014-82-K-0727

Report No.(s): AD-A458588; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458588>; Avail.: CASI: A02,

Hardcopy

The study reported in this paper addresses three issues related to phonetic classification: 1) whether it is important to choose an appropriate signal representation, 2) whether there are any advantages in extracting acoustic attributes over directly using the spectral information, and 3) whether it is advantageous to introduce an intermediate set of linguistic units, i.e. distinctive features. To restrict the scope of our study, we focused on 16 vowels in American English, and investigated classification performance using an artificial neural network with nearly 22,000 vowel tokens from 550 speakers excised from the TIMIT corpus. Our results indicate that 1) the combined outputs of Seneff's auditory model outperforms five other representations with both undegraded and noisy speech, 2) acoustic attributes give similar performance to raw spectral information, but at potentially considerable computational savings, and 3) the distinctive feature representation gives similar performance to direct vowel classification, but potentially offers a more flexible mechanism for describing context dependency.

DTIC

*Classifications; Extraction; Information Retrieval; Phonetics*

**20070001675** Maryland Univ., College Park, MD USA

**Evaluating Multilingual Gisting of Web Pages**

Resnik, P; Mar 1997; 9 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250; NSF-EIA0130422

Report No.(s): AD-A458592; LAMP-TR-009; UMIACS-TR-97-39; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458592>; Avail.: CASI: A02, Hardcopy

We describe a prototype system for multilingual gisting of Web pages, and present an evaluation methodology based on the notion of gisting as decision support. This evaluation paradigm is straightforward, rigorous, permits fair comparison of alternative approaches, and should easily generalize to evaluation in other situations where the user is faced with decision-making on the basis of information in restricted or alternative form.

DTIC

*Decision Support Systems; Internets*

**20070001676** SRI International Corp., Menlo Park, CA USA

**An Approach to Acquiring and Applying Knowledge**

Haas, Norman; Hendrix, Gary G; Nov 1980; 23 pp.; In English

Contract(s)/Grant(s): N00039-79-C-0118; N00039-80-C-O575

Report No.(s): AD-A458593; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458593>; Avail.: CASI: A03, Hardcopy

The problem addressed in this paper is how to enable a computer system to acquire facts about new domains from tutors who are experts in their respective fields, but who have little or no training in computer science. The information to be acquired is that needed to support question-answering activities. The basic acquisition approach is 'learning by being told.' The authors have been especially interested in exploring the notion of simultaneously learning not only new concepts, but also the linguistic constructions used to express those concepts. As a research vehicle they have developed a system that is preprogrammed with deductive algorithms and a fixed set of syntactic/semantic rules covering a small subset of English. It has been endowed with sufficient seed concepts and seed vocabulary to support effective tutorial interaction. Furthermore, the system is capable of learning new concepts and vocabulary, and can apply its acquired knowledge in a range of problem-solving situations.

DTIC

*Acquisition; Computers; Data Processing; Information Transfer; Knowledge Based Systems; Machine Learning; Natural Language (Computers)*

**20070001677** SRI International Corp., Menlo Park, CA USA

**Transportable Natural-Language Interfaces to Databases**

Hendrix, Gary G; Lewis, William H; Apr 30, 1981; 19 pp.; In English

Contract(s)/Grant(s): N00039-79-C-0118; N00039-80-C-0645

Report No.(s): AD-A458594; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458594>; Avail.: CASI: A03, Hardcopy

Several computer systems have now been constructed that allow users to access databases by posing questions in natural languages, such as English. When used in the restricted domains for which they have been especially designed, these systems have achieved reasonably high levels of performance. However, these systems require the encoding of knowledge about the domain of application in complex data structures that typically can be created for a new database only with considerable effort on the part of a computer professional who has had special training in computational linguistics and the use of databases. This paper describes initial work on a methodology for creating natural-language processing capabilities for new databases without the need for intervention by specially trained experts. The approach is to acquire logical schemata and lexical information through simple interactive dialogues with someone who is familiar with the form and content of the database, but unfamiliar with the technology of natural-language interfaces. A prototype system using this methodology is described and an example transcript is presented.

DTIC

*Data Bases; Graphical User Interface; Information Retrieval; Knowledge Based Systems; Natural Language (Computers); Natural Language Processing*

**20070001680** SRI International Corp., Menlo Park, CA USA

**Klaus: A System for Managing Information and Computational Resources**

Hendrix, Gary G; Oct 1980; 35 pp.; In English

Contract(s)/Grant(s): N00039-80-C-0575

Report No.(s): AD-A458597; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458597>; Avail.: CASI: A03, Hardcopy

This report presents a broad-brush description of the basic goals and philosophy of a research program at SRI International (SRI) aimed at developing the technology needed to support systems that can be tutored in English about new subject areas, and that can thereafter aid the user in filing and retrieving information and in conveniently applying to the new subject area other computer software, such as data-base management systems (DBMS), planners, schedulers, report generators, and simulators. These systems, which the authors call Knowledge Learning and Using Systems (KLAUS), are intended to act as brokers between the user's needs, as expressed in the user's terms, and the resources available in a rich computational environment. In a nutshell, the core concept of a KLAUS is that of an interactive system preprogrammed with essential skills for readily learning the concepts and vocabulary of new subject domains, and with expertise for applying acquired knowledge in problem-solving situations. A KLAUS is tutored about new domains in English (perhaps also using tables, menus, and domain-specific formalisms). While being taught, a KLAUS does not play a passive role, but actively looks for gaps and inconsistencies in its knowledge, asking its tutor pointed clarification questions. In this manner, the KLAUS aids the user in formalizing, organizing, and clarifying his or her ideas. After tutoring, a KLAUS can aid its tutor and other users in performing tasks that require combining knowledge of the new domain with knowledge of how to use sophisticated computer systems.

DTIC

*Acquisition; Data Management; Data Processing; Information Management; Knowledge Based Systems; Machine Learning; Man Machine Systems; Natural Language (Computers)*

**20070001703** Maryland Univ., College Park, MD USA

### **The Detection of Duplicates in Document Image Databases**

Doermann, David; Li, Huiping; Kia, Omid; Kilic, Kemal; Jan 1997; 41 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): MDA9049-C6-1250; EIA0130422

Report No.(s): AD-A458638; LAMP-TR-005; CFAR-TR-850; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458638>; Avail.: CASI: A03, Hardcopy

Document imaging technology has developed to the point where it is not uncommon for organizations to scan large numbers of documents into databases with little or no index information. This may be done for archival purposes, in which case the necessary index may be as simple as a case number, or with the ultimate goal of automatically extracting index information for content-based queries. Maintaining the integrity of such a database is difficult, especially in a distributed environment where copies of documents with different physical histories may be scanned at different times. In this paper we present a novel approach to detecting duplicate documents in very large databases using only features extracted from the image. The method is based on a robust 'signature' extracted from each document image which is used to index into a table of previously processed documents. The system is able to deal robustly with differences between scanned documents with respect to such factors as resolution, skew and image quality. The approach has a number of advantages over OCR or other recognition-based methods including speed and robustness to imaging distortions. To justify the approach and demonstrate its scalability, we have developed a simulator which allows us to change parameters of the system and examine performance while processing millions of document signatures. A complete system has been implemented and tested on a collection of technical articles and memos.

DTIC

*Data Bases; Detection*

**20070001704** Lawrence Livermore National Lab., Livermore, CA USA

### **Better Bounded Ethernet Load Balancing**

Gabler, J.; January 2006; 4 pp.; In English

Report No.(s): DE2006-883778; No Copyright; Avail.: National Technical Information Service (NTIS)

When a High Performance Storage System's mover shuttles large amounts of data to storage over a single Ethernet device that single channel can rapidly become saturated. Using Linux Ethernet channel bonding to address this and similar situations was not, until now, a viable solution. The various modes in which channel bonding could be configured always offered some benefit but only under strict conditions or at a system resource cost that was greater than the benefit gained by using channel bonding. Newer bonding modes designed by various networking hardware companies, helpful in such networking scenarios, were already present in their own switches. However, Linux-based systems were unable to take advantage of those new modes as they had not yet been implemented in the Linux kernel bonding driver. So, except for basic fault tolerance, Linux channel bonding could not positively combine separate Ethernet devices to provide the necessary bandwidth.

NTIS

*Balancing; Bonding; Ethernet; Loads (Forces)*



**20070001705** Maryland Univ., College Park, MD USA

**LEXICALL: Lexical Construction for Foreign Language Tutoring**

Dorr, Bonnie; Feb 1997; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA9049-C6-1250; EIA130422

Report No.(s): AD-A458641; LAMP-TR-006; UMIACS-TR-97-09; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458641>; Avail.: CASI: A03, Hardcopy

We focus on the problem of building large repositories of lexical conceptual structure (LCS) representations for verbs in multiple languages. One of the main results of this work is the definition of a relation between broad semantic classes and LCS meaning components. Our acquisition program LEXICALL takes, as input, the result of previous work on verb classification and thematic grid tagging, and outputs LCS representations for different languages. These representations have been ported into English, Arabic and Spanish lexicons, each containing approximately 9000 verbs. We are currently using these lexicons in an operational foreign language tutoring and machine translation.

DTIC

*Construction; Data Acquisition; Languages; Machine Translation*

**20070001706** Maryland Univ., College Park, MD USA

**Enhancing Automatic Acquisition of Thematic Structure in a Large-Scale Lexicon for Mandarin Chinese**

Olsen, Mari B; Dorr, Bonnie; Thomas, Scott; Jun 1998; 12 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250

Report No.(s): AD-A458646; LAMP-TR-016; UMIACS-TR-98-35; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458646>; Avail.: CASI: A03, Hardcopy

This paper describes a refinement to our procedure for porting lexical conceptual structure into new languages. Specifically we describe a two-step process for creating candidate thematic grids for Mandarin Chinese verbs, using the English verb heading the VP in the subdefinitions to separate senses, and roughly parsing the verb complement structure to match to our thematic structure templates. The procedure is part of a larger process of creating a usable lexicon for interlingual machine translation from a large on-line resource with both too much and too little information necessary for our system.

DTIC

*China; Data Acquisition; Machine Translation*

**20070001707** Maryland Univ., College Park, MD USA

**Parallel Strands: A Preliminary Investigation into Mining the Web**

Resnik, P; Aug 1998; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA9049-C6-1250; EIA0130422

Report No.(s): AD-A458649; LAMP-TR-019; UMIACS-TR-98-41; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458649>; Avail.: CASI: A03, Hardcopy

Parallel corpora are a valuable resource for machine translation, but at present their availability and utility is limited by genre- and domain-specificity, licensing restrictions, and the basic difficulty of locating parallel texts in all but the most dominant of the world's languages. A parallel corpus resource not yet explored is the World Wide Web which hosts an abundance of pages in parallel translation, offering a potential solution to some of these problems and unique opportunities of its own. This paper presents the necessary first step in that exploration: a method for automatically finding parallel translated documents on the Web. The technique is conceptually simple, fully language independent, and scalable, and preliminary evaluation results indicate that the method may be accurate enough to apply without human intervention.

DTIC

*Data Processing; Internets; Machine Translation; Mining; Texts*

**20070001722** Maryland Univ., College Park, MD USA

**The Bible, Truth, and Multilingual OCR Evaluation**

Kanungo, Tapas; Resnik, Philip; Dec 1998; 18 pp.; In English

Contract(s)/Grant(s): MDA9049-6C-1250; N66001-97-C-8540

Report No.(s): AD-A458666; LAMP-TR-029; CAR-TR-902; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458666>; Avail.: CASI: A03, Hardcopy

Multilingual OCR has emerged as an important information technology, thanks to the increasing need for cross-language information access. While many research groups and companies have developed OCR algorithms for various languages, it is

difficult to compare the performance of these OCR algorithms across languages. This difficulty arises because most evaluation methodologies rely on the use of a document image dataset in each of the languages and it is difficult to find document datasets in different languages that are similar in content and layout. In this paper we propose to use the Bible as a dataset for comparing OCR accuracy across languages. Besides being available in a wide range of languages, Bible translation are closely parallel in content, carefully translated, surprisingly relevant with respect to modern-day language, and quite inexpensive. A project at the University of Maryland is currently implementing this idea. We have created a scanned image dataset with groundtruth from an Arabic Bible. We have also used image degradation models to create synthetically degraded images of a French Bible. We hope to generate similar Bible datasets for other languages, and we are exploring alternative corpora such as the Koran and the Bhagavad Gita that have similar properties. Quantitative OCR evaluation based on the Arabic Bible dataset is currently in progress.

DTIC

*Character Recognition; Translating*

**20070001725** Unisys Corp., Paoli, PA USA

**Augmented Role Filling Capabilities for Semantic Interpretation of Spoken Language**

Norton, Lewis; Linebarger, Marcia; Dahl, Deborah; Nguyen, Nghi; Jan 1991; 10 pp.; In English

Contract(s)/Grant(s): N000014-89-C-0171

Report No.(s): AD-A458669; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458669>; Avail.: CASI: A02, Hardcopy

This paper describes recent work on the Unisys ATIS Spoken Language System, and reports benchmark results on natural language, spoken language, and speech recognition. We describe enhancements to the system's semantic processing for handling non-transparent argument structure and enhancements to the system's pragmatic processing of material in answers displayed to the user. We found that the system's score on the natural language benchmark test decreased from 48% to 36% without these enhancements. We also report results for three spoken language systems, Unisys natural language coupled with MIT-Summit speech recognition, Unisys natural language coupled with MIT-Lincoln Labs speech recognition and Unisys natural language coupled with BBN speech recognition. Speech recognition results are reported on the results of the Unisys natural language selecting a candidate from the MIT- Summit N-best (N=16).

DTIC

*Augmentation; Data Processing; Display Devices; Languages; Semantics; Speech; Speech Recognition; User Requirements*

**20070001727** Maryland Univ., College Park, MD USA

**A Statistical, Nonparametric Methodology for Document Degradation Model Validation**

Kanungo, Tapas; Haralick, Robert; Baird, Henry; Stuezele, Werner; Madigan, David; Jan 1999; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA9049-06-C-1250

Report No.(s): AD-A458671; LAMP-TR-032; CAR-TR-906; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458671>; Avail.: CASI: A03, Hardcopy

Printing, photocopying and scanning processes degrade the image quality of a document. Statistical models of these degradation processes are crucial for document image understanding research. Models allow us to predict system performance; conduct controlled experiments to study the break-down points of the systems; create large multi-lingual data sets with ground truth for training classifiers; design optimal noise removal algorithms; choose values for the free parameters of the algorithms; and so on. Although research in document understanding started many decades ago, only two document degradation models have been proposed this far. Furthermore, no attempts have been to statistically validate these models. In this paper we present a statistical methodology that can be used to validate local degradation models. This method is based on a non-parametric, two-sample permutation test. Another standard statistical device - the power function - is then used to choose between algorithm variables such as distance functions. Since the validation and the power function procedures are independent of the model, they can be used to validate any other degradation model. A method for comparing any two models is also described. It uses p-values associated with the estimated models to select the model that is closer to the real world.

DTIC

*Degradation; Statistics*

**20070001728** Maryland Univ., College Park, MD USA

**Automatic Text Detection and Tracking in Digital Video**

Li, Huiping; Doermann, David; Kia, Omid; Dec 1998; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA904-96-C-1250

Report No.(s): AD-A458675; LAMP-TR-028; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458675>; Avail.: CASI: A03, Hardcopy

Text which either appears in a scene or is graphically added to video can provide an important supplemental source of index information as well as clues for decoding the video's structure and for classification. In this paper we present algorithms for detecting and tracking text components that appear within digital video frames. Our system implements a scale-space feature extractor that feeds an artificial neural processor to extract textual regions and track their movement over time. The extracted regions can then be used as input to an appropriate Optical character Recognition system which produces indexable keywords.

DTIC

*Detection; Digital Systems; Digital Television; Texts; Tracking (Position)*

**20070001729** Oulu Univ., Finland

**Page Segmentation and Zone Classification: The State of the Art**

Okun, Oleg; Doermann, David; Pietikainen, Matti; Nov 1999; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA9049-C6-1250

Report No.(s): AD-A458676; LAMP-TR-036; CAR-TR-927; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458676>; Avail.: Defense Technical Information Center (DTIC)

Page segmentation and zone classification are key areas of research in document image processing, because they occupy an intermediate position between document preprocessing and higher-level document understanding such as logical page analysis and OCR. Such analysis of the page relies heavily on an appropriate document model and results in a representation of the physical structure of the document. The purpose of this review is to analyze progress made in page segmentation and zone classification and suggest what needs to be done to advance the field.

DTIC

*Classifications; Image Processing; Segments*

**20070001731** Maryland Univ., College Park, MD USA

**Paired Model Evaluation of OCR Algorithms**

Kanungo, Tapas; Marton, Gregory A; Bulbul, Osama; Dec 1998; 19 pp.; In English

Contract(s)/Grant(s): MDA9049-6C-1250

Report No.(s): AD-A458678; LAMP-TR-030; CAR-TR-903; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458678>; Avail.: Defense Technical Information Center (DTIC)

Characterizing the performance of Optical Character Recognition (OCR) systems is crucial for monitoring technical progress predicting, OCR performance, providing scientific explanations for system behavior and identifying open problems. While research has been done in the past to compare the performances of OCR systems, all methods assume that the accuracies achieved on individual documents in a dataset are independent. In this paper we argue that accuracies reported on any dataset are not independent and invoke the appropriate statistical technique -- the paired model -- to compare the accuracies of two recognition systems. We show theoretically that this method provides tighter confidence intervals than the methods used in the OCR and computer vision literature. We also propose a new visualization method, which we call the accuracy scatter plot, for providing a visual summary of performance results. This method summarizes the accuracy comparisons on the entire corpus while simultaneously allowing the researcher to visually compare the performances on individual document images. Finally, we report on the accuracy and speed performances as functions of image resolution. Contrary to what one might expect, the performance of one of the systems degrades when the image resolution is increased beyond 300 dpi. Furthermore, the average time taken to OCR a document image, after increasing almost linearly as a function of resolution, suddenly becomes a constant beyond 400 dpi. This behavior is most likely because the Sakhr OCR algorithm resamples the high-resolution images to a standard resolution. The two products that we compare are the Arabic OmniPage 2.0 and the Automatic Page Reader 3.01 from Sakhr. The SAIC Arabic dataset was used for the evaluations. The statistical and visualization methods presented in this paper are very general and can be used for comparing the accuracies of any two recognition systems, not just OCR systems.

DTIC

*Accuracy; Algorithms; Character Recognition; Evaluation; Performance Tests*

**20070001735** Maryland Univ., College Park, MD USA

**Large-Scale Construction of a Chinese-English Semantic Hierarchy**

Dorr, Bonnie J; Levow, Gina-Anne; Lin, Dekang; Apr 2000; 14 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250; EIA0130422

Report No.(s): AD-A458682; LAMP-TR-040; UMIACS-TR-2000-17; No Copyright; ONLINE:  
<http://hdl.handle.net/100.2/ADA458682>; Avail.: CASI: A03, Hardcopy

This paper addresses the problem of building conceptual resources for multilingual applications. We describe new techniques for large-scale construction of a semantic hierarchy for Chinese verbs, using thematic-role information to create links between Chinese concepts and English classes. We then present an approach to compensating for gaps in the existing resources. The resulting hierarchy is used for a multilingual lexicon for Chinese-English machine translation and cross-language information retrieval applications.

DTIC

*China; Construction; Hierarchies; Semantics*

**20070001737** Maryland Univ., College Park, MD USA

**A Methodology for Empirical Performance Evaluation of Page Segmentation Algorithms**

Mao, Song; Kanungo, Tapas; Dec 1999; 34 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): MDA9049-6C-1250

Report No.(s): AD-A458685; LAMP-TR-87; CAR-TR-933; No Copyright; ONLINE:  
<http://hdl.handle.net/100.2/ADA458685>; Avail.: CASI: A03, Hardcopy

Document page segmentation is a crucial preprocessing step in Optical Character Recognition (OCR) systems. While numerous page segmentation algorithms have been proposed, there is relatively less literature on comparative evaluation--empirical or theoretical-- of these algorithms. For the existing performance evaluation methods, two crucial components are usually missing: 1) automatic training of algorithms with free parameters and 2) statistical and error analysis of experimental results. In this thesis, we use the following five-step methodology to quantitatively compare the performance of page segmentation algorithms: 1) First we create mutually exclusive training and test datasets with groundtruth, 2) we then select a meaningful and computable performance metric, 3) an optimization procedure is then used to search automatically for the optimal parameter values of the segmentation algorithms, 4) the segmentation algorithms are then evaluated on the test dataset, and finally 5) a statistical error analysis is performed to give the statistical significance of the experimental results. The automatic training of algorithms is posed as an optimization problem and a direct search method -- the simplex method -- is used to search for a set of optimal parameter values. A paired-model statistical analysis and an error analysis are conducted to provide confidence intervals for the experimental results and to interpret the functionalities of algorithms. This methodology is applied to the evaluation of five page segmentation algorithms, of which three are representative research algorithms and the other two are well-known commercial products, on 978 images from the University of Washington III dataset. It is found that the performances of the Voronoi, Docstrum and Caere segmentation algorithms are not significantly different from each other, but they are significantly better than that of ScanSoft's segmentation algorithm, which in turn is significantly better than X-Y cut.

DTIC

*Algorithms; Character Recognition; Evaluation; Performance Tests; Segments; System Effectiveness*

**20070001740** Maryland Univ., College Park, MD USA

**Construction of Chinese-English Semantic Hierarchy for Information Retrieval**

Levow, Gina-Anne; Dorr, Bonnie J; Lin, Dekang; Jun 2000; 10 pp.; In English  
Contract(s)/Grant(s): MDA904-96-C-1250; N66001-97-C-8540

Report No.(s): AD-A458694; LAMP-TR-043; UMIACS-TR-2000-36; No Copyright; ONLINE:  
<http://hdl.handle.net/100.2/ADA458694>; Avail.: Defense Technical Information Center (DTIC)

This paper describes an approach to large-scale construction of a semantic hierarchy for Chinese verbs. Leveraging off of an existing Chinese conceptual database called HowNet and a Levin-based English verb classification, we use thematic-role information to create links between Chinese concepts and English classes. The resulting hierarchy is used for multilingual lexicons in an English-Chinese cross-language information retrieval application. We demonstrate a structured syntax interface that exploits this large-scale hierarchy and its linkages to WordNet for English-Chinese cross-language information retrieval.

DTIC

*China; Construction; English Language; Hierarchies; Information Retrieval; Semantics*

**20070001743** Maryland Univ., College Park, MD USA

**Full-Text Access to Historical Newspapers**

Kanungo, Tapas; Allen, Robert B; Apr 1999; 15 pp.; In English  
Contract(s)/Grant(s): MDA9049-6C-1250

Report No.(s): AD-A458699; LAMP-TR-033; CAR-TR-914; No Copyright; ONLINE:  
<http://hdl.handle.net/100.2/ADA458699>; Avail.: CASI: A03, Hardcopy

Newspapers are rich records of U. S. history. Due to the deterioration of older newspapers, the National Endowment for the Humanities is archiving 19th century newspapers on microfilm. Although microfilm is a good preservation method, it provides limited access to researchers and the general public. We are building a system to provide universal access to digital images and full-text content of historical newspapers. The system has three main components: a) an Optical Character Recognition (OCR) module that converts digitized images into searchable text and identifies regions, b) an Information Retrieval module that applies linguistic information to aid in segmentation, indexing, and retrieval of the noisy OCR'd text, and c) a User Interface module that allows historians and educators to query and view retrieved documents. Thus far, we have developed two OCR techniques targeted to processing historical newspapers and we have built a user interface to search the OCR output and superimpose matches on a page image from the newspaper.

DTIC

*Histories; Information Retrieval; Texts*

**20070001745** Maryland Univ., College Park, MD USA

**Chinese-English Semantic Resource Construction**

Dorr, Bonnie; Levow, Gina-Anne; Lin, Dekang; Thomas, Scott; Jun 2000; 9 pp.; In English

Contract(s)/Grant(s): MDA904-96-C-1250; N66001-97-C-8540

Report No.(s): AD-A458703; LAMP-TR-044; UMIACS-TR-2000-37; No Copyright; ONLINE:

<http://hdl.handle.net/100.2/ADA458703>; Avail.: CASI: A02, Hardcopy

We describe an approach to large-scale construction of a semantic lexicon for Chinese verbs. We leverage off of three existing resources-- a classification of English verbs called EVCA (English Verbs Classes and Alternations), a Chinese conceptual database called HowNet, and a large-machine readable dictionary called Optilex. The resulting lexicon is used for determining appropriate word senses in applications such as machine translation and cross-language information retrieval.

DTIC

*China; Construction; English Language; Semantics; Sensory Perception; Words (Language)*

**20070001748** Geological Survey, Nashville, TN USA

**Geographic Information System Index for the State of Tennessee**

Barron, Jr, William R; Norris, Pamela G; Jan 1989; 60 pp.; In English

Report No.(s): AD-A458724; OFR-89-39; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458724>; Avail.: CASI: A04, Hardcopy

Recently the use of Geographic Information Systems (GIS) has increased in Tennessee. As a results of this increase the U.S. Geological Survey, the Tennessee State Planning Office, and the Tennessee Comptroller of the Treasury entered into an agreement to conduct a survey of GIS users within the state. The objectives of the project were as follows: 1. To conduct and document a survey and subsequently develop a GIS index data base of existing map coverage, location-specific data bases, available transformation software, and transfer techniques that exist at various state, federal, county, and municipal agencies. 2. To develop suggested standards for digitized data. 3. To promote sharing of data by describing, in general terms, communications techniques that can be used to transfer data from one system to another. 4. To create a map coverage of Tennessee and the 7.5 minute quadrangle maps within the State that would allow identification of existing map coverage for these units through a retrieval from the GIS index data base. Two hundred and sixty-three agencies were contacted. Two hundred and sixteen used maps and kept maps on hand. One hundred and thirty-nine agencies maintained one or more computer system, including personal computers. Forty-eight had minicomputers or mainframe computers. Twenty-five agencies used GIS software. The number of coverage or layers that existed at the time of the survey as computerized digital data for Tennessee was 4,741. One hundred and twenty location-specific data bases were available.

DTIC

*Geographic Information Systems; Tennessee*

**20070001766** Office of Management and Budget, Washington, DC, USA

**Managing Information Collection and Dissemination, Fiscal Year 2003**

January 2003; 198 pp.; In English

Report No.(s): PB2007-102161; No Copyright; Avail.: CASI: A09, Hardcopy

The Paperwork Reduction Act requires OMB to report to Congress on the paperwork burden imposed on the public by

the Federal government and efforts to reduce this burden. As in previous years, the overall paperwork burden increased in 2002, from 7.65 billion hours in 2001 to 8.22 billion, an increase of nearly 8 percent. In addition to an accounting of burden hours for the 2002 fiscal year, this report highlights the following issues: -the relationship of paperwork burden to statutory changes and other factors outside agency control;-increased agency compliance with the Paperwork Reduction Act;-IRS efforts to reduce the paperwork burden it imposes (which accounts for nearly 80 percent of all burden); -the impact of the Administration's E-Government initiatives on paperwork burden; and-the agencies' initiatives to reduce paperwork burden.

NTIS

*Information Dissemination; Congressional Reports*

**20070001896** Maryland Univ., College Park, MD USA

**NTCIR CLIR Experiments at the University of Maryland**

Oard, Douglas W; Wang, Jianqiang; Jun 2000; 7 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250; N6600197-C-8540

Report No.(s): AD-A458793; LAMP-TR-054; UMIACS-TR-2000-47; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper presents results for the Japanese/English cross-language information retrieval task on the NACSIS Test Collection. Two automatic dictionary-based query translation techniques were tried with four variants of the queries. The results indicate that longer queries outperform the required description only queries and that use of the first translation in the edict dictionary is comparable with the use of every translation. Japanese term segmentation posed no unusual problems, which contrasts sharply with results previously obtained for cross-language retrieval between Chinese and English.

DTIC

*Information Retrieval; Translating*

**20070001897** Maryland Univ., College Park, MD USA

**The Function of Documents**

Doermann, David; Rivlin, Ehud; Rosenfeld, Azriel; Oct 1996; 28 pp.; In English

Contract(s)/Grant(s): MDA9049-C-06-1250; EIA0130422

Report No.(s): AD-A458794; LAMP-TR-002; CFAR-TR-841; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of a document is to facilitate the transfer of information from its author to its readers. It is the author's job to design the document so that the information it contains can be interpreted accurately and efficiently. To do this, the author can make use of a set of stylistic tools. In this paper we introduce the concept of document functionality, which attempts to describe the roles of documents and their components in the process of transferring information. A functional description of a document provides insight into the type of the document, into its intended uses, and into strategies for automatic document interpretation and retrieval. To demonstrate these ideas, we define a taxonomy of functional document components and show how functional descriptions can be used to reverse-engineer the intentions of the author, to navigate in document space, and to provide important contextual information to aid in interpretation.

DTIC

*Information Transfer; Taxonomy*

**20070001912** Maryland Univ., College Park, MD USA

**Symbolic Compression and Processing of Document Images**

Kia, Omid; Doermann, David; Rosenfeld, Azriel; Chellappa, Rama; Jan 1997; 37 pp.; In English

Contract(s)/Grant(s): MDA9049-C6-1250

Report No.(s): AD-A458853; LAMP-TR-004; CFAR-TR-894; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we describe a compression and representation scheme which exploits the component-level redundancy found within a document image. The approach identifies patterns which appear repeatedly, represents similar patterns with a single prototype, stores the location of pattern instances and codes the residuals between the prototypes and the pattern instances. Using a novel encoding scheme, we provide a representation which facilitates scalable lossy compression and progressive transmission, and supports document image analysis in the compressed domain. We motivate the approach, provide details of the encoding procedures, report compression results and describe a class of document image understanding tasks which operate on the compressed representation.

DTIC

*Data Compression; Image Processing*

**20070002024** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Learning to Identify TV News Monologues by Style and Context**

Snoek, Cees G; Hauptmann, Alexander G; Oct 2003; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA904-02-C-0451; NSF IRI-9817496

Report No.(s): AD-A458538; CMU-CS-03-193; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This research focused on the problem of learning semantics from multimedia data associated with broadcast video documents. The authors proposed to learn semantic concepts from multimodal sources based on style and context detectors, in combination with statistical classifier ensembles. As a case study, they present their method for detecting the concept of news subject monologues. This approach had the best average precision performance amongst 26 submissions in the 2003 video track of the Text Retrieval Conference benchmark. Experiments were conducted with respect to individual detector contribution, ensemble size, and ranking mechanism. It was found that the combination of detectors is decisive for the final result, although some detectors might appear useless in isolation. Moreover, by using a probabilistic ranking in combination with a large classifier ensemble, the results can be improved even further.

DTIC

*Broadcasting; Data Recording; Detection; Digital Systems; Pattern Recognition; Television Systems*

**20070002025** Aerospace Corp., El Segundo, CA USA

**On the Use of IDL for Instrument Control**

Mazuk, S; Venturini, C; Sep 20, 2006; 9 pp.; In English

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A458754; TAC-TR-2006-(8570)-4; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The Aerospace Corporation has developed a near-infrared and visible spectrograph that is used for astronomical observations at Lick observatory's 3-m telescope. This paper describes the instrument control and data handling system, which employs the Interactive Data Language (IDL) for both the user interface and instrument control. The system employs IDL in a client-server design to control all aspects of data acquisition, and has been operational for several years. The use of IDL has simplified the system design and allowed for extensive modifications.

DTIC

*Data Acquisition; Information Systems; Programming Languages; Spectrographs*

**20070002028** National Intelligence Council, Washington, DC USA

**Information Sharing Environment Implementation Plan**

Nov 2006; 187 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458786; No Copyright; Avail.: CASI: [A09](#), Hardcopy

Strengthening our nation's ability to share terrorism information constitutes a cornerstone of our national strategy to protect the American people and our institutions and to defeat terrorists and their support networks at home and abroad. Recognizing the need to go beyond individual solutions to create an environment the aggregation of legal, policy, cultural, organizational, and technological conditions for improving information sharing, Congress passed and the President signed the landmark Intelligence Reform and Terrorism Prevention Act of 2004 (IRTPA). The Act requires the President to establish an Information Sharing Environment (ISE), for the sharing of terrorism information in a manner consistent with national security and with applicable legal standards relating to privacy and civil liberties. It also requires designation of a Program Manager for the Information Sharing Environment (PM-ISE). The PM-ISE, in consultation with the interagency Information Sharing Council (ISC), is charged with planning and overseeing the ISE's implementation and management. Among other duties, the PM-ISE is responsible for assisting the President in submitting to Congress an ISE Implementation Plan (ISE IP) that addresses eleven requirements set forth in Section 1016(e) of IRTPA.

DTIC

*Security; Terrorism*

**20070002103** Maryland Univ., College Park, MD USA

**A Thematic Hierarchy for Efficient Generation from Lexical-Conceptual Structure**

Dorr, Bonnie J; Habash, Nizar; Traum, David; Oct 1998; 13 pp.; In English

Contract(s)/Grant(s): MDA904-96-C-1250

Report No.(s): AD-A458673; LAMP-TR-022; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458673>; Avail.:

CASI: [A03](#), Hardcopy

This paper describes an implemented algorithm for syntactic realization of a target-language sentence from an interlingual representation called Lexical Conceptual Structure (LCS). We provide a mapping between LCS thematic roles and Abstract Meaning Representation (AMR) relations; these relations serve as input to an off-the-shelf generator (Nitrogen). There are two contributions of this work: (1) the development of a thematic hierarchy that provides ordering information for realization of arguments in their surface positions; (2) the provision of a diagnostic tool for detecting inconsistencies in an existing online LCS-based lexicon that allows us to enhance principles for thematic-role assignment.

DTIC

*Hierarchies; Algorithms*

### 83

#### ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

**20070001132** Naval Postgraduate School, Monterey, CA USA

**Reform of Budgeting for Acquisition: Lessons from Private Sector Capital Budgeting for the Department of Defense**

Sep 30, 2006; 83 pp.; In English

Report No.(s): AD-A458429; NPS-GSBPP-06-014; No Copyright; Avail.: CASI: [A05](#), Hardcopy

No abstract available

*Budgeting; Defense Program*

### 84

#### LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

**20070001131** Library of Congress, Washington, DC USA

**Israel: Background and Relations with the USA**

Nov 14, 2006; 27 pp.; In English

Report No.(s): AD-A458427; CRS-RL33476; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*United States; Israel; International Cooperation*

**20070001133** Library of Congress, Washington, DC USA

**U.S.-EU Cooperation Against Terrorism**

Oct 16, 2006; 7 pp.; In English

Report No.(s): AD-A458428; CRS-RS22030; No Copyright; Avail.: CASI: [A02](#), Hardcopy

No abstract available

*Terrorism; International Cooperation; European Union*

**20070002081** Library of Congress, Washington, DC USA

**Defense Transformation: Background and Oversight Issues for Congress**

Nov 9, 2006; 50 pp.; In English

Report No.(s): AD-A458351; CRS-RL32238; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Defense Program; Conferences*



**TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION**

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety*, *16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

**20070001506** Schafer Corp., Albuquerque, NM USA

**SLMS(trademark) Athermal Technology for High Quality Wavefront Control of HEL Tactical Airborne and Relay Mirror Beam Control Applications (Postprint)**

Jul 15, 2005; 17 pp.; In English

Contract(s)/Grant(s): FA9451-05-C-0018; Proj-3005

Report No.(s): AD-A458387; No Copyright; Avail.: CASI: [A03](#), Hardcopy

No abstract available

*Mirrors; Wave Fronts; Technology Utilization; Beams*

**SPACE SCIENCES (GENERAL)**

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

**20070001009** NASA Johnson Space Center, Houston, TX, USA

**History of Artificial Gravity, Chapter 3**

Clement, Gilles; Bukley, Angie; Paloski, William; [2006]; 19 pp.; In English; Copyright; Avail.: CASI: [A03](#), Hardcopy

This chapter reviews the past and current projects on artificial gravity during space missions. The idea of a rotating wheel-like space station providing artificial gravity goes back in the writings of Tsiolkovsky, Noordung, and Wernher von Braun. Its most famous fictional representation is in the film *2001: A Space Odyssey*, which also depicts spin-generated artificial gravity aboard a space station and a spaceship bound for Jupiter. The O'Neill-type space colony provides another classic illustration of this technique. A more realistic approach to rotating the space station is to provide astronauts with a smaller centrifuge contained within a spacecraft. The astronauts would go into it for a workout, and get their gravity therapeutic dose for a certain period of time, daily or a few times a week. This simpler concept is current being tested during ground-based studies in several laboratories around the world.

Author

*Artificial Gravity; Histories; Space Missions; Space Exploration*

**20070001126** NASA Glenn Research Center, Cleveland, OH, USA

**A Compact, Broadband Antenna for Planetary Surface-to-Surface Wireless Communications**

Barr, Philip; Zaman, Afroz; Miranda, Felix; November 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-612-30-81-04

Report No.(s): NASA/TM-2006-213885; E-15256; No Copyright; ONLINE: <http://hdl.handle.net/2060/20070001126>;

Avail.: CASI: [A03](#), Hardcopy

The Compact Microstrip Monopole Antenna (CMMA) is a novel antenna design that combines a microstrip patch antenna with a three-dimensional structure to attain a highly directive, broadband, compact antenna. A Tri-Lobed Patch (TLP) was designed to minimize the patch's area while reducing the antenna's operating frequency. A Grounding Wall (GW) connects the patch to the ground plane and a Vertical Enclosure Wall (VEW) extends up away from portions of the patch's perimeter. This VEW supplies the antenna with a higher directivity in the radial direction as well as reduces the operating frequency. The CMMA was designed to operate at 2.23 GHz, but experimental results have shown this antenna resonates at 2.05 GHz which is on the order of approximately  $\lambda/11.6$  with respect to the antenna's largest dimension, with a directivity and bandwidth of 6.0 dBi, and 130 MHz (6.3 percent), respectively. This miniature, radially emitting antenna makes the CMMA attractive for planetary-based surface-to-surface communications.

Author

*Broadband; Antennas; Wireless Communication; Microstrip Antennas; Monopole Antennas; Patch Antennas; Miniaturization; Antenna Design*

**20070001472** NASA Johnson Space Center, Houston, TX, USA

**Contrasting Perspectives Of Junior versus Senior NASA ISS Flight Controllers On Leadership And Cultural Issues**

Clement, James L.; Boyd, J. E.; Saylor, S.; Kanas, N.; [2007]; In English; Aerospace Medical Association Scientific Meeting, 14-18 May 2007, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

NASA flight controllers have always worked in a very demanding environment, but the International Space Station (ISS) poses even more challenges than prior missions. A recent NASA/Ames survey by Parke and Orasanu of NASA/Johnson flight controllers uncovered concerns about communications problems between American personnel and their international counterparts. To better understand these problems, we interviewed 14 senior and 12 junior ISS flight controllers at NASA/Johnson about leadership and cultural challenges they face and strategies for addressing these challenges. The qualitative interview data were coded and tabulated. Here we present quantitative analyses testing for differences between junior and senior controllers. Based on nonparametric statistical tests comparing responses across groups, the senior controllers were significantly more aware of the impact of working in dispersed teams, the context of constant change, and the upcoming multilateral challenges, while junior controllers were more aware of language and cultural issues. We consider our findings in light of other studies of controllers and other known differences between senior and junior controllers. For example, the fact that senior controllers had their formative early experience controlling pre-ISS short-duration Shuttle missions seems to have both positive and negative aspects, which are supported by our data. Our findings may also reflect gender differences, but we cannot unconfound this effect in our data because all the senior respondents were males. Many of the junior-senior differences are not only due to elapsed time on the job, but also due to a cohort effect. The findings of this study should be used for training curricula tailored differently for junior and senior controllers.

Author

*Flight Control; International Space Station; Leadership; Culture (Social Sciences)*

**20070001502** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Forecasting Coronal Mass Ejections from Line-of-Sight Magnetograms**

Falconer, D. A.; Moore, R. L.; Gary, G. A.; [2006]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

We show that the length of strong-gradient, strong-field main neutral line,  $L(\text{sub SGM})$ , which can be measured from line-of-sight magnetograms such as from SOHO/MDI, is both a measure of active-region nonpotentiality and a useful predictor of an active region's future CME productivity. To demonstrate that  $L(\text{sub SGM})$  is a nonpotentiality measure, we show that it is strongly correlated with a direct measure of nonpotentiality. For an appropriate choice of a threshold value, an active region's measured  $L(\text{sub SGM})$  can be used as a predictor of whether the active region will produce a CME within a few days after the magnetogram. For our set of 36 MSFC vector magnetograms of bipolar active regions,  $L(\text{sub SGM})$  is found to have a success rate of 80% for prediction of CME productivity in the 0-2 day window. The development of  $L(\text{sub SGM})$  as a method of measuring nonpotentiality for forecasting large, fast CMEs from present space based assets is of value to NASA's Space Exploration Initiative (manned missions to the Moon and Mars)

Author

*Coronal Mass Ejection; Line of Sight; Magnetic Signatures; Space Weather*

**89**

**ASTRONOMY**

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

**20070000832** Naval Observatory, Washington, DC USA

**Space Astrometry in the Next Decade**

Gaume, Ralph A; Jan 2005; 6 pp.; In English

Report No.(s): AD-A458274; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A number of space astrometry missions have been proposed and planned for the next decade, as follow up to the highly successful Hipparcos space astrometry mission (1989-1993). These include DIVA, AMEX (SMEX), AMEX (MIDEX), FAME, JASMINE, ESA-PlanetQuest, Gaia, and OBSS. The capabilities and current status these missions is presented.

DTIC

*Astrometry; Astronomy; Space Missions*

**20070000833** Naval Observatory, Washington, DC USA

**The HgMn Binary Star Phi Herculis: Detection and Properties of the Secondary and Revision of the Elemental Abundances of the Primary**

Zavala, R T; Adelman, S J; Hummel, C A; Gulliver, A F; Caliskan, H; Armstrong, J T; Hutter, D J; Johnston, K J; Pauls, T A; Oct 26, 2006; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458275; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Observations of the Mercury-Manganese star phi Her with the Navy Prototype Optical Interferometer (NPOI) conclusively reveal the previously unseen companion in this single-lined binary system. The NPOI data were used to predict a spectral type of A8V for the secondary star phi Her B. This prediction was subsequently confirmed by spectroscopic observations obtained at the Dominion Astrophysical Observatory. Phi Her B is rotating at 50 +/- 3 km s(-1), in contrast to the 8 km s(-1) lines of phi Her A. Recognizing the lines from the secondary permits one to separate them from those of the primary. The abundance analysis of phi Her A shows an abundance pattern similar to those of other HgMn stars with Al being very underabundant and Sc, Cr, Mn, Zn, Ga, Sr, Y, Zr, Ba, Ce, and Hg being very overabundant.

DTIC

*Abundance; Binary Stars; Metallic Stars*

**20070000834** Naval Observatory, Washington, DC USA

**The Concept of a Stare-Mode Astrometric Space Mission**

Zacharias, N; Dorland, B; Oct 12, 2006; 10 pp.; In English

Report No.(s): AD-A458276; No Copyright; Avail.: CASI: [A02](#), Hardcopy

In this paper, we introduce the concept of a stare-mode astrometric space mission. The traditionally accepted mode of operation for a mapping astrometric space mission is that of a continuously scanning satellite, such as the successful Hipparcos and planned Gaia missions. With the advent of astrometry missions mapping out stars to 20th magnitude, the stare mode has become competitive. A stare mode of operation has several advantages over a scanning mission if absolute parallax and throughput issues can be successfully addressed. Requirements for a stare-mode operation are outlined here. The mission precision for a stare-mode astrometric mission is derived as a function of instrumental parameters, and examples are given. The stare-mode concept has been accepted as a baseline for the NASA road map study of the Origins Billions Star Survey (OBSS) mission and the proposed Milliarsecond Pathfinder Survey (MAPS) microsatellite project.

DTIC

*Astrometry; Astronomy; Space Missions*

**20070000835** Naval Observatory, Washington, DC USA

**The Origin Billions Star Survey: Galactic Explorer**

Johnston, K J; Dorland, B; Gaume, R; Hennessy, G; Olling, R; Zacharias, N; Behr, B; Efroimsky, M; Hajian, A; Harris, H; Oct 18, 2006; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A458277; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Origins Billions Star Survey is a mission concept addressing the astrophysics of extrasolar planets, Galactic structure, the Galactic halo and tidal streams, the Local Group and local supercluster of galaxies, dark matter, star formation, open clusters, the solar system, and the celestial reference frame by determining the position, parallax, and proper motion, as well as photometry, for billions of stars down to 23rd visual magnitude. It is capable of surveying the entire celestial sphere or dwelling on a star field by varying the cadence of observations. The mission's ability to measure objects fainter than 17th magnitude allows a large number of extragalactic compact objects to be observed, making the astrometric measurements absolute. The project mission accuracy is comparable to Gaia for a survey mission. Improved accuracy can be achieved by dwelling on a particular star field or by using the Gaia positions at 14th magnitude to improve the positions of objects at the 18th-23rd visual magnitudes.

DTIC

*Astrometry; Astronomy; Space Missions*

**20070001498** National Optical Astronomy Observatories, Tucson, AZ, USA, National Solar Observatory, Tucson, AZ, USA  
**NOAO/NSO Newsletter: Issue 88**

December 2006; 42 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Included in this issue of the newsletter are science highlights, information from the director's office, sections reviewing work at the NOAO Gemini Science Center, Cerro Tololo Inter-American Observatory, Kitt Peak National Observatory,

National Solar Observatory, news in observational programs as well as work in public affairs and educational outreach.  
CASI

*Astronomical Observatories; Solar Observatories*

**20070001503** NASA Marshall Space Flight Center, Huntsville, AL, USA

**The Lack of Halo Ultraluminous X-Ray Sources**

Swartz, Douglas A.; [2006]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The premise that Ultraluminous X-ray sources (ULXs) exist beyond the optical extent of nearby galaxies is investigated. A published catalog containing 41 ULX candidates located between 1 and approx. 3 times the standard  $D_{25}$  isophotal radius of their putative host galaxies is examined. Twenty-one of these sources have spectroscopically-confirmed distances. All 21 are background objects giving a 95% probability that at least 37 of the 41 candidates are background sources. Thirty-nine of the 41 sources have X-ray-to-optical flux ratios,  $-1.6 \log(F_X/F_O) \geq 1.3$ , consistent with those of background active galactic nuclei. (The remaining two are not detected in optical to a weak limit of  $m_B = 21.5$  mag corresponding to  $\log(F_X/F_O) \geq 1.6$ .) The uniform spatial distribution of the sample is also consistent with a background population. This evidence suggests that ULXs rarely, if at all, exist beyond the distribution of luminous matter in nearby galaxies and, as a consequence, there is no correlation between the population of ULXs and halo objects such as old globular clusters or Population III remnants.

Author

*X Ray Astronomy; X Ray Sources; Galaxies; Background Radiation*

**20070001539** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Implications of Cometary Water: Deep Impact, Stardust and Hayabusa**

Sheldon, Robert B.; Hoover, Richard B.; August 29, 2006; 2 pp.; In English; 9th SPIE Optics and Photonics Symposium 2006: Instruments, Methods and Missions for Astrobiology, 13-17 Aug. 2006, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Three recent in situ spacecraft missions have explored comets or asteroids, producing data in conflict with the standard comet paradigm, the Whipple Dirty Snowball Model (DSM). We have developed an alternative Wet Comet Model (WCM) which proposes that comets undergo an irreversible phase change to a wet comet when they enter within Mars orbit. The WCM may explain some of the observational discrepancies seen by Deep Impact, Stardust and Hayabusa. In particular, it accurately predicted Deep Impact observation of organics, biominerals, and meltwater temperatures. Predictions concerning Stardust's returned cometary dust particles have yet to be falsified, but if comets are largely composed of the silicates seen by Stardust, there may be a cometary explanation for Itokawa's low density rubble-pile observed by Hayabusa.

Author

*Cometary Collisions; Astronomical Models; Stardust Mission; Asteroids; Comets*

**20070001542** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Relativistic MHD Simulations of Precessed Jets**

Mizuno, Y.; Nishikawa, K.-I.; Hardee, P.; Koide, S.; Fishman, G. J.; [2006]; 1 pp.; In English; Microquasars and Beyond, 18-22 Sep. 2006, Como, Italy; Copyright; Avail.: Other Sources; Abstract Only

Relativistic jets are considered to be generated by magnetic fields in a rotating black hole with accretion disk. Consequently, resulting outflows contain magnetic fields in them and control the propagation of jets. We have performed 3D relativistic MHD simulations to investigate the stability and structure of precessed MHD jets with large Lorentz factor by using a newly developed 3D GRMHD code. We have performed simulations of supermagnetosonic jets surrounded by a fast wind. The simulation results reveal complex pressure structure inside the RMHD jet. The structure is produced by a combination of the helical surface and body modes excited by the precession as predicted theoretically. The wavelength of the body mode which occurs in an internal helical twist is much shorter than that of the helical twist surface mode. We will present some comparisons between the RMHD simulations and theoretical predictions, and potential observables and discuss the effect of wind.

Author

*Jet Control; Magnetohydrodynamics; Accretion Disks; Black Holes (Astronomy); Wind Effects; Precession*

**20070001718** Air Force Research Lab., Hanscom AFB, MA USA

**Absolute Infrared Calibration of Standard Stars by the Midcourse Space Experiment**

Price, S D; Paxson, C; Engelke, E; Murdock, T L; Kraemer, K E; Apr 2004; 239 pp.; In English

Contract(s)/Grant(s): Proj-1182

Report No.(s): AD-A458662; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458662>; Avail.: CASI: A11, Hardcopy

Calibration experiments were conducted with the SPIRIT III infrared instrument on the Midcourse Space Experiment (MSX) against a number of infrared standard stars and five emissive reference spheres that were ejected at various times during the mission. The physical properties of the 2 cm diameter aluminum spheres, such as the Bond albedo and thermal emissivity of the Martin Black coating, were measured in the laboratory. The thermal balance equation between total flux absorbed and that emitted by the sphere was solved to obtain the time dependent temperature of the sphere under the assumption that the sphere radiates as a blackbody at this temperature with a mean infrared emissivity. The estimated uncertainties in the modeling of the sphere are estimated to be about 1K in the thermal component and 3% for the geometry contribution. MSX also measured more than 150 averaged fluxes on eight standard infrared calibration stars during the 10-month mission. The photometric spectral energy distributions of the stars are measured to be within the uncertainties assigned to absolute fluxes adopted for these stars, with a few exceptions. However, the small MSX measurement uncertainties did reveal statistically significant deviations from the recommended values. Beta Peg was the only calibrations star that was found to be variable. MSX also observed excess fluxes for Vega in the 12.1, 14.7 and 21.3  $\mu\text{m}$  spectral bands; the excesses in the latter two bands are consistent with the published thermal model for the dust ring around this star. The absolute calibration of the fluxes of the stellar standards based on the average of the measurements of the spheres over all MSX bands and the five experiments agrees with the predictions to within the uncertainties. The zero magnitude absolute fluxes proposed by Cohen et al (1992) are validated if the flux from Sirius is increased by 1%.

DTIC

*Aerospace Environments; Calibrating; Infrared Stars; Spaceborne Experiments*

**20070001982** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Final Results from the BIMA CMB Anisotropy Survey and Search for Signature of the SZ Effect**

Dawson, K. S.; Holzapfel, W. L.; Carlstrom, J. E.; Joy, M.; LaRoque, S. J.; [2006]; 1 pp.; In English; Copyright; Avail.:

Other Sources; Abstract Only

We report the final results of our study of the cosmic microwave background (CMB) with the BIMA array. Over 1000 hours of observation were dedicated to this project exploring CMB anisotropy on scales between 1' and 2' in eighteen 6'.6 FWHM fields. In the analysis of the CMB power spectrum, the visibility data is divided into two bins corresponding to different angular scales. Modeling the observed excess power as a flat band of average multipole  $l(\text{sub eff}) = 5237$ , we find  $\Delta T(\text{sup } 2)(\text{sub } 1) = 220(\text{sup } +140)(\text{sub } -120) \mu\text{K}(\text{sup } 2)$  at 68% confidence and  $\Delta T(\text{sup } 2)(\text{sub } 1)$  greater than 0  $\mu\text{K}(\text{sup } 2)$  with 94.7% confidence. In a second band with average multipole of  $l(\text{sub eff}) = 8748$ , we find  $\Delta T(\text{sup } 2)(\text{sub } 2)$  consistent with zero, and an upper limit 880  $\mu\text{K}(\text{sup } 2)$  at 95% confidence. An extensive series of tests and supplemental observations with the VLA provide strong evidence against systematic errors or radio point sources being the source of the observed excess power. The dominant source of anisotropy on these scales is expected to arise from the Sunyaev-Zel'dovich (SZ) effect in a population of distant galaxy clusters. If the excess power is due to the SZ effect, we can place constraints on the normalization of the matter power spectrum  $\sigma_8 = 1.03(\text{sup } +0.20)(\text{sub } -0.29)$  at 68% confidence. The distribution of pixel fluxes in the BIMA images are found to be consistent with simulated observations of the expected SZ background and rule out instrumental noise or radio sources as the source of the observed excess power with similar confidence to the detection of excess power. Follow-up optical observations to search for galaxy over-densities anti-correlated with flux in the BIMA images, as might be expected from the SZ effect, proved to be inconclusive.

Author

*Anisotropy; Cosmic Microwave Background Radiation; Surveys; Sunyaev-Zeldovich Effect*

**20070001983** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Gamma-ray Burst Afterglows as Probes of Environment and Blastwave Physics: Absorption by Host Galaxy Gas and Dust, Circumburst Media and the Distribution of P**

Starling, R. L. C.; Wijers, R. a. M. J.; Curran, P.; Rol, E.; Wiersema, K.; Kouveliotou, C.; vanderHorst, A. J.; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We use a new approach to obtain limits on the absorbing columns towards a sample of 10 Gamma-ray Bursts observed by BeppoSAX from simultaneous fits to X-ray, optical and IR data, in counts space and including the effects of metallicity.

For half the afterglows the best-fitting model to the SED includes SMC-like extinction (as opposed to LMC or MW) and in one LMC-like extinction, and in no cases is there a preference for MW-like extinction. Gas-to-dust ratios generally do not match those of the 3 standard and most well-known extinction models of SMC, LMC and MW, but tend to be higher. We compare the results from this method to those of previous works using other methods. We constrain the jet models for a subsample of the bursts by constraining the cooling break position and power law spectral slopes, allowing the injected electron energy index to be measured. We derive secure values of  $p$  from our spectral fits and comparison with the temporal optical and X-ray slopes for 4 afterglows. The mean of these single value, suggesting that either external factors such as circumburst medium play a strong role or that the microphysics is not identical for each GRB. For GRB 971214 we find that the circumburst medium has a wind-like density profile and the cooling frequency appears to be moving to higher frequencies.

Author

*Afterglows; Gamma Ray Bursts; Blasts; Cosmic Dust; Interstellar Gas; Absorption*

**20070001991** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Lifetime Evolution of UV Jets**

Corti, G.; Poletto, G.; Suess, S. T.; Moore, R.; Sterling, A.; September 27, 2006; 1 pp.; In English; Copyright; Avail.:

Other Sources; Abstract Only

We report on observations acquired in May 2003 during a SOHO-Ulysses quadrature campaign. From May 25 to May 28, the SoHO LASCO Coronal Mass Ejection (CME) catalog lists a number of events which might have been observed by SOHO/UVCS, whose slit was centered along the Ulysses direction. However, because of time gaps in the observing schedule, or because of the unfavorable position of some CMEs, the most interesting events recorded by UVCS were a few short-lived ejections that represent the extension at higher altitudes of recursive EIT jets. We focus on jets occurring on May 26/27, visible also in EIT and LASCO images, which seem to propagate along the radial to Ulysses. UVCS spectra at 1.7 R<sub>sun</sub> showed an unusually high emission in cool lines, lasting for about 10 to 25 minutes, with no evidence of hot plasma. Analysis of the cool line emission allowed us to infer the evolution of physical parameters during the jets lifetime and derive a crude estimate of the energy needed to account for their properties. We also looked for any evidence of the event in in situ data. Whether UVCS is observing jets or narrow CMEs is discussed in the context of previous works on these classes of events and, in the last Section, we propose a scenario that accounts for our observations.

Author

*Ulysses Mission; In Situ Measurement; Coronal Mass Ejection; High Temperature Plasmas; Emission Spectra; Ejection*

**20070001995** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **On the 5-50 keV Energy Spectrum of the Unresolved X-ray Background**

Weisskopf, Martin C.; Swartz, Douglas A.; O'Dell, Stephen L.; Ramsey, Brian D.; [2006]; 1 pp.; In English; 2006 High Energy Astrophysics Division Meeting, 4-7 Oct. 2006, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Previous analyses of HEAO-1 proportional-counter observations of the unresolved 5-50-keV background described its spectrum in terms of a 40-keV thermal bremsstrahlung. We have used Monte-Carlo simulations of that experiment in order to determine a more precise response matrix, which incorporates effects not previously included. Here we describe the simulation, the new response matrix, a re-analysis of the HEAO-1 data, and implications for the RXTE.

Author

*HEAO 1; Proportional Counters; Background Radiation; Energy Spectra; X Ray Timing Explorer; Monte Carlo Method*

**20070002015** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Status of Knowledge after Ulysses and SOHO: Session 2: Investigate the Links between the Solar Surface, Corona, and Inner Heliosphere.**

Suess, Steven; [2006]; 1 pp.; In English; Second Solar Orbiter Workshop, 16-20 Oct. 2006, Athens, Greece; No Copyright; Avail.: Other Sources; Abstract Only

As spacecraft observations of the heliosphere have moved from exploration into studies of physical processes, we are learning about the linkages that exist between different parts of the system. The past fifteen years have led to new ideas for how the heliospheric magnetic field connects back to the Sun and to how that connection plays a role in the origin of the solar wind. A growing understanding these connections, in turn, has led to the ability to use composition, ionization state, the microscopic state of the in situ plasma, and energetic particles as tools to further analyze the linkages and the underlying physical processes. Many missions have contributed to these investigations of the heliosphere as an integrated system. Two

of the most important are Ulysses and SOHO, because of the types of measurements they make, their specific orbits, and how they have worked to complement each other. I will review and summarize the status of knowledge about these linkages, with emphasis on results from the Ulysses and SOHO missions. Some of the topics will be the global heliosphere at sunspot maximum and minimum, the physics and morphology of coronal holes, the origin(s) of slow wind, SOHO-Ulysses quadrature observations, mysteries in the propagation of energetic particles, and the physics of eruptive events and their associated current sheets. These specific topics are selected because they point towards the investigations that will be carried out with Solar Orbiter (SO) and the opportunity will be used to illustrate how SO will uniquely contribute to our knowledge of the underlying physical processes.

Author

*Coronal Holes; Energetic Particles; Systems Integration; Satellite Observation; Ulysses Mission; Magnetic Fields*

**20070002064** NASA Marshall Space Flight Center, Huntsville, AL, USA

**A Chandra Search for Coronal X Rays from the Cool White Dwarf GD 356**

Weisskopf, Martin C.; Wu, Kinwah; Trimble, Virginia; O'Dell, Stephen L.; Elsner, Ronald F.; Zavlin, Vyacheslav E.; Kouveliotou, Chryssa; [2006]; 1 pp.; In English; To be submitted to The Astrophysical Journal; Copyright; Avail.: Other Sources; Abstract Only

We report observations with the Chandra X-ray Observatory of the single, cool, magnetic white dwarf GD 356. For consistent comparison with other X-ray observations of single white dwarfs, we also re-analyzed archival ROSAT data for GD 356 (GJ 1205), G 99-47 (GR 290 = V1201 Ori), GD 90, G 195-19 (EG250 = GJ 339.1), and WD 2316+123 and archival Chandra data for LHS 1038 (GJ 1004) and GD 358 (V777 Her). Our Chandra observation detected no X rays from GD 356, setting the most restrictive upper limit to the X-ray luminosity from any cool white dwarf -  $L_x$  less than  $6.0 \times 10^{25}$  erg s<sup>(sup -1)</sup>, at 99.7% confidence, for a 1- keV thermal-bremsstrahlung spectrum. The corresponding limit to the electron density is no less than  $4.4 \times 10^{11}$  per cubic centimeter. Our re-analysis of the archival data confirmed the non-detections reported by the original investigators. We discuss the implications of our and prior observations on models for coronal emission from white dwarfs. For magnetic white dwarfs, we emphasize the more stringent constraints imposed by cyclotron radiation. In addition, we describe (in an appendix) a statistical methodology for detecting a source and for constraining the strength of a source, which applies even when the number of source or background events is small.

Author

*White Dwarf Stars; Coronas; Cool Stars; Magnetic Stars; X Ray Astrophysics Facility*

**20070002085** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Particle Acceleration, Magnetic Field Generation and Emission from Relativistic Jets and Supernova Remnants**

Nishikawa, K.-I.; Hartmann, D. H.; Hardee, P.; Hededal, C.; Mizunno, Y.; Fishman, G. J.; [2006]; 1 pp.; In English; 6th INTEGRAL Workshop: The Obscured Universe, 2-8 Jul. 2006, Moscow, Russia; Copyright; Avail.: Other Sources; Abstract Only

We performed numerical simulations of particle acceleration, magnetic field generation, and emission from shocks in order to understand the observed emission from relativistic jets and supernova remnants. The investigation involves the study of collisionless shocks, where the Weibel instability is responsible for particle acceleration as well as magnetic field generation. A 3-D relativistic particle-in-cell (RPIC) code has been used to investigate the shock processes in electron-positron plasmas. The evolution of the Weibel instability and its associated magnetic field generation and particle acceleration are studied with two different jet velocities ( $\beta = 2, 5$  - slow, fast) corresponding to either outflows in supernova remnants or relativistic jets, such as those found in AGNs and microquasars. Slow jets have intrinsically different structures in both the generated magnetic fields and the accelerated particle spectrum. In particular, the jet head has a very weak magnetic field and the ambient electrons are strongly accelerated and dragged by the jet particles. The simulation results exhibit jitter radiation from inhomogeneous magnetic fields, generated by the Weibel instability, which has different spectral properties than standard synchrotron emission in a homogeneous magnetic field.

Author

*Magnetic Fields; Particle Acceleration; Relativistic Particles; Simulation; Supernova Remnants; Emission; Direct Numerical Simulation*

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

**20070000517** Lawrence Livermore National Lab., Livermore, CA USA

**Wide New Window on the Universe**

Hazi, A.; Jan. 26, 2006; 14 pp.; In English

Report No.(s): DE2006-883766; UCRL-TR-218446; No Copyright; Avail.: Department of Energy Information Bridge

For decades, ground-based astronomy has consisted mostly of a lone astronomer earning the right to train a powerful telescope for a few nights on an extremely small patch of sky. If the astronomer is fortunate, a celestial discovery will be shared many months later with colleagues through a journal article or private correspondence. Lawrence Livermore is a major partner in a new telescope project that promises to forever change that scenario--and all of astronomy--by taking advantage of advanced optical manufacturing techniques, digital imaging, supercomputer data processing, and the Internet. The ground-based Large Synoptic Survey Telescope (LSST), scheduled for completion in 2012, will provide, for the first time, digital imaging of objects, including changing events, in deep space across the entire sky. Data from LSST's Reprinted from Science & Technology Review, November 2005 UCRL-TR-218446 observation will catch a transient event. Furthermore, such an instrument would take many years to map the entire sky. Current all-sky maps made with smaller telescopes are limited in depth (faintness) and detail. LSST will overcome these drawbacks by mapping the entire sky deeply, rapidly, and continuously with a 10-square-degree field of view. What's more, when the telescope detects an object of interest, such as an exploding supernova, it will send out an alert for more specialized telescopes to follow up with higher resolution images.

NTIS

*Astrophysics; Telescopes; Universe*

**20070000739** Naval Health Research Center, San Diego, CA USA

**Epidemiologic Evidence for Different Roles of Ultraviolet A and B Radiation in Melanoma Mortality Rates**

Garland, Cedric F; Garland, Frank C; Gorham, Edward D; Mar 11, 2003; 25 pp.; In English

Report No.(s): AD-A458111; NHRC-03-12; No Copyright; Avail.: CASI: A03, Hardcopy

The action spectrum of ultraviolet radiation mainly responsible for melanoma induction is unknown, but evidence suggests it could be ultraviolet A (UVA), which has a different geographic distribution than ultraviolet B (UVB). This study assessed whether melanoma mortality rates are more closely related to the global distribution of UVA or UVB. UVA and UVB radiation and age-adjusted melanoma mortality rates were obtained for all 45 countries reporting cancer data to the World Health Organization. Stratospheric ozone data were obtained from NASA satellites. Average population skin pigmentation was obtained from skin reflectometry measurements. Paradoxically, melanoma mortality rates decreased with increasing UVB in men ( $r = -0.48$ ,  $p < 0.001$ ), and women ( $r = -0.57$ ,  $p < 0.001$ ), and with increasing UVA in both sexes. By contrast, rates were positively associated with increasing UVA/UVB ratio in men ( $r = +0.49$ ,  $p < 0.001$ ) and women ( $r = +0.55$ ,  $p < 0.001$ ). After multiple adjustment that included controlling for skin pigmentation, only UVA was associated with melanoma mortality rates in men ( $p < 0.02$ ), with a suggestive but nonsignificant trend present in women ( $p = 0.12$ ). UVA radiation was associated with melanoma mortality rates after controlling for UVB and average pigmentation. The results require confirmation in observational studies.

DTIC

*Cancer; Epidemiology; Mortality; Solar Radiation; Tumors; Ultraviolet Radiation*

**20070001552** NASA Marshall Space Flight Center, Huntsville, AL, USA

**GRMHD Simulations of Jet Formation with a Newly-Developed GRMHD Code**

Mizuno, Y.; Nishikawa, K.-I.; Koide, S.; Hardee, P.; Fishman, G. J.; [2006]; 1 pp.; In English; Microquasars and Beyond, 18-22 Sep. 2006, Como, Italy; Copyright; Avail.: Other Sources; Abstract Only

We have developed a new three-dimensional general relativistic magnetohydrodynamic code by using a conservative, high-resolution shock-capturing scheme. The numerical fluxes are calculated using the HLL approximate Riemann solver scheme. The flux-CT scheme is used to maintain a divergence-free magnetic field. Various 1-dimensional test problems show significant improvements over our previous GRMHD code. We have performed simulations of jet formations from a geometrically thin accretion disk near a non-rotating and a rotating black hole. The new simulation results show that the jet is formed by the same manner as in previous works and propagates outward. As the magnetic field strength becomes weaker, larger amount of matter launches with the jet. On the other hand when the magnetic field strength becomes stronger, the jet



has less-matter and becomes poynting flux dominated. We will also discuss how the jet properties depend on the rotation of a black hole.

Author

*Magnetohydrodynamics; High Resolution; Magnetic Flux; Accretion Disks; Magnetic Fields*

**20070001604** Brandeis Univ., Waltham, MA USA

**Multisensory Spatial Orientation and Localization in Novel Gravitoinertial Force Backgrounds**

Lackner, James R; DiZio, Paul; Oct 20, 2006; 8 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0171

Report No.(s): AD-A458469; No Copyright; ONLINE: <http://hdl.handle.net/100.2/ADA458469>; Avail.: CASI: [A02](#),  
Hardcopy

Our aim was to develop quantitative models to predict and prevent errors in spatial orientation and sensory localization during exposure to the novel forces of aerial environments. Most of our effort focused on localization of the subjective vertical. The accomplishments of the project were: (1) we acquired the requisite data to build a three-dimensional model of static vestibular orientation, (2) we built a novel static vestibular orientation model based on biological principles, and (3) we acquired additional data to independently test our model against other models. One model fit our new data as well as all existing data which had been collected in 1 g and in various hyper-g centrifuge experiments. The model made different predictions than every other model about orientation in the yaw axis in hyper-g environments, and this prediction turned out to be correct. Thus, our final model makes the most comprehensive, accurate predictions of orientation errors in multi-force backgrounds. It also implies that somato-sensory cues will have a heightened role in negative-g situations. We also collected data to help extend our model to dynamic situations.

DTIC

*Attitude (Inclination); Gravitational Fields; Position (Location); Spatial Distribution*

**20070001975** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Synchrotron Radiation from Outer Space and the Chandra X-Ray Observatory**

Weisskopf, M. C.; [2006]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The universe provides numerous extremely interesting astrophysical sources of synchrotron X radiation. The Chandra X-ray Observatory and other X-ray missions provide powerful probes of these and other cosmic X-ray sources. Chandra is the X-ray component of NASA's Great Observatory Program which also includes the Hubble Space telescope, the Spitzer Infrared Telescope Facility, and the now defunct Compton Gamma-Ray Observatory. The Chandra X-Ray Observatory provides the best angular resolution (sub-arcsecond) of any previous, current, or planned (for the foreseeable near future) space-based X-ray instrumentation. We present here a brief overview of the technical capability of this X-Ray observatory and some of the remarkable discoveries involving cosmic synchrotron sources.

Author

*X Ray Sources; Synchrotron Radiation; Infrared Telescopes; Gamma Rays; Astrophysics; X Ray Astrophysics Facility; Angular Resolution*

**20070001988** NASA Marshall Space Flight Center, Huntsville, AL, USA

**RAISHIN: A High-Resolution Three-Dimensional General Relativistic Magnetohydrodynamics Code**

Mizuno, Yosuke; Nishikawa, Ken-Ichi; Koide, Shinji; Hardee, Philip; Fishman, Gerald J.; August 21, 2006; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We have developed a new three-dimensional general relativistic magnetohydrodynamic (GRMHD) code, RAISHIN, using a conservative, high resolution shock-capturing scheme. The numerical fluxes are calculated using the Harten, Lax, & van Leer (HLL) approximate Riemann solver scheme. The flux-interpolated, constrained transport scheme is used to maintain a divergence-free magnetic field. In order to examine the numerical accuracy and the numerical efficiency, the code uses four different reconstruction methods: piecewise linear methods with Minmod and MC slope-limiter function, convex essentially non-oscillatory (CENO) method, and piecewise parabolic method (PPM) using multistep TVD Runge-Kutta time advance methods with second and third-order time accuracy. We describe code performance on an extensive set of test problems in both special and general relativity. Our new GRMHD code has proven to be accurate in second order and has successfully passed with all tests performed, including highly relativistic and magnetized cases in both special and general relativity.

Author

*Magnetohydrodynamics; High Resolution; Runge-Kutta Method; Magnetic Fields; Interpolation; Accuracy; Convexity*

**20070002001** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Observations of High-Redshift X-Ray Selected Clusters with the Sunyaev-Zel'dovich Array**

Muchovej, Stephen; Carlstrom, John E.; Cartwright, John; Greer, Christopher; Hawkins, David; Hennessy, Ryan; Joy, Marshall; Lamb, James W.; Leitch, Erik M.; Loh, Michael; Miller, Amber D.; Mroczkowski, Tony; Pryke, Clem; Reddall, Ben; Runyan, Marcus; Sharp, Matthew; Woody, David; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We report measurements of the Sunyaev-Zel'dovich (SZ) effect in three highredshift ( $0.89 \leq z \leq 1.03$ ), X-ray selected galaxy clusters. The observations were obtained at 30 GHz during the commissioning period of a new, eight-element interferometer - the Sunyaev-Zel'dovich Array (SZA) - built for dedicated SZ effect observations. The SZA observations are sensitive to angular scales larger than those subtended by the virial radii of the clusters. Assuming isothermality and hydrostatic equilibrium for the intracluster medium, and gas-mass fractions consistent with those for clusters at moderate redshift, we calculate electron temperatures, gas masses, and total cluster masses from the SZ data. The SZ-derived masses, integrated approximately to the virial radii, are  $1.9^{(+0.5)}_{(-0.4)} \times 10^{14}$  solar mass for CIJ1415.1+3612,  $3.4^{(+0.6)}_{(-0.5)} \times 10^{14}$  solar mass for CIJ1429.0+4241 and  $7.2^{(+1.3)}_{(-0.9)} \times 10^{14}$  solar mass for CIJ1226.9+3332. The SZ-derived quantities are in good agreement with the cluster properties derived from X-ray measurements.

Author

*Red Shift; X Rays; Sunyaev-Zeldovich Effect; Galactic Clusters; Arrays*

**20070002059** NASA Marshall Space Flight Center, Huntsville, AL, USA

**General Relativistic Magnetohydrodynamic Simulations of Jet Formation with a Thin Keplerian Disk**

Mizuno, Yosuke; Nishikawa, Ken-Ichi; Koide, Shinji; Hardee, Philip; Gerald, J. Fishman; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We have performed several simulations of black hole systems (non-rotating, black hole spin parameter  $a = 0.0$  and rapidly rotating,  $a = 0.95$ ) with a geometrically thin Keplerian disk using the newly developed RAISHIN code. The simulation results show the formation of jets driven by the Lorentz force and the gas pressure gradient. The jets have mildly relativistic speed (greater than or equal to  $0.4c$ ). The matter is continuously supplied from the accretion disk and the jet propagates outward until each applicable terminal simulation time (non-rotating:  $t/\tau_S = 275$  and rotating:  $t/\tau_S = 200$ ,  $\tau_S$  equivalent to  $r(\text{sub } s/c)$ ). It appears that a rotating black hole creates an additional, faster, and more collimated inner outflow (greater than or equal to  $0.5c$ ) formed and accelerated by the twisted magnetic field resulting from frame-dragging in the black hole ergosphere. This new result indicates that jet kinematic structure depends on black hole rotation.

Author

*Accretion Disks; Relativistic Effects; Magnetohydrodynamic Simulation; Magnetohydrodynamics; Astrophysics; Jet Flow; Black Holes (Astronomy)*

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*.

**20070000532** NASA Johnson Space Center, Houston, TX, USA

**Elemental Compositions of Comet 81P/Wild 2 Samples Collected by Stardust**

Flynn, G. J.; Bleuet, P.; Borg, J.; Bradley, J.; Brenker, F.; Brennan, S.; Bridges, J.; Brownlee, D. E.; Bullock, E.; Clark, B. C.; Papanastassiou, D. A.; Schwandt, C. S.; See, T. H.; Taylor, S.; Tsou, P.; [2006]; 35 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We measured the chemical compositions of material from 23 particles in aerogel and residue in 7 craters in aluminum foil, collected during passage of the Stardust spacecraft through the coma of Comet 81P/Wild 2. These particles are chemically heterogeneous at the largest size-scale analyzed, ~180 nanograms. The mean chemical composition of this Wild 2 material agrees with the CI meteorite composition for the refractory elements Mg, Si, Cr, Fe, and Ni to 35%, and for Ca and Mn to 50%. The data suggest the moderately volatile elements Cu, Zn, and Ga may be enriched in this Wild 2 material.

Author

*Chemical Composition; Comets; Stardust Mission; Wild 2 Comet; Comet Nuclei*

**2007000533** NASA Johnson Space Center, Houston, TX, USA

**Ar-Ar Age of NWA-1460 and Evidence For Young Formation Ages of the Shergottites**

Bogard, Donald D.; Park, Jisun; [2006]; 2 pp.; In English; Lunar & Planetary Science Conference, 12 - 16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; No Copyright; ONLINE: <http://hdl.handle.net/2060/2007000533>; Avail.: CASI: **A01**, Hardcopy

Agreement of Ar-Ar, Sm-Nd, and Rb-Sr ages for NWA1460, and the inconsistency between a low shock-heating temperature for Zagami and the proposition that a 4.0 Gyr-old Zagami lost most of its Ar-40 are inconsistent with ancient formation ages for these shergottites, but are consistent with relatively young igneous formation ages.

Derived from text

*Argon Isotopes; Shergottites; SNC Meteorites; Isotope Ratios; Geochronology; Meteoritic Composition*

**20070001535** NASA Glenn Research Center, Cleveland, OH, USA

**Multi-Megawatt Gas Turbine Power Systems for Lunar Colonies**

Juhasz, Albert J.; December 2006; 17 pp.; In English; Fourth International Energy Conversion Engineering Conference and Exhibit (IECES), 26-29 Jun. 2006, San Diego, CA, USA; Original contains color and black and white illustrations  
Contract(s)/Grant(s): WBS 22.973.90.1

Report No.(s): NASA/TM-2006-214658; E-15789; AIAA Paper 2006-4117; No Copyright; ONLINE:

<http://hdl.handle.net/2060/20070001535>; Avail.: CASI: **A03**, Hardcopy

A concept for development of second generation 10 MWe prototype lunar power plant utilizing a gas cooled fission reactor supplying heated helium working fluid to two parallel 5 MWe closed cycle gas turbines is presented. Such a power system is expected to supply the energy needs for an initial lunar colony with a crew of up to 50 persons engaged in mining and manufacturing activities. System performance and mass details were generated by an author developed code (BRMAPS). The proposed pilot power plant can be a model for future plants of the same capacity that could be tied to an evolutionary lunar power grid.

Author

*Nuclear Power Plants; Gas Turbines; Lunar Bases; Space Colonies; Gas Cooled Reactors*

**20070001546** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Thiophenes as Indicators of Aqueous Alteration in Carbonaceous Meteorites**

Sephton, Mark A.; Perry, Randall S.; Hoover, Richard B.; [2006]; 1 pp.; In English; SPIE Optics and Photonics Symposium 2006: Instruments, Methods and Missions for Astrobiology IX, 13-17 Aug. 2006, San Diego, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

A common class of organic compound in low petrographic type meteorites is the sulfur-containing thiophenes. The presence of this compound class in organic-rich meteorites which have experienced substantial levels of aqueous alteration is relatively unexplored. Early reports of these compounds attributed them to artifacts brought about by reactions between elemental sulfur and organic matter during high temperature extraction and analysis steps. Subsequent investigations confirmed their indigeneity, yet their environment of formation remained unconstrained. Here we present data which suggests that thiophenes are parent body alteration products that reflect the role of liquid water on asteroids in the early solar system.

Author

*Carbonaceous Meteorites; Thiophenes; Aqueous Solutions; Revisions; Petrography*

**20070001554** NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems, Huntsville, AL, USA

**Structural and Radiation Shielding Properties of a Martian Habitat Material Synthesized From In-Situ Resources**

Sen, S.; Caranza, S.; Bhattacharya, M.; Makel, D. B.; [2006]; 1 pp.; In English; Space VI, 18-21 Sep. 2006, San Jose, CA, USA

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail.: Other Sources; Abstract Only

The 2 primary requirements of a Martian habitat structure include sufficient structural integrity and effective radiation shielding. In addition, the capability to synthesize such building materials primarily from in-situ resources would significantly reduce the cost associated with transportation of such materials and structures from earth. To demonstrate the feasibility of such an approach we have fabricated samples in the laboratory using simulated in-situ resources, evaluated radiation shielding effectiveness using radiation transport codes and radiation test data, and conducted mechanical properties testing. In this paper we will present experimental results that demonstrate the synthesis of polyethylene from a simulated Martian atmosphere and the fabrication of a composite material using simulated Martian regolith with polyethylene as the binding material. Results

from radiation transport calculations and data from laboratory radiation testing using a 500 MeV/nucleon Fe beam will be discussed. Mechanical properties of the proposed composite as a function of composition and processing parameters will also be presented.

Author

*Composite Materials; Fabrication; Habitats; Mars Surface; Planetary Geology; Radiation Shielding*

**20070001585** Nautical Almanac Office, Washington, DC, USA

**Nautical Almanac for the Year 2006**

January 2005; 362 pp.; In English

Report No.(s): PB2007-100108; No Copyright; Avail.: CASI: [A16](#), Hardcopy

The report contains the 2006 nautical almanac.

NTIS

*Nautical Charts; Documents*

**20070001976** NASA Ames Research Center, Moffett Field, CA, USA

**Turbulence, Chondrules, and Planetesimals**

Cuzzi, Jeffrey; Hogan, Robert C.; Dobrovolskis, Anthony R.; Paque, Julie M.; [1998]; 1 pp.; In English; Protostars and Planets IV Conference, 6-10 Jul. 1998, Santa Barbara, CA, USA

Contract(s)/Grant(s): RTOP 344-37-22-03; Copyright; Avail.: Other Sources; Abstract Only

It has been shown both numerically and experimentally that 3-D turbulence concentrates aerodynamically size-selected particles by orders of magnitude. In a previous review chapter, in 'Chondrules and the protoplanetary disk' we illustrated the initial predictions of Turbulent Concentration (TC) as applied to the solar nebula. We predicted the particle size which will be most effectively concentrated by turbulence; it is the particle which has a gas drag stopping time equal to the overturn time of the smallest (Kolmogorov scale) eddy. The primary uncertainty is the level of nebula turbulence, or Reynolds number  $Re$ , which can be expressed in terms of the standard nebula eddy viscosity parameter  $\alpha = Re(\nu)_{(sub\ m)}/cH$ , where  $\nu_{(sub\ m)}$  is molecular viscosity,  $c$  is sound speed, and  $H$  is vertical scale height. Several studies, and observed lifetimes of circumstellar disks, have suggested that the level of nebula turbulence can be described by  $\alpha = 10(\exp -2) - 10(\exp -4)$ . There is some recent concern about how energy is provided to maintain this turbulence, but the issue remains open. We adopt a canonical minimum mass nebula with a range of  $\alpha \gtrsim 0$ . We originally showed that chondrule-sized particles are selected for concentration in the terrestrial planet region if  $\alpha = 10(\exp -3) - 10(\exp -4)$ . In addition, Paque and Cuzzi found that the size distribution of chondrules is an excellent match for theoretical predictions. One then asks by what concentration factor  $C$  these particles can be concentrated; our early numerical results indicated an increase of  $C$  with  $\alpha$ , and were supported by simple scaling arguments, but the extrapolation range was quite large and the predictions ( $C \sim 10(\exp 5) - 10(\exp 6)$  not unlikely) uncertain. The work presented here, which makes use of our recent demonstration that the particle density field is a multifractal with flow-independent properties provides a far more secure ground for such predictions. We also indicate how fine-grained dust rims on chondrules might enter into constraining the situation.

Author

*Chondrule; Solar Nebula; Turbulence; Eddy Viscosity; Protoplanets*

**20070002077** NASA Marshall Space Flight Center, Huntsville, AL, USA

**NASA's Robotic Lunar Exploration Program (RLEP) 2 Mission**

Horack, John M.; Lavoie, Anthony; Spudis, Paul; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain; Copyright; Avail.: Other Sources; Abstract Only

Before returning humans to the Moon for mankind's seventh lunar landing, NASA will embark upon a series of robotic missions to prepare the way for further exploration. These missions, part of the Robotic Lunar Exploration Program (RLEP), are designed to acquire decisive knowledge about the moon as well as to develop infrastructure needed to sustain human exploration in the lunar environment. Here we focus on the second mission in the RLEP program, RLEP-2, the first dedicated to landing in the south polar region of the moon. Managed by NASA's Marshall Space Flight Center in Huntsville, Alabama, along with the Applied Physics Laboratory and NASA Goddard Space Flight Center, RLEP-2 will build upon knowledge gained from the Chandrayaan-1 and Lunar Robotic Orbiter orbital missions, to help further the prospects for sustainable human exploration on the moon. This mission will characterize the lighting environment in the polar region, critically important to understanding the amount of power available and to the thermal design of hardware, as well as explore the nature and distribution of volatiles that may be present in permanently shadowed regions of polar craters. We shall review the current

status of the mission, articulate the results of ongoing trade studies in power, surface mobility, launch vehicles, measurements and instrumentation, and navigation/communication, as well as discuss the primary mission objectives in detail.

Author

*Lunar Exploration; Robotics; Space Missions; NASA Space Programs*

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### SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

**20070001986** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **The Heliosphere Through the Solar Activity Cycle**

Balogh, A.; Lanzerotti, L. J.; Suess, S. T.; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Understanding how the Sun changes through its 11-year sunspot cycle and how these changes affect the vast space around the Sun the heliosphere has been one of the principal objectives of space research since the advent of the space age. This book presents the evolution of the heliosphere through an entire solar activity cycle. The last solar cycle (cycle 23) has been the best observed from both the Earth and from a fleet of spacecraft. Of these, the joint ESA-NASA Ulysses probe has provided continuous observations of the state of the heliosphere since 1990 from a unique vantage point, that of a nearly polar orbit around the Sun. Ulysses results affect our understanding of the heliosphere from the interior of the Sun to the interstellar medium - beyond the outer boundary of the heliosphere. Written by scientists closely associated with the Ulysses mission, the book describes and explains the many different aspects of changes in the heliosphere in response to solar activity. In particular, the authors describe the rise in solar activity. ESA and NASA have now unanimously agreed a third extension to operate the highly successful Ulysses spacecraft until March 2008 and, in 2007 and 2008, the European-built space probe will fly over the poles of the Sun for a third time. This will enable Ulysses to add an important chapter to its survey of the high-latitude heliosphere and this additional material would be included in a 2nd edition of this book.

Author

*Heliosphere; Solar Activity; Sun; Sunspot Cycle; Solar Cycles*

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### SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics*.

**20070000503** Lawrence Livermore National Lab., Livermore, CA USA

#### **Keeping Cool Close to the Sun**

Hazi, A.; Jan. 18, 2006; 10 pp.; In English

Report No.(s): DE2006-883732; UCRL-TR-218250; No Copyright; Avail.: Department of Energy Information Bridge

THE germanium detector in the gamma-ray spectrometer (GRS) aboard the MESSENGER spacecraft is only the size and weight of a can of peaches but will play a critical role in investigating Mercury, the planet closest to the Sun. The MESSENGER (MErcury Surface, Space ENvironment, GEochemistry, and Ranging) spacecraft travels at about 38 kilometers per second and is named after the scientific goals of the mission. It is the first spacecraft to visit Mercury since 1975. Launched on August 3, 2004, MESSENGER is on its six-and-a-half-year trip to Mercury. While traveling, the GRS is already recording gamma rays from space and with slightly better resolution than expected. In addition, the detector has undergone a scheduled anneal cycle. Scientists are excited about these promising early results and look forward to the data the GRS will obtain once in orbit around Mercury.

NTIS

*Gamma Ray Spectrometers; Germanium; Mercury (Planet); Sun*

99  
GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

**20070001078** Ceskoslovenska Akademie Ved, Prague, Czechoslovakia  
**Molecular Tinkertoy Construction Kit: Computer Simulations of Molecular Propellers and Paddle Wheels**  
Oct 31, 2006; 5 pp.; In English  
Contract(s)/Grant(s): N62558-03-M-0806; W90C2K9479-CH-01S  
Report No.(s): AD-A458453; No Copyright; Avail.: CASI: [A01](#), Hardcopy  
No abstract available  
*Computerized Simulation; Propellers; Paddles; Wheels; Construction*

**20070001082** Woods Hole Oceanographic Inst., MA USA  
**Extracting Wind Sea and Swell from Directional Wave Spectra Derived from a Bottom-Mounted ADCP**  
Jul 2006; 41 pp.; In English  
Contract(s)/Grant(s): N00014-03-1-0681  
Report No.(s): AD-A458452; WHOI-2006-13; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
No abstract available  
*Air Water Interactions; Ocean Surface; Water Waves*

**20070001440** Library of Congress, Washington, DC USA  
**Israeli-Arab Negotiations: Background, Conflicts, and U.S. Policy**  
Nov 14, 2006; 35 pp.; In English  
Report No.(s): AD-A458426; CRS-RL33530; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
No abstract available  
*Policies; Israel*

**20070001442** California Univ., Santa Cruz, CA USA  
**Transient Response of Thin Film SiGe Micro Coolers**  
Jan 2006; 7 pp.; In English  
Report No.(s): AD-A458425; No Copyright; Avail.: CASI: [A02](#), Hardcopy  
No abstract available  
*Transient Response; Thin Films; Silicon Compounds*

**20070001443** Nelson Engineering Co., Titusville, FL USA  
**Replaceable Inserts for Ship's Line Handling Chocks**  
Oct 30, 2006; 64 pp.; In English  
Contract(s)/Grant(s): N65538-06-M-0156  
Report No.(s): AD-A458424; NEC-0004; No Copyright; Avail.: CASI: [A04](#), Hardcopy  
No abstract available  
*Inserts; Supports; Ships*

**20070001446** Library of Congress, Washington, DC USA  
**Iran: U.S. Concerns and Policy Responses**  
Nov 1, 2006; 50 pp.; In English  
Report No.(s): AD-A458423; CRS-RL32048; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
No abstract available  
*Policies; Iran*

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