



**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.

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

# Introduction

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

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

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

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

## The NASA STI Program

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

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

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

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

# NASA STI Availability Information

## NASA Center for AeroSpace Information (CASI)

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

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

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

## National Technical Information Service (NTIS)

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

## The Federal Depository Library Program (FDLP)

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

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

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

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

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[Subject Term Index](#)

[Personal Author Index](#)

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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 46, NUMBER 13

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01

## AERONAUTICS (GENERAL)

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

**20080021434** Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA

### **Assessment of Software Development Tools for Safety-Critical, Real-Time Systems**

Kornecki, A. J.; Brixius, N.; Zalewski, J.; Lau, H.; Linardon, J. P.; Jul. 2007; 159 pp.; In English

Contract(s)/Grant(s): DTFA0301C00048

Report No.(s): PB2007-112090; No Copyright; Avail.: CASI: [A08](#), Hardcopy

Modern software development tools have direct and growing impact on the effective and efficient development of complex, safety-critical, real-time avionics systems and, consequently, on the safety of the flying public. The objective of tool qualification is to ensure that the tool provides confidence at least equivalent to that of the processes eliminated, reduced, or automated in the certification of the developed airborne software. Existing Federal Aviation Administration (FAA) software guidelines are more restrictive with regard to development tool qualification than they are for verification tool qualification. These existing guidelines for development tools state that the tool must meet the same objectives as the software development processes of the airborne software in the certified system. In addition, the software level assigned to the tool should be the same as the level assigned to the software it produces. These guidelines make it very difficult and expensive to qualify development tools because they do not consider differences between development environments on a general-purpose workstation with a commercial off-the-shelf (COTS) operating system and the dedicated target application environments of the airborne software.

NTIS

*Aircraft Industry; Flight Safety; Real Time Operation; Safety; Software Development Tools*

**20080021435** Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA

### **Software Development Tools for Safety-Critical, Real-Time Systems Handbook**

Kornecki, A. J.; Jun. 2007; 39 pp.; In English

Contract(s)/Grant(s): DTFA0301C00048

Report No.(s): PB2007-112089; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Since the early years of computing, programmers, system analysts, and software engineers have sought ways to improve the efficiency of the development process. Software development tools are programs that help software developers create other programs or documentation. Their objective is to automate mundane operations and bring the level of abstraction closer to the application engineer. In practice, software development tools have been in wide use among safety-critical system developers. Examples of such use, in addition to aviation, include automotive, space, nuclear, railroad, medical, and military applications. This Handbook is directed to the aviation industry and the Federal Aviation Administration to facilitate use of software development tools on airborne projects developed under DO-178B certification criteria. This Handbook outlines the issues to be considered while using development tools on software-intensive airborne systems in a regulated industry and formulates questions applicable to related DO-178B objectives. This Handbook also addresses the progress of modern software engineering and its impact on the safety-critical software development process and products.

NTIS

*Aircraft Industry; Flight Safety; Handbooks; Real Time Operation; Safety; Software Development Tools*



**20080021717** NASA Dryden Flight Research Center, Edwards, CA, USA

**Recent NASA Dryden COA Experience**

Cobleigh, Brent; April 29, 2008; 10 pp.; In English; UAS Symposium/National Transportation Safety Board, 29-30 Apr. 2008, Washington, DC, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080021717>

This viewgraph presentation concerns the experience that Dryden has had with Certificate of Authorization (COA) in reference to unmanned aerial systems (UAS). It reviews recent Certificate of Authorization UAS's i.e., 2005 Altair NOAA Mission, 2006 Altair Western States Fire Mission, and 2007 Ikhana. The priorities for the safety process is reviewed, as are typical UAS hazards. Slides also review the common COA provisions, best practices and lessons learned, the 2005 NOAA/NASA Science Demonstration Flights and the use of the UAS systems during fire emergencies.

CASI

*Pilotless Aircraft; Unmanned Aircraft Systems; Aircraft Reliability; Certification*

**20080021724** NASA Dryden Flight Research Center, Edwards, CA, USA

**Suborbital Science Program: Dryden Flight Research Center**

DelFrate, John; April 15, 2008; 15 pp.; In English; W-HALES 2008: NASA-NICT Joint Workshop on HALE UAV and Wireless System, 15-18 Apr. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080021724>

This viewgraph presentation reviews the suborbital science program at NASA Dryden Flight Research Center. The Program Objectives are given in various areas: (1) Satellite Calibration and Validation (Cal/val)--Provide methods to perform the cal/val requirements for Earth Observing System satellites; (2) New Sensor Development -- Provide methods to reduce risk for new sensor concepts and algorithm development prior to committing sensors to operations; (3) Process Studies -- Facilitate the acquisition of high spatial/temporal resolution focused measurements that are required to understand small atmospheric and surface structures which generate powerful Earth system effects; and (4) Airborne Networking -- Develop disruption-tolerant networking to enable integrated multiple scale measurements of critical environmental features. Dryden supports the NASA Airborne Science Program and the nation in several elements: ER-2, G-3, DC-8, Ikhana (Predator B) & Global Hawk and Reveal. These are reviewed in detail in the presentation.

CASI

*Suborbital Flight; NASA Programs*

**20080022160** California Univ., Berkeley, CA, USA

**In-Flight Thermal Control of Droplets**

Smith, R. F., Inventor; Michaelis, B. M., Inventor; Orme-Marmarelis, M. E., Inventor; 12 Nov 04; 4 pp.; In English  
Contract(s)/Grant(s): NSF-DMI-0070053  
Patent Info.: Filed Filed 12 Nov 04; US-Patent-Appl-SN-10-986-683  
Report No.(s): PB2007-109176; No Copyright; Avail.: CASI: [A01](#), Hardcopy

A temperature control device and methods that facilitate highly efficient thermal control of in-flight material. The temperature control device includes a two piece disc shaped body formed of an insulating material with a stepped second axial passage extending there through. A diffuser is mounted within a stepped portion of the axial passage in spaced relation with a lateral wall of the passage. A heat exchanger extends about the exterior of the diffuser between the diffuser and the lateral wall. In operation, gas flows from a gas flow passageway into the space between the diffuser and the lateral wall, and then diffuses into an interior space of the diffuser as material, such as a droplet stream, passes through the passage and cooled or heated accordingly. The temperature of droplets passing through the passage can be precisely altered up to about 90.degree. F. in 10 ms (milliseconds).

NTIS

*Drops (Liquids); Patent Applications; Temperature Control*



## 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.

**20080021260** NASA Dryden Flight Research Center, Edwards, CA, USA

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

Davis, Mark C.; White, J. Terry; Journal of Spacecraft and Rockets; May 2008; Volume 45, No. 3, pp. 472-484; In English; 14th AIAA/AHI Space Planes and Hypersonic Systems and Technologies Conference, 6-9 Nov. 2006, Canberra, Australia; Original contains color and black and white illustrations

Report No.(s): AIAA Paper-2006-8028; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021260>; <http://dx.doi.org/10.2514/1.30413>

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 6.80-0.95 and at altitudes from 92,000 ft mean sea level to sea level. The dynamic pressure varied from 1300 to 400 psf with the angle of attack ranging from 0 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 10-15% higher than prediction. Underpredictions 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

*Aerodynamic Forces; Engine Airframe Integration; Angle of Attack; Mach Number; Lateral Stability; Hypersonic Flight; Flight Tests; Dynamic Pressure; Directional Stability; Aerodynamic Stability*

**20080021360** NASA Dryden Flight Research Center, Edwards, CA, USA

### **Fiber Optic Wing Shape Sensing on NASA's Ikhana UAV**

Richards, Lance; Parker, Allen R.; Ko, William L.; Piazza, Anthony; May 2008; 17 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021360>

Fiber Optic Wing Shape Sensing on Ikhana involves five major areas 1) Algorithm development: Local-strain-to-displacement algorithms have been developed for complex wing shapes for real-time implementation (NASA TP-2007-214612, patent application submitted) 2) FBG system development: Dryden advancements to fiber optic sensing technology have increased data sampling rates to levels suitable for monitoring structures in flight (patent application submitted) 3) Instrumentation: 2880 FBG strain sensors have been successfully installed on the Ikhana wings 4) Ground Testing: Fiber optic wing shape sensing methods for high aspect ratio UAVs have been validated through extensive ground testing in Dryden s Flight Loads Laboratory 5) Flight Testing: Real time fiber Bragg strain measurements successfully acquired and validated in flight (4/28/2008) Real-time fiber optic wing shape sensing successfully demonstrated in flight

Derived from text

*Fiber Optics; Wings; Shapes; Algorithms; Flight Tests; Strain Measurement; Time Measurement; Aerodynamic Loads; Pilotless Aircraft*

**20080021457** Coburn (Thompson) LLP, Saint Louis, MO, USA

### **Landing Assist Apparatus Retention Strap Spool**

Mylaert, N. W., Inventor; Tebon, D., Inventor; 3 Jun 04; 35 pp.; In English

Contract(s)/Grant(s): DAAH23-99-C-0111

Patent Info.: Filed Filed 3 Jun 04; US-Patent-Appl-SN-10-806-044

Report No.(s): PB2007-110136; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An aircraft landing assist apparatus is designed to be retrofit to existing aircraft having internal constructions that have

been modified to support the apparatus. The apparatus is designed so that on rough landings of the aircraft on a ship deck, the apparatus will collapse in a controlled manner to avoid any damage to ammunition and/or fuel storage areas of the aircraft.  
NTIS

*Landing Aids; Patent Applications; Spools; Straps*

**20080022018** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

**Flow Control Over Sharp-Edged Wings**

Rullan, Jose; Vlachos, Pavlos P; Telionis, Demetri P; Jul 2007; 136 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0144

Report No.(s): AD-A477947; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wings swept by 30 to 40 degrees with sharp leading edges are today very common on fighter aircraft. There is very little work devoted to the understanding of the aerodynamics of such wings. The problem is that such wings may be able to sustain attached flow, even if their tip vortices are broken down, or stall like two-dimensional wings. The aerodynamics of such wings were studied and investigated experimentally. Pressure distributions and velocity fields were obtained in a wind tunnel and a water tunnel. The effectiveness of leading-edge control of the flow over such wings was explored. Oscillating mini-flaps and pulsed jets along the leading edge were employed. The results indicate that two-D-like vortices are periodically generated and shed. It was also discovered that an underline feature of the flow, a streamwise vortex is periodically activated, penetrating the separated flow, eventually emerging downstream of the trailing edge of the wing. The results indicate that significant increases in tilt can be achieved in the average, by managing the development of streamwise and spanwise vortices. The technique is effective in the range of angles of attack of 10 to 20 degrees, for which the uncontrolled flow is stalled.

DTIC

*Aerodynamics; Boundary Layer Separation; Fighter Aircraft; Particle Image Velocimetry; Separated Flow; Wind Tunnels; Wings*

**20080022273** NASA Dryden Flight Research Center, Edwards, CA, USA

**Computational Fluid Dynamics Analysis Success Stories of X-Plane Design to Flight Test**

Cosentino, Gary B.; May 2008; 21 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2008-214636; H-2838; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022273>

Examples of the design and flight test of three true X-planes are described, particularly X-plane design techniques that relied heavily on computational fluid dynamics(CFD) analysis. Three examples are presented: the X-36 Tailless Fighter Agility Research Aircraft, the X-45A Unmanned Combat Air Vehicle, and the X-48B Blended Wing Body Demonstrator Aircraft. An overview is presented of the uses of CFD analysis, comparison and contrast with wind tunnel testing, and information derived from CFD analysis that directly related to successful flight test. Lessons learned on the proper and improper application of CFD analysis are presented. Highlights of the flight-test results of the three example X-planes are presented. This report discusses developing an aircraft shape from early concept and three-dimensional modeling through CFD analysis, wind tunnel testing, further refined CFD analysis, and, finally, flight. An overview of the areas in which CFD analysis does and does not perform well during this process is presented. How wind tunnel testing complements, calibrates, and verifies CFD analysis is discussed. Lessons learned revealing circumstances under which CFD analysis results can be misleading are given. Strengths and weaknesses of the various flow solvers, including panel methods, Euler, and Navier-Stokes techniques, are discussed.

Author

*Computational Fluid Dynamics; Blended-Wing-Body Configurations; Flight Tests; X-36 Aircraft*

### 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.

**20080021428** William J. Hughes Technical Center, Atlantic City, NJ, USA

**Modification of Visual Approach Slope Indicator Baffles at Pearson Field Airpark, Vancouver, WA**

Patterson, J. W.; Jun. 2007; 24 pp.; In English

Report No.(s): PB2007-112097; DOT/FAA/AR-TN07/12; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This technical note describes a research effort that was accomplished to correct a safety deficiency with a Visual Approach

Slope Indicator (VASI) system at the Pearson Field Airpark in Vancouver, Washington. During a recent inspection flight, the VASI system was found to be emitting signals that could potentially draw an approaching aircraft dangerously close to an obstruction near the final approach path. As a result, the system was shutdown. The VASI system had baffles previously installed on the inside and on the front opening of the unit that were intended to limit the emission of light in the direction of the obstruction. The baffles were found to have very comparable opening widths in all units of the system, which allowed the signal from some units to be visible within a very close proximity to an obstruction. Typically, each opening requires a different width to provide proper signal blocking at the specific location of the obstruction. The Federal Aviation Administration Northwest-Mountain Region, Navigational Surveillance Weather Systems Team requested the Airport Technology Research and Development Branch's assistance in correcting the misaligned baffles so that the VASI system could be restored to operation. Engineers from the Airport Technology Research and Development Branch visited the site to analyze the problem; collect data on the geometry of the obstruction, the baffles, and the general layout of the airport; and install and test the new baffles to make sure they operate properly. Engineers designed, constructed, and installed aluminum baffles that blocked the signal from the obstruction area, and provided a 2 degree margin of safety between the obstruction and the visible signal of the VASI. Ground and flight evaluations conducted by the Airport Technology Research and Development Branch verified that the installed baffles had eliminated the hazard by preventing a usable VASI signal from being seen near the obstruction.

NTIS

*Approach Indicators; Baffles; Slopes; Runways; Airports*

**20080021429** William J. Hughes Technical Center, Atlantic City, NJ, USA

**Preliminary Examination of the Effectiveness of Hand-Held Extinguishers Against Hidden Fires in the Cabin Overhead Area of Narrow-Body and Wide-Body Transport Aircraft**

Marker, T. R.; Jul. 2007; 33 pp.; In English

Report No.(s): PB2007-112096; DOT/FAA/AR-TN04/33; No Copyright; Avail.: National Technical Information Service (NTIS)

Twenty hand-held extinguisher tests were performed in the overhead space in both narrow- and wide-body aircraft. These tests simulated a typical hidden fire in the inaccessible area above the cabin ceiling by using a number of small, controllable candle lanterns. The purpose of the tests was to determine the performance of the Federal Aviation Administration-required, hand-held Halon 1211 extinguishers against a fire in this area when discharging the agent through a ceiling-mounted port. In an effort to maximize agent performance, the port design was modified as these tests progressed. The tests indicated that individual hand-held extinguishers did not predictably extinguish fires in the large-volume cabin overhead area typical of a wide-body aircraft, regardless of the port design. However, the use of ceiling-mounted discharge ports combined with hand-held extinguishers was more promising against fires in the more confined and smaller-volume overhead area typical of a narrow-body aircraft.

NTIS

*Fire Extinguishers; Fires; Passenger Aircraft; Transport Aircraft; Aircraft Compartments; Effectiveness; Performance Tests*

**20080021433** Sandia National Labs., Albuquerque, NM, USA

**Cargo Compartment Smoke Transport Computational Fluid Dynamics Code Validation**

Suo-Anttila, J.; Gill, W.; Luketa-Hanlin, A.; Gallegos, C.; Jul. 2007; 64 pp.; In English

Contract(s)/Grant(s): DTFA03-00-X-90019

Report No.(s): PB2007-112092; No Copyright; Avail.: National Technical Information Service (NTIS)

A computational model designed to predict smoke and gas transport within aircraft cargo compartments has been validated for potential use in the certification process of cargo compartment fire detection systems. The simulations and experiments compared herein represent a spectrum of scenarios that provide confidence in the models ability to predict the transport of smoke and combustion products in a variety of conditions. The main variables that changed between the cases were fire location, compartment size, and ventilation. Validation metrics suitable for fire detection system response were selected and, overall, the model favorably predicted these metrics for the selected cases. The model can now be used with improved confidence to simulate certification scenarios of interest to assist in designing the optimum detection systems for cargo compartments.

NTIS

*Cargo; Compartments; Computational Fluid Dynamics; Detection; Fires; Smoke*

**20080021550** Air Univ., Maxwell AFB, AL USA

**Meeting the Asymmetric Challenge: How Air and Space Power Can Combat Adversaries Using Dispersed and Hidden Forces**

Waller, Stephen B; Jun 2004; 74 pp.; In English

Report No.(s): AD-A477082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477082>

This study addresses how air and space power can best combat adversaries using dispersed and hidden forces (i.e. insurgents, guerrillas, and terrorists). Through research of past air and space efforts to combat these forces; the strategy, organization, and support of representative groups (i.e. Vietnamese communists, Hamas, Iraqi insurgents, and al Qaeda), and a model for strategy against these groups, air and space power demonstrates significant relevance. Air and space power relevance is important, as it can support and enable the success of US operations against adversaries in the foreseeable future. As adversaries continue to counter America can conventional superiority, US leaders and commanders must pursue proper employment of air and space power to answer these challenges effectively. Air and space power via special operations, air attack, airlift, ISR, and information operations hold congruent links to combating these adversaries and provide capabilities to overcome incongruence when innovatively employed with agility and flexibility. This thesis provides a past, present, and near future assessment of how these air and space functions can combat enemies using dispersed and hidden forces. This study reveals the importance of using these functions in conjunction with other civil- military-political efforts and national instruments of power, and the role of intelligence as a key enabler. The author proposes a model that plugs air and space capabilities, or tasks, into an integrated political, economic, civil-military effort against enemy dispersed forces to meet US national objectives. The Clausewitzian trinity of the people, the government, and the armed forces provides the foundation for this model.

DTIC

*Asymmetry; Combat; Warfare*

**20080021788** Government Accountability Office, Washington, DC, USA

**Airport Finance: Observations on Planned Airport Development Costs and Funding Levels and the Administration's Proposed Changes in the Airport Improvement Program**

Jun. 2007; 39 pp.; In English

Report No.(s): PB2007-113044; GAO-07-885; No Copyright; Avail.: CASI: [A03](#), Hardcopy

To address the strain on the aviation system, the Federal Aviation Administration (FAA) has proposed transitioning to the Next Generation Air Transportation System (NextGen). To fund this system and to make its costs to users more equitable, the Administration has proposed fundamental changes in the way that FAA is funded. As part of the reauthorization, the Administration proposes major changes in the way that grants through the Airport Improvement Program (AIP) are funded and allocated to the 3,400 airports in the national airport system. In response, GAO was asked for an update on current funding levels for airport development and the sufficiency of those levels to meet planned development costs. This report comprises capital development estimates made by FAA and Airports Council International (ACI), a leading industry association; analyzes how much airports have received for capital development and if sustained, whether it can meet future planned development; and summarizes the effects of proposed changes in funding for airport development. Airport funding and planned development data are drawn from the best available sources and have been assessed for their reliability. The Department of Transportation agreed with the findings of this report. This report does not contain recommendations.

NTIS

*Airports; Costs; Management*

**20080021815** Library of Congress, Washington, DC USA

**Air Force Aerial Refueling**

Bolkcom, Christopher; Aug 29, 2006; 7 pp.; In English

Report No.(s): AD-A477594; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477594>

Aerial refueling aircraft are key to air operations. The U.S. tanker fleet is large and effective, but old. Modernizing or replacing the current fleet of tankers presents the Department of Defense (DOD) with difficult choices in terms of desired capabilities, force structure, and budget. How this fleet will be maintained or replaced, and on what schedule, has proven controversial. This report will be updated as events warrant.

DTIC

*Air to Air Refueling; Refueling; Tanker Aircraft*

**20080021848** Air Univ., Maxwell AFB, AL USA

**Strategic Studies Quarterly: An Air Force-Sponsored Strategic Forum for Military, Government, and Academic Professionals. Volume 2, Number 1**

Wynne, Michel W; Worden, R M; Blazejewski, Kenneth S; Ackerman, John T; Munson, Robert; Esterhuysen, Abel; Mar 2008; 156 pp.; In English

Report No.(s): AD-A477684; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477684>

Contents: Sovereign Options: Securing Global Stability and Prosperity - A Strategy for the US Air Force by Michael W. Wayne; Developing Twenty-First-Century Airpower Strategists by Maj Gen R. Michael Worden; Space Weaponization and US-China Relations by Kenneth S. Balzejewski; Climate Change, National Security and the Quadrennial Defense Review: Avoiding the Perfect Storm by John T. Ackerman; Do We Want to 'Kill People and Break Things' in Africa? A Historian's Thoughts on Africa Command by Maj Robert Munson, USAFR; The Iraqization of Africa? Looking at AFRICOM from a South African Perspective by Abel Esterhuysen; book reviews; and letters to the editor.

DTIC

*Military Operations; Strategy*

**20080022050** Joint Air Power Competence Centre, Kalkar, German Democratic Republic

**Future of Air-to-Air Refueling in NATO**

Jun 11, 2007; 36 pp.; In English

Report No.(s): AD-A478072; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Air to Air Refueling; Military Operations; North Atlantic Treaty Organization (NATO); Refueling; Tanker Aircraft*

**20080022070** Office of the Under Secretary of Defense (Acquisitions and Technology), Washington, DC USA

**Directed Energy Weapons**

Welch, Larry; Hermann, Robert; Dec 2007; 96 pp.; In English

Report No.(s): AD-A478165; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Directed energy continues to offer promise as a transformational 'game changer' as the Department of Defense (DOD) encounters new asymmetric and disruptive threats, while facing increasingly sophisticated traditional challenges. Yet years of investment have not resulted in any current operational high-energy laser capability. In addition, the single high-energy laser program of record, the Airborne Laser (ABL) for boost phase missile defense, continues to experience delays and potential budget reductions. There is a strong belief in the directed energy community, and in segments of the warfighter and force-provider communities, that high- power microwave (HPM) offers capabilities in anti-sensor applications and as non-lethal weapons. Still, HPM advancement has been limited by uncertainty about its effects and effectiveness. Years of major investment in chemical lasers has produced megawatt-class systems that could have a wide range of applications. However, size, weight, and logistics issues limit them to integration on large platforms, such as the 747 used for the ABL program, or fixed ground applications such as the Ground-Based Laser for Space Control. As a consequence, interest in these systems and expectations of progress has significantly decreased. The current focus is on solid state lasers with the promise of providing for smaller, lighter systems with deep magazines. However, the current goal for solid state laser development would provide a power level more than an order of magnitude lower than current chemical lasers. While beam quality and other factors can compensate for some of the difference in power level, there is currently little investment in those aspects. Further, these cannot make up the delta in power of chemical vs. solid state lasers. The near-term projection for solid state lasers is a power level closer to two orders of magnitude below that of chemical lasers.

DTIC

*Chemical Lasers; Missiles; Weapon Systems*

**04**

**AIRCRAFT COMMUNICATIONS AND NAVIGATION**

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

**20080021723** NASA Dryden Flight Research Center, Edwards, CA, USA

**Emergency Response Fire-Imaging UAS Missions over the Southern California Wildfire Disaster**

DelFrate, John H.; April 15, 2008; 25 pp.; In English; W-HALES 2008: NASA-NICT Joint Workshop on HALE UAV and



Wireless Systems, 15-18 Apr. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080021723>

Objectives include: Demonstrate capabilities of UAS to overfly and collect sensor data on widespread fires throughout Western US. Demonstrate long-endurance mission capabilities (20-hours+). Image multiple fires (greater than 4 fires per mission), to showcase extendable mission configuration and ability to either linger over key fires or station over disparate regional fires. Demonstrate new UAV-compatible, autonomous sensor for improved thermal characterization of fires. Provide automated, on-board, terrain and geo-rectified sensor imagery over OTH satcom links to national fire personnel and Incident commanders. Deliver real-time imagery (within 10-minutes of acquisition). Demonstrate capabilities of OTS technologies (GoogleEarth) to serve and display mission-critical sensor data, coincident with other pertinent data elements to facilitate information processing (WX data, ground asset data, other satellite data, R/T video, flight track info, etc).

Derived from text

*Pilotless Aircraft; Fires; Real Time Operation; Imaging Techniques; Ground Tests; Emergencies; Disasters; Data Acquisition; Communication Satellites*

## 05

### AIRCRAFT DESIGN, TESTING AND PERFORMANCE

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

**20080021404** Air Univ., Maxwell AFB, AL USA

#### **Unmanned Combat Aerial Vehicles: Examining the Political, Moral, and Social Implications**

Dawkins, Jr, James C; Jun. 2005; 67 pp.; In English

Report No.(s): AD-A476987; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA476987>

There will likely be political, moral, and social implications of UCAV employment that strategists and military commanders will need to pay attention to as they craft strategies for future conflict. UCAVs are a very appealing option for the politician faced with use-of-force decisions due to reduced forward basing requirements and the possibility of zero friendly operator casualties. The flexibility of the weapon system offers the politician a seemingly high degree of control over the process of war. Together, these advantages may make a politician more inclined to use force first rather than last. In the moral realm, UCAVs are neither immoral nor illegal simply because risk to one of the combatants is removed. Additionally, notions of chivalry and fairness are not good standards by which to judge this technology. The social impact of widespread UCAV employment on the operator is an area of further concern. Remote-control war, however, does not change the underlying assumptions that have been the basis for the military ethos in the past. The final chapter highlights the dynamic between political, moral, and social issues as it addresses a range of possible unintended consequences resulting from extensive UCAV employment. Ultimately, the purpose of this thesis is to provide strategists greater clarity on the political, moral, and social issues surrounding UCAV employment. Doing so allows them to more effectively address, both objectively and subjectively, the implications of this new technology.

DTIC

*Combat; Drone Aircraft; Pilotless Aircraft; Remotely Piloted Vehicles*

**20080021408** Air Univ., Maxwell AFB, AL USA

#### **Fear and Loathing in the Air: Combat Fear and Stress in the Air Force**

Hamilton, Phillip T; Jun 2005; 83 pp.; In English

Report No.(s): AD-A477017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477017>

This thesis is about the Air Force's organizational response to acute combat fear and stress -- past and present. Despite the practical experience of dealing with this issue from World War II to Vietnam, the Air Force's response has become muddled in recent years. Anecdotal evidence indicates that some airmen have proven unable or unwilling to do their duty in the air, but little data exist to corroborate the stories or record the response. To answer a series of related questions about the genesis and state of the Air Force's organizational response to acute combat fear and stress, the author has divided this study into four parts: an examination of the related literature on combat stress; a review of the Air Force's actions in World War II,

Korea, and Vietnam; a look at the actors and policies that form the contemporary organizational response; and a report on the formulation and results of the Combat Stress Survey -- an instrument designed to provide contemporary data on the subject. The study demonstrates that the Air Force's organizational response to combat fear and stress has been a combination of medical and administrative policies designed to balance the needs of affected pilots with the warfighting demands of the Air Force. Unfortunately, there is little balance in the current approach to the issue. Survey results indicate that commanders -- the first line of defense -- have proven unwilling to take long-term administrative actions in the aftermath of stark failures. The Air Force needs to confront this issue with discussion, Air Force-wide policy, and education so that commanders have the requisite tools and knowledge to deal with a problem that is likely to return in future conflicts.

DTIC

*Combat; Fear; Pilots; Policies; Warfare*

**20080021432** William J. Hughes Technical Center, Atlantic City, NJ, USA

**Analysis of Factors Effecting Cargo Bay Fire Suppression Using a Fuel Tank Inerting System**

Cavage, W. M.; Jun. 2007; 36 pp.; In English

Contract(s)/Grant(s): DOT/FAA/AR-07/28

Report No.(s): PB2007-112093; No Copyright; Avail.: National Technical Information Service (NTIS)

Adding the capability of inert gas generation for fuel tank inerting to a commercial transport airplane has the potential to improve fire safety and reduce the weight and complexity of existing cargo bay fire suppression systems. To determine the effectiveness of a potential fuel tank inerting system for use as a cargo bay fire suppression metered system, a single air separation module (ASM) was tested to obtain specific performance points relevant to cargo bay fire suppression. These performance points were then used to calculate the time required to inert a single cargo bay with that inerting system and also to calculate how much time the cargo bay would not be inert using the Onboard Inert Gas Generation System (OBIGGS) with a discharge of halon. The acquired ASM performance data illustrated that an ASM based OBIGGS used for fuel tank inerting would be consistent with the requirements for a cargo bay fire suppression metered agent system. The nitrogen-enriched air (NEA) flow was very sensitive to ASM feed pressure (bleed air pressure) and the NEA flow from the ASM decreases as the static permeate pressure increases (aircraft altitude decreases). As expected, it is easier to inert the cargo bay as pressure altitude increases due to the decrease of gas mass in the compartment. The results of modeling the oxygen concentration with a halon discharge and representative air leakage into the bay to determine time not inert for given conditions illustrated the same date trends.

NTIS

*Air Cargo; Bays (Structural Units); Cargo; Fires; Fuel Tanks; Fire Extinguishers; Fire Prevention*

**20080021456** Wichita State Univ., Wichita, KS, USA; William J. Hughes Technical Center, Atlantic City, NJ, USA

**Teardown Evaluation of Two T-34A Wing Sets**

Laubach, M.; Cope, D.; Shiao, M.; Nuss, M.; Jul. 2007; 140 pp.; In English

Contract(s)/Grant(s): 01-C-AW-WISU

Report No.(s): PB2007-112088; No Copyright; Avail.: CASI: [A07](#), Hardcopy

To aid with the assessment of aging acrobatic aircraft, the Federal Aviation Administration (FAA) teamed with the National Institute for Aviation Research of Wichita State University to teardown and inspect two sets of high-time Beech T-34A wings. Due to the recent history of fatigue cracking and failure, a destructive evaluation of the T-34A would be useful to the FAA to specifically address the T-34A concerns, and in a general sense, to assess the condition of a high-time acrobatic category aircraft. The teardown evaluation involved performing inspections prescribed in Airworthiness Directive 2001-13-18; disassembly to gain access to the underlying primary structure; paint removal and etching of the wing primary structure to enhance damage detection; post-disassembly nondestructive inspections, and a detailed microscopic examination of all primary structure. Selected cracks were also analyzed to determine failure modes.

NTIS

*Wing Tips; Wings*

**20080021545** Air Univ., Maxwell AFB, AL USA

**The Need for Speed. Hypersonic Aircraft and the Transformation of Long Range Airpower**

Johnson, Kenneth F; Jun 2005; 73 pp.; In English

Report No.(s): AD-A477042; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477042>

Transformation to the next level of technology is a pressing issue for the Air Force's strategic planners. Just how much of



a leap in technology do engineers try to take when designing a new system? The answer depends if new discoveries have increased the technology available when they design a new system. However, it makes little sense to build new equipment that does not provide an improved capability or a more reliable system. That being said, the next long-range strike platform could take that technological leap and be a very fast near-space vehicle. Past events, such as the 2004 X-43 launch, show that technological progress is occurring on critical hypersonic components. While this is not a, paper on the technology per se, it covers the implications of building and operating a 'hypersonic' bomber force. This paper addresses the question of whether or not the hypersonic bomber is worth the required investment and covers several aspects involved with hypersonic bomber operations. The purpose of this study is to determine if the advantages gained from developing a hypersonic fleet outweigh the disadvantages. The author concludes that the advantages gained from developing a hypersonic fleet outweigh the platform's disadvantages.

DTIC

*Hypersonic Aircraft; Bomber Aircraft; Hypersonics; Launching*

**20080021551** Air Univ., Maxwell AFB, AL USA

**Balanced Insanity: An Argument for the Inclusion of Tasking, Processing, Exploitation, and Dissemination in Future Security Assistance Unmanned Aerial Vehicle Programs**

Hamilton, Shane P; May 2005; 150 pp.; In English

Report No.(s): AD-A477094; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477094>

The changes in the threat posed by global terrorism may be drastic, especially when weapons of mass destruction (WMD) are involved. The coalition nature of the current war on terrorism may also change rapidly as coalition partners enter, leave, or rejoin the coalition. The USA and its coalition partners must take advantage of the capabilities of modern communications to transmit and share the most basic levels of intelligence to meet the threat posed by global, potentially catastrophic terrorism. Time spent analyzing raw information and collating it into finished analytical products as in the NATO alliance framework may simply not be available. The Cold War intelligence structure no longer achieves the nation's goals when America's alliances in the global war on terror are based on loose regional or global coalitions organized to meet specific threats. Perhaps the most glaring example of the disconnect between America's stated policies regarding the global war on terror and its obsolete security assistance programs is the sale of intelligence unmanned aerial vehicles (UAVs) to foreign coalition partners. The USA, as the leader of the worldwide coalition against terrorism, is involved in maintaining the intelligence databases critical to success in a war that spans the globe. As the leading nation of this coalition it is in the best interests of the USA to maintain a global intelligence network capable of sharing critical information among its partners. If all coalition partners have access to interoperable intelligence systems, there is a decreased reliance on liaison officers, translators, and other less effective methods to achieve interoperability. A shared intelligence picture ensures the coalition's military commander has centralized control of intelligence. With the direct exchange of intelligence, there is less of a chance for fog and friction to affect the coalition's intelligence capabilities.

DTIC

*Exploitation; Pilotless Aircraft; Security*

**20080021737** Dayton Univ. Research Inst., OH, USA

**Aging Mechanical Systems Program**

Fry, T. A.; Jun. 2007; 104 pp.; In English

Contract(s)/Grant(s): DTFAC-04-C-00021

Report No.(s): PB2007-112087; No Copyright; Avail.: CASI: [A06](#), Hardcopy

This report details the development and demonstration of an Aging Mechanical Systems Methodology, a methodology for the proactive study of commercial aging aircraft in an effort to ensure on-going safety. The report includes a description of the methodology and documentation of an inaugural case study. The Embraer 120 pitch control system was the subject of the case study. Findings and recommendations resulting from both the development of the methodology and the execution of the case study were included.

NTIS

*Aging (Materials); Aircraft Parts*

**20080021807** North Carolina Agricultural and Technical State Univ., Greensboro, NC USA

**Fault-Tolerant and Reconfigurable Control of Unmanned Aerial Vehicles (UAVs)**

Song, Yong D; Feb 29, 2008; 31 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0462

Report No.(s): AD-A477558; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477558>

Unmanned aerial vehicles (UAVs) are critical components of the future naval forces. UAV control and monitoring with autonomous operation will become an absolute necessity and adaptive cooperation of vehicles is the only practical alternative. The objective of this project is to develop and evaluate new methodologies for cooperative (formation) control of multiple unmanned air vehicles. The goal is to have multiple UAVs working together as a group. Instead of separately assigning distinct tasks to each vehicle, the operator would assign tasks to the UAV group, which then determines the best way to accomplish each task, freeing the operator to maintain surveillance over the entire operation. In this project we investigated Path Tracking and obstacle avoidance of UAVs using fuzzy logic method. Algorithms for close formation control of multi-UAVs are developed and simulated. We also investigated fault-tolerant control of single UAVs by neuro-adaptive method. Detailed description of this method is provided in this document. The project has supported S graduate students with 9 technical papers published.

DTIC

*Drone Vehicles; Fault Tolerance; Pilotless Aircraft*

**20080021821** Defence Research and Development Canada, Toronto, Ontario Canada

**Shin Clearance in the Hawk Mk115**

Meunier, Pierre; Jan 2008; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477620; DRDC-T-TM-2007-129; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477620>

In 2006, the Canadian Forces (CF) transitioned to a new anthropometric selection standard for pilots. The new standard bases acceptance and rejection on whether individuals are physically compatible with the cockpits of all current aircraft; the previous standard was not aircraft specific. As a result, cockpit compatibility assessments are not currently available for student pilots who were admitted under the previous standard. In July 2007, a pilot slated to train on the Hawk suspected he was too large for the cockpit. This prompted a series of events including an anthropometric assessment of current Hawk pilots and a review of the screening process and limits currently in place. Ten pilots from 15 Wing and an external pilot were recruited to participate in a field trial designed to assess the shin clearance limits of the Hawk Mk 115. Clearance measurements between the shins and the main instrument panel were taken with the seat completely down or up, in summer and winter clothing. The minimum distance between the shins and the instrument panel was recorded with the rudder pedals in neutral and full left positions. In addition, the largest subject was assessed in the Hawk ejection trainer. The objective was twofold: 1) to observe the effect of seat movement on shin clearance and 2) to determine whether the trainer could be used as a cockpit compatibility assessment tool. The results indicate that there is scope for a small increase in the current anthropometric limits with respect to shin clearance. However, the significance of this increase in terms of population accommodation depends on which option is retained. The recommended option would provide a risk-balanced limit that accepts a reduced ejection clearance zone between the knees and the rearview mirrors. This would increase accommodation by about 2.5%. It was also determined that the ejection simulator was not sufficiently similar to the actual cockpit to be used as a cockpit compatibility assessment tool.

DTIC

*Anthropometry; Clearances; Cockpits*

**20080021822** Defence Research and Development Canada, Toronto, Ontario Canada

**Intelligent Adaptive Interfaces: Summary Report on Design, Development, and Evaluation of Intelligent Adaptive Interfaces for the Control of Multiple UAVs from an Airborne Platform**

Hou, Ming; Kobierski, Robert D; Dec 2006; 88 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477622; DRDC-T-TR-2006-292; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477622>

An absence of guidance on designing complex, dynamic, and networked systems presents challenges to the design of such systems to maximize overall human-machine system performance. An Intelligent Adaptive Interface (IAI) concept and associated technologies have been developed to address this problem. A typical IAI is driven by software agents that can change the display and /or control characteristics to react to the changes of mission and operator states in real time. The work

reported here is the result of the two final phases of a three-year project conducted by DRDC Toronto. This project investigated the efficacy of IAIs in a multi-Uninhabited Aerial Vehicle (UAV) scenario. The IAI was modelled as part of the UAV tactical workstations found in a maritime patrol aircraft. In the first phase of the project, a performance model was developed to compare the difference in mission activities with and without IAI agent aids. The simulation results revealed that the control of multiple UAVs is a cognitively complex task with high workload. With the augmentation of automation agents, operators could continue working under high time pressure, resulting in critical tasks being achieved in reduced time. To further test the effectiveness of IAIs and validate the simulation results, a prototype IAI multiagent experimental environment was implemented for an empirical study. Six IAI agent function groups have been integrated into the UAV operator interfaces. Operator's performance was examined with and without IAIs under three different workload conditions. The results from both objective and subjective measures verified the findings of the simulation research. IAIs facilitated a significant reduction in workload and an improvement in situation awareness. This research also developed preliminary guidance on designing IAI systems.

DTIC

*Adaptive Control; Drone Vehicles; Flying Platforms; Man Machine Systems; Workloads (Psychophysiology)*

**20080021826** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Corrosion Preventing Characteristics of Military Hydraulic Fluids, Part 2**

Jackman, Rachel; Tebbe, Jill; Villahermosa, Luis; Apr 19, 2007; 19 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A477636; TARDEC-17052RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA477636>

Presentation Content: Introduction and Brief History; Sample Identification; Laboratory Corrosion Tests and Parameters: Rust Preventing Characteristics ASTM D 665, Corrosiveness to Copper ASTM D 130, Corrosiveness and Oxidative Stability ASTM D 4636; Conclusion.

DTIC

*Corrosion; Corrosion Prevention; Hydraulic Fluids; Lubricating Oils*

**20080021827** Library of Congress, Washington, DC USA

**Unmanned Vehicles for U.S. Naval Forces: Background and Issues for Congress**

O'Rourke, Ronald; May 31, 2006; 7 pp.; In English

Report No.(s): AD-A477638; CRS-RS21294; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA477638>

Unmanned vehicles (UVs) are viewed as a key component of U.S. defense transformation. Recent U.S. military operations have highlighted the potential of UVs to significantly improve and reshape U.S. military capabilities. Perhaps uniquely among the military departments, the Department of the Navy (DON), which includes the Navy and Marine Corps, may eventually acquire every major kind of UV, including unmanned air vehicles (UAVs), unmanned combat air vehicles (or UCAVs, which are UAVs armed with weapons), unmanned surface vehicles (USVs), unmanned underwater vehicles (UUVs), and unmanned ground vehicles (UGVs). Navy and Marine Corps UV programs raise several potential issues for Congress. This report will be updated as events warrant.

DTIC

*Combat; Drone Vehicles; Procurement; Underwater Vehicles*

**20080021828** Library of Congress, Washington, DC USA

**Unmanned Vehicles for U.S. Naval Forces: Background and Issues for Congress**

O'Rourke, Ronald; Jul 26, 2006; 7 pp.; In English

Report No.(s): AD-A477639; CRS-RS21294; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA477639>

Unmanned vehicles (UVs) are viewed as a key component of U.S. defense transformation. Perhaps uniquely among the military departments, the Department of the Navy (DON), which includes the Navy and Marine Corps, may eventually acquire every major kind of UV, including unmanned air vehicles (UAVs), unmanned combat air vehicles (or UCAVs, which are UAVs armed with weapons), unmanned surface vehicles (USVs), unmanned underwater vehicles (UUVs), and unmanned ground vehicles (UGVs). Navy and Marine Corps UV programs raise several potential issues for Congress. This report will be updated as events warrant.

DTIC

*Combat; Drone Vehicles; Procurement; Underwater Vehicles*

**20080021831** RAND Corp., Santa Monica, CA USA

**Advanced Composite Materials: The Air Force's Role in Technology Development**

Rogers, Curt; Jan 1992; 58 pp.; In English

Contract(s)/Grant(s): F49620-91-C-0003

Report No.(s): AD-A477647; RAND-N-3503-AF; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477647>

This RAND Note documents a study on the important institutional activities and processes that contributed to the timely maturation of advanced composite materials technology for use in combat aircraft structures. The primary purpose of this Note is to identify the roles that the Air Force (and other governmental organizations) played in the transition of composites from an emerging and potentially important military technology to the point of initial applications in new aircraft designs. This study was motivated by the hypothesis that the successful development of divergent technologies (for military purposes) may have some important and common institutional factors that can be identified. For example, the phasing of critical-technologies identification studies, the enduring presence of technology advocates within the Department of Defense, and the funding of advanced technology development programs may all be as important to a maturation process as are those elements that are strictly technical in nature. This work was performed in the Resource Management and System Acquisition Program within Project AIR FORCE. This Note supplements RAND report R-4199-AF, Maintaining Future Military Aircraft Design Capability (1992), which examines the general question of how to maintain combat aircraft design capabilities in rapidly changing threat and budget environments.

DTIC

*Aircraft Design; Composite Materials; Composite Structures; Military Technology; Reinforced Plastics; Research and Development*

**20080021856** Library of Congress, Washington, DC USA

**Homeland Security: Unmanned Aerial Vehicles and Border Surveillance**

Bolkcom, Christopher; Jun 28, 2004; 7 pp.; In English

Report No.(s): AD-A477712; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477712>

The use of Unmanned Aerial Vehicles (UAVs) to improve border security is a technique that has garnered congressional attention. This report examines the strengths and limitations of deploying UAVs along the borders and related issues for Congress. This report will be updated as events warrant.

DTIC

*Drone Vehicles; Pilotless Aircraft; Remotely Piloted Vehicles; Surveillance*

**20080021857** Library of Congress, Washington, DC USA

**F-22 Raptor Aircraft Program**

Bolkcom, Christopher; Nov 5, 2001; 19 pp.; In English

Report No.(s): AD-A477714; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477714>

The F-22 Raptor is a next-generation fighter/attack aircraft using the latest stealth technology to reduce detection by radar. Equipped with more advanced engines and avionics than the current F-15 Eagle, the F-22 is expected to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. In 1986 two contractors were selected to build competing prototypes: Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development, now termed 'Engineering and Manufacturing Development' (EMD). The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. If produced as now projected, F-22s could begin replacing F-15s after 2005. The Administrations' FY2002 budget requested almost \$4.8 billion for the F-22 program in procurement and development funds. Through FY2000, Congress provided some \$22.8 billion for the F-22. A 341-aircraft program was estimated in June 2000 to cost about \$61.9 billion in actual prior-year and projected out-year expenditures.

DTIC

*Attack Aircraft; F-22 Aircraft; Fighter Aircraft*

**20080021858** Naval Air Warfare Center, Patuxent River, MD USA

**Usability Evaluation of Unmanned Aerial Vehicle Symbology**

Hart, Chris; Williams, Henry P; Mar 10, 2008; 18 pp.; In English

Report No.(s): AD-A477719; NAWCADPAX/TR-2007/208; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477719>

Symbology to represent fixed-wing and rotary-wing Unmanned Aerial Vehicles (UAVs) was developed and compared to MIL-STD-1787C symbology. The symbology was evaluated in several simulated UAV operator tasks. In the first portion of the study, static screen-shots from a simulated UAV control station display screen were presented to participants. Participants were required to determine how many air vehicle symbols of a particular type or affiliation were present in the screen-shot. The results indicated that the new symbology was recognized at least as quickly and accurately as existing MIL-STD-1787C symbology. In the second portion of the study, participants monitored dynamic video on the control station display. Participants were required to monitor the display for specific events associated with their own ships. Again, performance with the new symbology was at least as good as that with MIL-STD-1787C symbology. While this study was limited in scope, the results represent a productive step in the development, evaluation, and standardization of new UAV symbology.

DTIC

*Display Devices; Drone Vehicles; Pilotless Aircraft; Symbols*

**20080021865** Library of Congress, Washington, DC USA

**Homeland Security: Unmanned Aerial Vehicles and Border Surveillance**

Bolkcom, Christopher; Dec 7, 2004; 7 pp.; In English

Report No.(s): AD-A477727; CRS-RS21698; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477727>

The use of Unmanned Aerial Vehicles (UAVs) to improve border security is a technique that has garnered congressional attention. This report examines the strengths and limitations of deploying UAVs along the borders and related issues for Congress. This report will be updated as events warrant.

DTIC

*Drone Vehicles; Pilotless Aircraft; Security; Surveillance*

**20080021866** Library of Congress, Washington, DC USA

**F/A-22 Raptor**

Bolkcom, Christopher; Jan 6, 2005; 28 pp.; In English

Report No.(s): AD-A477729; CRS-RL31673; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477729>

The F/A-22 Raptor is a next-generation fighter/attack aircraft that features the latest stealth technology to reduce detection by radar. Using more advanced engines and avionics than the current F-15 Eagle, the F/A-22 is intended to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. This report examines the Air Force's F/A-22 Raptor program, including costs and schedule; considers several key issues, and concludes with a synopsis of recent legislative activity the program. The F/A-22 has had strong congressional support, although some have criticized the program on grounds of cost, requirements, and coordination with other tactical aircraft programs. Deletion of procurement funds in the FY2000 defense appropriation bill passed by the House made the future of the program a major issue for House and Senate conferees in 1999. Some question the urgency of procuring of the F/A-22 when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F/A-22 should enter production as early as possible to cope with future threats from more advanced air defenses of potential enemies and to maintain the preeminent U.S. position in aviation technology and production.

DTIC

*Attack Aircraft; Costs; Fighter Aircraft; Government Procurement; Law (Jurisprudence)*

**20080021868** Library of Congress, Washington, DC USA

**Russian Fighter Aircraft Industrial Base: Parallels with the USA**

Bolkcom, Christopher; Schwarzler, Ellen; Nov 8, 2000; 22 pp.; In English

Report No.(s): AD-A477734; CRS-RL30730; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477734>

There are many differences between the fighter aircraft industry in the USA and in Russia. The USA has traditionally



produced its weaponry within a capitalist framework which allowed free enterprise and competition between companies in private industry. The former Soviet Union's economy, and its fighter aircraft industry was based on a Marxist, command economy, where the central government dictated the type and number of aircraft produced and allocated resources for construction. Once among the most glamorous components of the Soviet military industrial complex, the Russian military aircraft industry has been described by some analysts as being on the verge of collapse. Russia's civilian aircraft industry has faced similar pressures, which does not bode well for the military aviation infrastructure. It may be difficult for fighter aircraft companies to find employment in Russia's beleaguered civil aircraft sector. The Russian government has attempted to reform its fighter aircraft industrial base and make it more efficient and competitive with western industry. It has initiated several reforms aimed at reducing the stratification and compartmentalization of industrial processes, as well as improving access to financial resources. These reforms have had mixed success. While Russia's military aviation infrastructure has consolidated dramatically, the overall effectiveness of these reform efforts still remains to be seen. As Russia reforms its fighter aircraft industrial base, there appear to be many parallels between their experience and what is happening in the USA in terms of declining domestic demand and pressure for consolidation. By examining the events in Russia's military aviation industrial base, especially the experience of the Sukhoi and Mikoyan aircraft design bureaus, policy makers in the USA may gain insight into current and forthcoming domestic fighter aircraft industrial base issues.

DTIC

*Defense Industry; Fighter Aircraft; Industries; Russian Federation; United States*

**20080021869** Library of Congress, Washington, DC USA

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

Geer, Harlan; Bolkcom, Christopher; Nov 21, 2005; 63 pp.; In English

Report No.(s): AD-A477738; CRS-RL31872; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477738>

The war on terrorism has put a high premium on a primary mission of UAVs, intelligence gathering. Furthermore, the military effectiveness of UAVs in recent conflicts such as Iraq (1990) and Kosovo (1999) opened the eyes of many to both the advantages and disadvantages provided by unmanned aircraft. Long relegated to the sidelines in military operations, UAVs are now making national headlines as they are used in ways normally reserved for manned aircraft. Conventional wisdom states that UAVs offer two main advantages over manned aircraft: they are considered more cost-effective, and they minimize the risk to a pilot's life. However, the current UAV accident rate (the rate at which the aircraft are lost or damaged) is 100 times that of manned aircraft. UAVs range from the size of an insect to that of a commercial airliner. DOD currently possesses five major UAVs: the Air Force's Predator and Global Hawk, the Navy and Marine Corps's Pioneer, and the Army's Hunter and Shadow. Other key UAV developmental efforts include the Air Force and Navy's unmanned combat air vehicle (UCAV), Navy's vertical takeoff and landing UAV (VTUAV), and the Broad Area Maritime Surveillance UAV (BAMS), and the Marine Corps's Dragon Eye and Dragon Warrior. The services continue to be innovative in their use of UAVs. Recent examples include arming UAVs (Predator, Hunter), using UAVs to extend the eyes of submarines, and teaming UAVs with strike aircraft and armed helicopters to improve targeting. Congressional considerations include the proper pace, scope, and management of DoD UAV procurement; appropriate investment priorities for UAVs versus manned aircraft; UAV future roles and applications; personnel issues; industrial base issues; and technology proliferation. This report will be updated as necessary.

DTIC

*Acquisition; Costs; Drone Vehicles; Military Operations; Pilotless Aircraft*

**20080021872** Library of Congress, Washington, DC USA

**F-22 Raptor Aircraft Program**

Bolkcom, Christopher; Jan 14, 2002; 19 pp.; In English

Report No.(s): AD-A477749; CRS-IB87111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477749>

The F-22 Raptor is a next-generation fighter-attack aircraft using the latest stealth technology to reduce detection by radar. Equipped with more advanced engines and avionics than the current F-15, the F-22 is expected to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. In 1986 two contractors were selected to build competing prototypes: Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development. The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. If produced as projected, F-22s could begin replacing F-15s after 2005. The Administration's FY2002 budget requested almost \$4.8 billion for the F-22 program in procurement and development funds. Through FY2000, Congress provided some \$22.8 billion for the F-22. A 341-aircraft program was

estimated in June 2000 to cost about \$61.9 billion in actual prior-year and projected out-year expenditures. The F-22 program raises questions about its cost and the need for this aircraft, the capabilities it would have, and the number of these planes needed to meet military requirements. The F-22 has had strong congressional support, although some have criticized the program on grounds of cost, requirements, and coordination with other tactical aircraft programs. Deletion of procurement funds in the FY2000 defense appropriation bill passed by the House made the future of the program a major issue for House and Senate conferees in 1999. Some question the urgency of beginning production of the F-22 when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F-22 should enter production as early as possible to cope with future threats from more advanced air defenses of potential enemies and to maintain the U.S. position in aviation technology and production.

DTIC

*Armed Forces (United States); Attack Aircraft; Cost Estimates; F-22 Aircraft; Federal Budgets; Fighter Aircraft; Government Procurement; Stealth Technology*

**20080021873** Library of Congress, Washington, DC USA

### **F-22 Raptor Aircraft Program**

Bolkcom, Christopher; Jul 3, 2002; 19 pp.; In English

Report No.(s): AD-A477750; CRS-IB87111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477750>

The F-22 Raptor is a next-generation fighter-attack aircraft using the latest stealth technology to reduce detection by radar. Equipped with more advanced engines and avionics than the current F-15, the F-22 is expected to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. In 1986 two contractors were selected to build competing prototypes: Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development. The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. If produced as projected, F-22s could begin replacing F-15s after 2005. The Administration's FY2003 budget requested \$5.2 billion for the F-22 program in procurement and development funds. Through FY2000, Congress provided some \$22.8 billion for the F-22. A 341-aircraft program was estimated in June 2000 to cost about \$61.9 billion in actual prior-year and projected out-year expenditures. The F-22 program raises questions about its cost and the need for this aircraft, the capabilities it would have, and the number of these planes needed to meet military requirements. The F-22 has had strong congressional support, although some have criticized the program on grounds of cost, requirements, and coordination with other tactical aircraft programs. Deletion of procurement funds in the FY2000 defense appropriation bill passed by the House made the future of the program a major issue for House and Senate conferees in 1999. Some question the urgency of beginning production of the F-22 when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F-22 should enter production as early as possible to cope with future threats from more advanced air defenses of potential enemies and to maintain the U.S. position in aviation technology and production.

DTIC

*Armed Forces (United States); Attack Aircraft; Cost Estimates; F-22 Aircraft; Federal Budgets; Fighter Aircraft; Government Procurement; Stealth Technology*

**20080021874** Library of Congress, Washington, DC USA

### **F-22 Raptor Aircraft Program**

Bolkcom, Christopher; Aug 9, 2002; 19 pp.; In English

Report No.(s): AD-A477751; CRS-IB87111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477751>

The F-22 Raptor is a next-generation fighter-attack aircraft using the latest stealth technology to reduce detection by radar. Equipped with more advanced engines and avionics than the current F-15, the F-22 is expected to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. In 1986 two contractors were selected to build competing prototypes: Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development. The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. If produced as projected, F-22s could begin replacing F-15s after 2005. The Administration's FY2003 budget requested \$5.2 billion for the F-22 program in procurement and development funds. Through FY2000, Congress provided some \$22.8 billion for the F-22. A 341-aircraft program was estimated in June 2000 to cost about \$61.9 billion in actual prior-year and projected out-year expenditures. The F-22 program raises questions about its cost and the need for this aircraft, the capabilities it would have, and the number of these planes



needed to meet military requirements. The F-22 has had strong congressional support, although some have criticized the program on grounds of cost, requirements, and coordination with other tactical aircraft programs. Deletion of procurement funds in the FY2000 defense appropriation bill passed by the House made the future of the program a major issue for House and Senate conferees in 1999. Some question the urgency of beginning production of the F-22 when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F-22 should enter production as early as possible to cope with future threats from more advanced air defenses of potential enemies and to maintain the U.S. position in aviation technology and production.

DTIC

*Armed Forces (United States); Attack Aircraft; Cost Estimates; F-22 Aircraft; Federal Budgets; Fighter Aircraft; Government Procurement; Stealth Technology*

**20080021875** Library of Congress, Washington, DC USA

**F-22 Raptor Aircraft Program**

Bolkcom, Christopher; Sep 11, 2002; 19 pp.; In English

Report No.(s): AD-A477752; CRS-IB87111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477752>

The F-22 Raptor is a next-generation fighter-attack aircraft using the latest stealth technology to reduce detection by radar. Equipped with more advanced engines and avionics than the current F-15, the F-22 is expected to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. In 1986 two contractors were selected to build competing prototypes: Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development. The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. If produced as projected, F-22s could begin replacing F-15s after 2005. The Administration's FY2003 budget requested \$5.2 billion for the F-22 program in procurement and development funds. Through FY2000, Congress provided some \$22.8 billion for the F-22. A 341-aircraft program was estimated in June 2000 to cost about \$61.9 billion in actual prior-year and projected out-year expenditures. The F-22 program raises questions about its cost and the need for this aircraft, the capabilities it would have, and the number of these planes needed to meet military requirements. The F-22 has had strong congressional support, although some have criticized the program on grounds of cost, requirements, and coordination with other tactical aircraft programs. Deletion of procurement funds in the FY2000 defense appropriation bill passed by the House made the future of the program a major issue for House and Senate conferees in 1999. Some question the urgency of beginning production of the F-22 when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F-22 should enter production as early as possible to cope with future threats from more advanced air defenses of potential enemies and to maintain the U.S. position in aviation technology and production.

DTIC

*Armed Forces (United States); Attack Aircraft; Cost Estimates; F-22 Aircraft; Federal Budgets; Fighter Aircraft; Government Procurement; Stealth Technology*

**20080021876** Library of Congress, Washington, DC USA

**F-22 Raptor Aircraft Program**

Bolkcom, Christopher; Oct 16, 2002; 20 pp.; In English

Report No.(s): AD-A477753; CRS-IB87111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477753>

The F-22 Raptor is a next-generation fighter-attack aircraft using the latest stealth technology to reduce detection by radar. Equipped with more advanced engines and avionics than the current F-15, the F-22 is expected to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. In 1986 two contractors were selected to build competing prototypes: Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development. The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. If produced as projected, F-22s could begin replacing F-15s after 2005. The Administration's FY2003 budget requested \$5.2 billion for the F-22 program in procurement and development funds. Through FY2000, Congress provided some \$22.8 billion for the F-22. A 341-aircraft program was estimated in June 2000 to cost about \$61.9 billion in actual prior-year and projected out-year expenditures. The F-22 program raises questions about its cost and the need for this aircraft, the capabilities it would have, and the number of these planes needed to meet military requirements. The F-22 has had strong congressional support, although some have criticized the program on grounds of cost, requirements, and coordination with other tactical aircraft programs. Deletion of procurement

funds in the FY2000 defense appropriation bill passed by the House made the future of the program a major issue for House and Senate conferees in 1999. Some question the urgency of beginning production of the F-22 when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F-22 should enter production as early as possible to cope with future threats from more advanced air defenses of potential enemies and to maintain the U.S. position in aviation technology and production.

DTIC

*Armed Forces (United States); Attack Aircraft; Cost Estimates; F-22 Aircraft; Federal Budgets; Fighter Aircraft; Government Procurement; Stealth Technology*

**20080021895** Library of Congress, Washington, DC USA

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

Bolkcom, Christopher; Jan 14, 2002; 19 pp.; In English

Report No.(s): AD-A477814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477814>

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies like a plane by tilting its wing-mounted rotors to function as propellers. Combining a helicopter's operational flexibility with the greater speed, range, and efficiency of fixed-wing aircraft, the V-22 can perform such missions as troop/cargo transport, amphibious assault, special operations, and search and rescue operations. Begun in FY1982 by the Army and now funded in part by the Air Force, the V-22 has been primarily a Marine Corps program funded by the Navy Department. The aircraft is produced by Bell Helicopter Textron and Boeing Helicopters, with engines produced by Rolls-Royce/Allison. Flight testing and operational evaluation of pre-production V-22s began in early 1997, with procurement of production aircraft approved in April 1997. The future of the aircraft was at issue in 1989-92, when Secretary of Defense Cheney sought to cancel the program on grounds of affordability. Congress continued to fund the program, however, and through FY2000 some \$ 10 billion was provided for the program, which as of December 31, 1999, was estimated by the Defense Department to cost some \$38.1 billion to develop and produce 458 aircraft.

DTIC

*Cost Analysis; Helicopters; Tilt Rotor Aircraft; V-22 Aircraft*

**20080021897** Library of Congress, Washington, DC USA

**C-17 Cargo Aircraft Program**

Bolkcom, Christopher; Mar 20, 2000; 15 pp.; In English

Report No.(s): AD-A477823; CRS-IB93-41; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477823>

The C-17 Globemaster III is a long-range cargo/transport aircraft operated by the U.S. Air Force since 1993. Congress approved development of the aircraft in the late 1970s, when it was recognized that the Air Force did not have enough airlift capability. In 1981, the McDonnell Douglas C-17 emerged as winner of a competition with Boeing and Lockheed to develop a next-generation aircraft to replace C-130s and C-141s. Full-scale development of the C-17 got underway in 1986, but technical problems and funding shortfalls delayed the program, leading to slipped schedules and increased costs. Despite these difficulties, the C-17 has retained congressional support and enjoyed strong Air Force and Army backing. Defense officials view the C-17 as essential in the post-Cold War environment, because of its ability to use smaller bases in remote areas. The C-17 first flew in 1991, about a year later than originally scheduled. Deliveries began in 1993, and in January 1995 the Air Force declared the aircraft fully operational. By January 2000, the Air Force had taken delivery of 57 C-17s, some of which were used in Bosnia and later in Kosovo operations with notable success. Production problems in the late 1980s raised questions about the possibility of more cost-effective alternatives. In April 1990, Defense Secretary Cheney reduced the projected buy from 210 to 120 planes. In late 1993, DOD gave the contractor two years to solve production problems or face termination of the contract, with airlift shortfalls to be filled by modified commercial transport planes or existing military airlifters.

DTIC

*C-17 Aircraft; Cargo; Cargo Aircraft; Transport Aircraft*

**20080021901** Lehigh Univ., Bethlehem, PA USA

**Origin and Control of the Flow Structure on Unmanned Combat Air Vehicle**

Rockwell, Donald; Yaniktepe, B; Yavuz, M M; Goruney, T; Kosoglu, M A; Kim, Y; Liakopoulos, A; Dec 2007; 136 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0072; F49620-02-1-0061

Report No.(s): AD-A477828; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477828>

Flow structure on delta wings having low sweep angle, representative of those used in UCAVs and MAVs, is characterized in detail using; technique of quantitative imaging, high-image-density particle image velocimetry. Cases of stationary wings, wings subjected to control at their trailing-edges, and wings undergoing prescribed pitching maneuvers have been addressed as part of this investigation. The sweep angle of each wing is sufficiently small, such that the patterns of the flow structure exhibit elongated separation layers in the crossflow plane. These patterns can be interpreted in conjunction with patterns of streamline topology in the cross flow plane, as well as patterns of root-mean-square velocity fluctuation and velocity spectra, in order to provide insight into the origin of unsteady loading of the aerodynamic surface. As an adjunct to the series of investigations of flow past delta wings in absence of a tail, the interaction of vortex breakdown with the simulated tail of a wing has been characterized using quantitative imaging and evaluated using a technique of proper orthogonal decomposition (POD). DTIC

*Boundary Layer Separation; Combat; Control Systems Design; Controllers; Decomposition; Delta Wings; Drone Vehicles; Separated Flow; Topology; Vortices*

**20080021909** General Accounting Office, Washington, DC USA

**Joint Strike Fighter. Recent Decisions by DOD Add to Program Risks**

Mar 2008; 59 pp.; In English

Report No.(s): AD-A477840; GAO-08-388; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477840>

The JSF total acquisition cost estimate increased by more than \$23 billion since our March 2007 report due to changes in procurement costs. Principal driving factors were (1) increased unit costs from extending the procurement period seven years at lower annual rates and (2) increased future price estimates based on contractor proposals for the first production lot. The official cost estimate for development remained about the same in total as it has since the program was restructured in 2004. However, this was largely achieved by reducing requirements, not fully program, and spending management reserves much faster than budgeted. Facing a probable contract cost overrun, DOD officials decided not to request additional funding and time for development, opting instead to reduce test resources in order to replenish management reserves from \$400 million to \$1 billion. During the last year, DOD and the contractor also reported progress in several important areas, including international partner agreements, first flights of a JSF prototype and test bed, and a more realistic procurement schedule. The recent decision to replenish management reserves by reducing test resources, known as the Mid-Course Risk Reduction Plan, significantly increases the risks of not completing development testing on time and not finding and fixing design and performance problems until late into operational testing and production, when it is more expensive and disruptive to do so. The plan also does not directly address and correct the continuing production and schedule concerns that depleted management reserves. We expect program development and procurement costs to increase substantially and schedule pressures to worsen based on performance to date and the conditions that gave rise to the risk reduction plan. Two-thirds of budgeted funding for the JSF has been spent on the prime development contract, but only about one-half of the work has been completed. DTIC

*Cost Estimates; Costs; Fighter Aircraft; Flight Tests; Risk*

**20080021913** General Accounting Office, Washington, DC USA

**Joint Strike Fighter: Impact of Recent Decisions on Program Risks**

Sullivan, Michael J; Bonner, Marvin; Clark, Jerry; Fairbairn, Bruce; Keener, J K; Lea, Matt; Mullins, Brian; Novillo, Daniel; Perdue, Charles; Mar 11, 2008; 27 pp.; In English

Report No.(s): AD-A477858; GAO-08-569T; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477858>

The Joint Strike Fighter (JSF) is the Department of Defense's (DoD) most expensive aircraft acquisition program. DoD is expected to develop, procure, and maintain 2,443 aircraft at a cost of more than \$950 billion. DoD plans for the JSF to replace or complement several types of aircraft in the Air Force, Navy, and Marine Corps. Given the program's cost and importance, it is critical that decisions are made within this program to maximize its benefit to the nation. This testimony

highlights a number of those decisions and impacts. The testimony does the following: (1) discusses emerging risks to the overall program, and (2) updates information for GAO's cost analysis of last year regarding sole-source and competitive scenarios for acquisition and sustainment of the JSF engine. Information on the overall program is from GAO's mandated annual report, also issued today. GAO tracked annual cost and schedule changes, reasons for changes, decisions affecting development, and compared DoD cost estimating methodologies to best practices. For the two engines, GAO updated cost data from last year's testimony and made new projections. This testimony does not have recommendations, but GAO's mandated report recommends revisiting the mid-course plan and improving cost estimates. DoD substantially agreed.

DTIC

*Competition; Cost Analysis; Defense Program; Fighter Aircraft; Jet Aircraft; Jet Engines; Procurement; Risk*

**20080021916** Library of Congress, Washington, DC USA

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

Bolkcom, Christopher; Nov 5, 2001; 18 pp.; In English

Report No.(s): AD-A477882; CRS-IB86103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477882>

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies like a plane by tilting its wing-mounted rotors to function as propellers. Combining a helicopter's operational flexibility with the greater speed, range, and efficiency of fixed-wing aircraft, the V-22 can perform such missions as troop/cargo transport, amphibious assault, special operations, and search and rescue operations. Begun in FY1982 by the Army and now funded in part by the Air Force, the V-22 has been primarily a Marine Corps program funded by the Navy Department. The aircraft is produced by Bell Helicopter Textron and Boeing Helicopters, with engines produced by Rolls-Royce/Allison. Flight testing and operational evaluation of pre-production V-22s began in early 1997, with procurement of production aircraft approved in April 1997. The future of the aircraft was at issue in 1989-92, when Secretary of Defense Cheney sought to cancel the program on grounds of affordability. Congress continued to fund the program, however, and through FY2000 some \$10 billion was provided for the program, which as of December 31, 1999, was estimated by the Defense Department to cost some \$38.1 billion to develop and produce 458 aircraft. For FY2000, the Administration requested some \$1,100 million in Navy and Air Force procurement funds and Navy R&D funding for 10 aircraft. Congress authorized and appropriated funding for 12 MV-22s for the U.S. Marine Corps in FY2000. For FY2001, the Administration requested \$1,843 million for the program, including procurement funds for 16 MV-22s and 4 Air Force CV-22s. The Administration's FY2002 defense budget requested \$3,278.3 million for the V-22 program including procurement of 12 MV-22s for the Marine Corps, modification of existing aircraft, and RDT&E.

DTIC

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

**20080021990** Library of Congress, Washington, DC USA

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

Bolkcom, Christopher; Aug 4, 2005; 19 pp.; In English

Report No.(s): AD-A477901; CRS-RL31384; No Copyright; Avail.: Defense Technical Information Center (DTIC)

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



Knight the Marine Corps currently operates. They argue that this combination of attributes will provide the Marine Corps with new and potentially transformational capabilities.

DTIC

*Aircraft Accidents; Flight Tests; Government Procurement; Maintenance; Procurement; Tilt Rotor Aircraft; V-22 Aircraft*

**20080021991** Library of Congress, Washington, DC USA

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

Bolkcom, Christopher; Aug 23, 2006; 19 pp.; In English

Report No.(s): AD-A477902; CRS-RL31384; No Copyright; Avail.: Defense Technical Information Center (DTIC)

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

DTIC

*Aircraft Accidents; Flight Tests; Government Procurement; Maintenance; Procurement; Tilt Rotor Aircraft; V-22 Aircraft*

**20080022047** Maryland Univ., Baltimore, MD USA

### **Critical Care Performance in a Simulated Military Aircraft Cabin Environment**

McNeill, Margaret M; Jan 2007; 269 pp.; In English

Report No.(s): AD-A478058; CI08-0008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the start of Operation Enduring Freedom in 2001, over 42,063 patients have been transported by the USA Air Force aeromedical evacuation system. Critical Care Air Transport Teams (CCATTs) provide care for 5-10% of the injured and ill warriors that are transported on military cargo aircraft to definitive treatment facilities. The purposes of this study were to determine the effect of two stressors of flight, altitude-induced hypoxia and aircraft noise, and to examine the contributions of fatigue and clinical experience on cognitive and physiological performance of CCATT providers. This repeated measures 2 x 2 x 4 factorial study included a sample of 60 military nurses. The participants completed a simulated patient care scenario under aircraft cabin noise and altitude conditions. Cognitive performance was measured with Critical Care Scores, Critical Care Errors and Omissions, and Critical Care Reaction Times during the scenario. Physiological performance was measured four times during the scenario via vital signs and oxygen saturation. Differences in cognitive and physiological performance were analyzed using RM ANOVA. A multiple regression model was developed to determine the independent contribution of fatigue and clinical experience to cognitive and physiological performance as a function of altitude and noise. Critical Care Scores ( $p = .020$ ) and Errors and Omissions ( $p = .047$ ) were negatively impacted by aircraft cabin noise. Noise resulted in increase in respiratory rate ( $p = .019$ ). Critical Care Scores ( $p < .001$ ) and Errors and Omissions ( $p = .002$ ) worsened with altitude. Heart rate ( $p < .001$ ) and respiratory rate ( $p < .001$ ) increased with altitude, and oxygen saturation ( $p < .001$ ) decreased. A regression analysis of Critical Care Reaction Time to First Defibrillation with altitude, noise, fatigue, current critical care experience, and experience accounted for 20% of the variance in reaction time ( $p = .028$ ).

DTIC

*Aircraft Compartments; Aircraft Noise; Cabin Atmospheres; Hypoxia; Patients; Transport Aircraft*

**20080022059** Army Research Development and Engineering Command, Warren, MI USA

**Rapidly Installed Fluid Transfer System (RIFTS)**

Li, Rebecca; Jan 10, 2005; 8 pp.; In English

Report No.(s): AD-A478110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Fossil fuels will continue to be the primary propulsion fuel for military aircraft, vehicles, and ground equipment for the foreseeable future. Water is the critical fuel to sustain the ultimate weapon, our soldiers. Distributing large quantities of bulk fuel and water required on the battlefield in the 21st century will require rapid deployment, installation, and recovery capabilities not inherent in existing petroleum and water distribution equipment. The Rapidly Installed Fluid Transfer System (RIFTS) will be designed to minimize strategic transport assets to deliver it to the theater of operation, will require fewer assets to deploy, will be easily recovered for redeployment. and will have an expected minimum service life of 15-25 years.

DTIC

*Fossil Fuels; Geological Faults; Ground Support Equipment; Water*

**20080022073** Sky Research, Ashland, OR USA

**Demonstration of Airborne Wide Area Assessment Technologies at the Toussaint River, Ohio**

Foley, Jack; Wright, David; Apr 17, 2007; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W912HQ-05-C-0036; Proj-MM-0535

Report No.(s): AD-A478170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The former Erie Army Depot, Ottawa County, Ohio, is located along the western shore of Lake Erie. This site and the associated impact areas are classified by the USA Government as Formerly Used Defense Sites (FUDS) and was formerly used for artillery testing, resulting in impact areas on land and in Lake Erie. This demonstration utilized Helicopter Multi-Towed Array Detection System (MTADS) Magnetometry (HeliMag) technology, a wide area assessment technology, to assist in the characterization of the shore and shallow areas in and around the Toussaint River relative to munitions contamination from historical activities at the Erie Army Depot and Camp Perry. A data collection survey was conducted in September of 2006 and resulted in the survey of 3,389 acres. Targets were selected using manual picking procedures and 1,904 anomalies were selected from the data to assess the distribution of metal objects across the study area.

DTIC

*Ammunition; Artillery; Contamination; Helicopters; Magnetic Measurement; Rivers*

**20080022258** Naval Postgraduate School, Monterey, CA USA

**A Resurvey of Shift Work-Related Fatigue in MQ-1 Predator Unmanned Aircraft System Crewmembers**

Tvaryanas, Anthony P; Platte, William; Swigart, Caleb; Colebank, Jayson; Miller, Nita L; Mar 2008; 51 pp.; In English

Report No.(s): AD-A477976; NPS-OR-08-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A previous study showed shift working crewmembers in a MQ-1 Predator unmanned aircraft system (UAS) squadron had significantly increased fatigue, emotional exhaustion, and burnout relative to traditional aircrew from another 'high-demand, low density' weapon system. This study presents the results of a follow-up survey of this population of UAS crewmembers who were supporting 'reachback' teleoperations using a modified rotational shift work schedule. Specifically, shift work-related increases in fatigue, sleepiness, and risk for performance decrements were examined. Shift system features and individual and situational differences associated with fatigue were also explored. Finally, shift system features of several types of schedules were assessed through modeling and simulation. The study found no significant reduction in reported fatigue despite prior modifications to the shift work schedule. It also demonstrated the potential for inadequate staffing levels to magnify the adverse effects of shift work.

DTIC

*Crews; Pilotless Aircraft; Predators; Remotely Piloted Vehicles*

## 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.

**20080021214** NASA Glenn Research Center, Cleveland, OH, USA

### **Distributed Turboelectric Propulsion for Hybrid Wing Body Aircraft**

Kim, Hyun Dae; Brown, Gerald V.; Felder, James L.; [2008]; 11 pp.; In English; 2008 International Powered Lift Conference Royal Aeronautical Society, 22-24 Jul. 2008, London, UK; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.13.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021214>

Meeting future goals for aircraft and air traffic system performance will require new airframes with more highly integrated propulsion. Previous studies have evaluated hybrid wing body (HWB) configurations with various numbers of engines and with increasing degrees of propulsion-airframe integration. A recently published configuration with 12 small engines partially embedded in a HWB aircraft, reviewed herein, serves as the airframe baseline for the new concept aircraft that is the subject of this paper. To achieve high cruise efficiency, a high lift-to-drag ratio HWB was adopted as the baseline airframe along with boundary layer ingestion inlets and distributed thrust nozzles to fill in the wakes generated by the vehicle. The distributed powered-lift propulsion concept for the baseline vehicle used a simple, high-lift-capable internally blown flap or jet flap system with a number of small high bypass ratio turbofan engines in the airframe. In that concept, the engine flow path from the inlet to the nozzle is direct and does not involve complicated internal ducts through the airframe to redistribute the engine flow. In addition, partially embedded engines, distributed along the upper surface of the HWB airframe, provide noise reduction through airframe shielding and promote jet flow mixing with the ambient airflow. To improve performance and to reduce noise and environmental impact even further, a drastic change in the propulsion system is proposed in this paper. The new concept adopts the previous baseline cruise-efficient short take-off and landing (CESTOL) airframe but employs a number of superconducting motors to drive the distributed fans rather than using many small conventional engines. The power to drive these electric fans is generated by two remotely located gas-turbine-driven superconducting generators. This arrangement allows many small partially embedded fans while retaining the superior efficiency of large core engines, which are physically separated but connected through electric power lines to the fans. This paper presents a brief description of the earlier CESTOL vehicle concept and the newly proposed electrically driven fan concept vehicle, using the previous CESTOL vehicle as a baseline.

Author

*Electric Propulsion; Aerodynamic Configurations; Engine Airframe Integration; Turbogenerators; Powered Lift Aircraft; Lift Drag Ratio; Ingestion (Engines); Engine Design*

**20080022161** United Technologies Corp., East Hartford, CT, USA

### **Divergent Flap for a Gas Turbine Engine**

Arbona, J. A., Inventor; 20 May 04; 11 pp.; In English

Patent Info.: Filed Filed 20 May 04; US-Patent-Appl-SN-10-850-252

Report No.(s): PB2007-109174; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A divergent flap assembly of a gas turbine engine includes a hotsheet, a backbone structure for supporting the hotsheet, and a plow portion secured to the backbone structure to bridge a gap between the hotsheet and an external flap. The plow portion is fabricated from CMC material and has external geometry to complement and substantially continue geometry of the external flap to minimize plane detection. The plow portion is attached to the backbone structure such that when the backbone structure thermally expands, the plow portion is shifted to minimize an offset between a trailing edge of the hotsheet and the plow portion. The plow portion is fastened to the backbone structure by a plurality of fasteners, which are arranged to minimize thermal stresses.

NTIS

*Flapping; Gas Turbine Engines; Patent Applications; Thermal Stresses*



**20080022238** General Electric Co., Cincinnati, OH, USA

**Turbine Engine Shroud Segment, Hanger and Assembly**

Alford, M. E., Inventor; Bulman, D. E., Inventor; 8 Jun 04; 11 pp.; In English

Contract(s)/Grant(s): AF-F33615-97-C-2778

Patent Info.: Filed 8 Jun 04; US-Patent-Appl-SN-10-863-434

Report No.(s): PB2007-109277; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A turbine engine shroud segment comprises a body including an outer surface from and along which a segment projection extends away from and in an axial direction. The segment projection includes circumferentially spaced apart segment support surfaces. A shroud hanger comprises a body including an inner surface from and along which a hanger projection extends in an axial direction. The hanger projection includes circumferentially spaced hanger bearing surfaces. In a circumferential turbine engine shroud assembly of shroud segments and hangers, a shroud hanger is assembled between a pair of adjacent shroud segments separated by an axial interface. The hanger projection is in juxtaposition with the interface, and respective segment support surfaces and hanger bearing surfaces are in registry.

NTIS

*Patent Applications; Shrouds; Turbine Engines*

**20080022271** Bachman and Lapointe, P.C., New Haven, CT, USA

**Nozzle (PAT-APPL-10 843 908)**

Chen, A. G., Inventor; Cohen, J. M., Inventor; 11 May 04; 6 pp.; In English

Contract(s)/Grant(s): DEFC02-00CH11060

Patent Info.: Filed 11 May 04; US-Patent-Appl-SN-10-843-908

Report No.(s): PB2007-109081; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A fuel injector has a number of groups of nozzles. The groups are generally concentric with an injector axis. Each nozzle defines a gas flowpath having an outlet for discharging a fuel/air mixture jet. There are means for introducing the fuel to the air. One or more groups of the nozzles are oriented to direct the associated jets skew to the injector axis.

NTIS

*Fuel Injection; Gas Turbine Engines; Patent Applications; Nozzles*

## 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*.

**20080021514** Air Univ., Maxwell AFB, AL USA

**CADRE Quick-Look: The Next Phase: Air and Space Power in Current Operations**

Cain, Anthony C; Jan 2004; 3 pp.; In English

Report No.(s): AD-A477433; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Air and Space Power doctrine, command and control structures, and operating concepts are optimized for combat and are not designed for post-conflict operations. Additionally, Air Operation Center (AOC) planning processes are geared toward providing destructive effects that support joint campaign objectives. As objectives shift from attacking enemy forces toward restoring order and bolstering social, economic, and cultural stability, airmen do not have a way to articulate their continued relevance to the joint campaign. This issue of CADRE Quick-Look discusses the need for ways to measure the effectiveness of air and space power in post-conflict operations. The Berlin Airlift is an example of a post-conflict operation whose effectiveness was measured. Possible courses of action are as follows: (1) Organize AOCs to maximize efficiency and effectiveness for post-combat operations by merging Combat Operations and Mobility segments to achieve seamless operability for effects-based planning; (2) Map the effects that describe how air and space power can contribute to achieving strategic, operational, and tactical objectives in post-combat operations to a set of air and space power capabilities; (3) Develop a menu of measurements linked to potential effects that focus collection and assessment efforts for all phases of air and space

power operations; and (4) Codify EBO for constructive as well as destructive operations in doctrine to emphasize the potential rather than the limits of air and space power in post-combat operations.

DTIC

*Aerospace Engineering; Armed Forces (United States); Military Personnel; Warfare*

**20080022032** Aerospace Corp., El Segundo, CA USA

**HEO Satellite Surface and Frame Charging and SCATHA Low-Level Frame Charging**

Fennell, Joseph F; Roeder, James L; Nov 15, 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A477996; AERO-TR-2007(8570)-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this report, we show the results of spacecraft frame and differential potentials that have been measured over several years on a highly elliptical orbit, HEO2, satellite. The measurements are of charging levels  $\leq -30$  V, and are summarized according to their occurrence in MLT and L. The data show that the HEO2 satellite frame charged to potentials  $\leq -30$  V, and that the occurrence of satellite frame charging at these high latitudes mimics the charging local time patterns observed by geosynchronous satellites. In addition, the data show that such charging extends from at least a minimum L  $\leq 4 R_e$  to L  $> 10 R_e$ . About 930 extended frame-charging intervals were observed during the late 1995 through mid-2002 interval. For each charging interval that occurred, the maximum frame voltage and the minimum and maximum L values during charging were obtained. Signatures of differential charging were also observed and are given as a function of L, local time, and charging levels. It was found that the differential charging potential usually exceeded the frame potential and could be estimated by  $V(\text{sub D}) \sim 74 + 1.384 V(\text{sub F})$ .

DTIC

*Artificial Satellites; SCATHA Satellite; Spacecraft Charging*

## 14

### GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

**20080022248** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Mars Reconnaissance Orbiter, Ground Data System, Receivables and Deliverables (REC/DELS)**

Carlton, Magdi; June 19, 2006; 9 pp.; In English; SpaceOps, Earth, Moon, Mars and Beyond, 19-23 Jun. 2006, Rome, Italy;

Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40785>

This paper presents one JPL element manager's approach to describe a complex Ground Data System (GDS) with its receivables and deliverables (REC/DEL). The Mars Reconnaissance Orbiter (MRO) Ground Data System is the integrated set of ground software, hardware, facilities and networks that support mission operation. REC/DEL is a powerful tool for specifying hierarchy of commitments among systems and teams. Receivable of a system is a deliverable of another system. Focusing on tangible products enables the manager to objectively measure progress in a schedule. The Jet Propulsion Laboratory mandates the use of REC/DEL for flight projects. Tutorial and training is provided for managers to create an integrated REC/DEL database using automated systems. Project schedules are based on REC/DELS. This paper is not focusing on the mechanics of REC/DEL database creation, but it provides a guideline how one systematically creates categories of deliverables and receivables for ground data system components...

Author

*Mars Reconnaissance Orbiter; Data Processing Equipment; Automatic Control; Data Acquisition; Data Systems; Data Bases; Complex Systems*

## 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*.

**20080021513** Air Univ., Maxwell AFB, AL USA

### **CADRE Quick-Look: Low-Cost Access to Space -- Is It Possible?**

Brown, Kendall; Jan 2004; 3 pp.; In English

Report No.(s): AD-A477432; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The high cost of launching payloads into space has limited the USA military's ability to exploit the potential of space in support of national objectives. Today, the average cost to put a payload in low earth orbit ranges from \$4,400 to \$10,000 per pound. Based upon the commercial market elasticity for new and emerging systems, the launch cost needs to decrease by 50 to 75 percent to create significantly increased launch vehicle demand. However, is it even possible to dramatically lower the cost? Currently, the cost of conducting a prototype launch vehicle test program from a government launch range can be equal to or greater than the cost of the test vehicle itself. The following specific recommendations are made: (1) the U.S. Government should absorb and fund the sustainment and operations costs for national launch ranges and charge users only for the direct costs associated with the test; (2) government ranges must stop dictating how a vehicle is designed and what analysis and testing is performed. Instead the government's focus should be on protecting public safety and range assets. Therefore, the government should fund the development of a modern, simple, low-cost range safety destruct package to destruct the vehicle at any flight path deviation. Using this approach, the government cannot become reliant upon or invested into any particular launch vehicle service provider. If a company has a technical, quality, management, or any other type of problem, the government cannot step in to help; it must allow the free market system to work. Otherwise, the changes and improvements implemented to satisfy the government that the service is reliable will cause the costs to increase.

DTIC

*Cost Reduction; Launch Vehicles; Launching; Low Cost; United States*

**20080021549** Air Univ., Maxwell AFB, AL USA

### **Operational Assessment of Space: Toward Efficiency and Effectiveness**

Lindsay, Nathan J; Jun 2005; 92 pp.; In English

Report No.(s): AD-A477083; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477083>

Assessing effects is one of the biggest challenges the Air Force faces today. The Air Force has struggled with assessing air operations since they began dropping bombs, and the problem persists today. As problematic as the assessment of combat effects might be for air operations, the assessment of effects from space operations is even more difficult. This thesis uses a theoretical framework to better understand the problem and provide a framework for how the Air Force should address the issue of assessing space operations. By examining experiences from the use of airpower, specifically strategic bombing and close air support (CAS), the thesis will evaluate those lessons in terms fundamental to the issues of assessment. The answers gleaned from this analysis will help inform the Air Force on better methods for assessing space operations in the future. Operational assessment is the process of relating tactical tasks to operational effects. In the military, tactical tasks are developed with the 'theory' that they will enable victory on the battlefield. The scientific method used in this thesis can serve the assessment community well by strengthening theories relating cause and effect and aid in the commander's judgment. This is the very purpose of operational assessment. The Air Force has historically focused on tactical assessments because it is inherently difficult to assess at the operational level. Operational level space effects are indirect, non-kinetic, indistinguishable from other effects, and often take time to recognize. The theater commander needs both tactical assessments to know that he is doing things right, and operational assessments to know if he is doing the right things. He will probably know if he is not succeeding and want to know why. But what if he is succeeding?

DTIC

*Space Missions; Space Weapons; System Effectiveness; Warfare*

**20080021554** Air Univ., Maxwell AFB, AL USA

### **The Best Defense: Charting the Future of US Space Strategy and Policy**

Coffelt, Christopher A; Jun 2005; 112 pp.; In English

Report No.(s): AD-A477110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477110>

The USA is at a cross-roads with respect to space. The challenge that now presents itself is how to craft a strategy that

maintains the USA' asymmetric advantage in space while moving from the current age of uncontested access to one where access must be assured by deliberate actions. All military strategies are key to the overall grand strategy of the state, but the U.S. military strategy for space holds a special degree of influence upon the overall success of U.S. grand strategy. What type of strategy would best achieve U.S. security objectives? Should the USA adopt a largely defensive strategy to protect its interests and preserve its advantages, or does the adage 'the best defense is a strong offense' hold true for space? This thesis seeks to inform modern-day space strategy decisions through an examination of three historical case studies in which U.S. strategists and decision makers faced similar high stakes national security decisions with uncertain outcomes: the hydrogen bomb, MIRV missiles, and Star Wars. Analyses of these decision making processes and the resulting consequences give insight into these important questions and may inform us on the potential road ahead for space. These cases reveal how military superiority strategies; faith in, and reliance upon technology to solve complex national security problems; and a strong preference for offensive solutions to secure U.S. national security can produce the opposite of their intended effects. The potential exists for the USA to adopt a military strategy for space -- and acquire weapons to support its fulfillment -- that undermines U.S. grand strategy and delivers less security. The author concludes that given the current context, the nation is better off pushing the status quo in space without perturbing strategic stability, which will help retain the political, military, and economic advantages it has worked so hard to achieve.

DTIC

*Charts; Decision Making; Military Operations; Policies; Space Weapons; Strategy; United States; Warfare*

**20080021877** Naval Postgraduate School, Monterey, CA USA

**Design and Integration of a Three Degrees-of-Freedom Robotic Vehicle with Control Moment Gyro for the Autonomous Multi-Agent Physically Interacting Spacecraft (AMPHIS) Testbed**

Hall, Jason S; Sep 2006; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477754; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477754>

The use of fractionated spacecraft systems in on-orbit spacecraft assembly has the potential to provide benefits to both the defense and civil space community. To this end, much research must be conducted to develop and prove the requisite technologies to achieve these benefits. This thesis contributes to that effort by presenting the design and system integration, operating procedures and software development for a prototype three Degrees-Of-Freedom (DOF) Spacecraft Simulator. This simulator will be used in the Proximity Operations Simulator Facility, as part of the Naval Postgraduate School's Spacecraft Robotics Laboratory, to simulate autonomous guidance, navigation and control (GNC) for spacecraft proximity operations and assembly within the framework of the Autonomous Multi-Agent Physically Interacting Spacecraft project. The new spacecraft simulator includes several key enhancements over the previous Autonomous Docking and Spacecraft Servicing Simulator (AUDASS) developed in 2005 including a smaller and more agile structure, reduced air consumption and a Miniature Single-Gimbaled Control-Moment-Gyroscope (MSGCMG) to provide the necessary torque about the rotation axis. The MSGCMG in the simulator is a low-cost, low-mass easily controlled momentum exchange device with a high torque to required power ratio. Furthermore, it provides the vehicle with high slew-rate capability, a key measure of performance in on-orbit spacecraft assembly. Simulation and experimental results are presented for the prototype AMPHIS vehicle, demonstrating a potential slew-rate of 4.8 deg/s for a 30 degree rest-to-rest maneuver. The ultimate goal of this thesis is to provide the design specifications combined with the necessary documentation and software development, for the prototype vehicle of the testbed for the AMPHIS project.

DTIC

*Autonomy; Control Moment Gyroscopes; Degrees of Freedom; Docking; Robotics; Simulators*

**20080022025** Library of Congress, Washington, DC USA

**Antisatellites (Killer Satellites)**

Smith, Marcia S; Mar 21, 1983; 23 pp.; In English

Report No.(s): AD-A477965; CRS-IB81123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

According to the U.S. Department of Defense, the Soviet Union has an operational capability to destroy satellites in near Earth orbit by using a type of antisatellite (ASAT) termed a 'killer satellite.' The USA had an operational ASAT system using ground-based missiles, but it was deactivated in 1975; a new ASAT device using miniature homing vehicles launched from F-15 aircraft is now being developed. Both the USA and the Soviet Union are performing research on laser and particle beam weapons which may ultimately have ASAT applications. During 1978 and 1979, the USA and Soviet Union held ASAT limitation talks, but no further talks have been scheduled. In the fall of 1981, the Soviets introduced a draft treaty at the United Nations to ban weapons from space, although it apparently would not include the ground- or air-based systems now in use

of development. The Soviets continue to test their ASAT system, and President Reagan has reaffirmed the U.S. commitment to developing an operational ASAT system. Should the USA develop an operational ASAT capability, or should the focus instead be on renewing the stalled ASAT limitation talks, or should there be some combination of the two approaches? If the USA pursues an ASAT system, is the current effort related to air-launched missiles sufficient, or should a ground-based option be pursued? Should research into laser and particle beam weapons be accelerated? In the absence of an ASAT limitation treaty, should the USA place more emphasis on means to ensure the survivability of critical military satellites and their associated ground stations and data links?

DTIC

*Artificial Satellites; Military Spacecraft*

**20080022114** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Road to Launch and Operations of the Spitzer Space Telescope**

Wilson, Robert K.; June 16, 2006; 16 pp.; In English; AIAA 9th International Conference on Space Operations (SpaceOps), 19-24 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources  
ONLINE: <http://hdl.handle.net/2014/40801>

This paper describes how the project was able to overcome these stumbling blocks along with changes in philosophies, experiences, and lessons learned. It will describe how projects must invest early or else heavily later in the development phase to achieve a successful operations phase. The result for the Spitzer Space Telescope was a successful launch of the observatory followed by an extremely successful In Orbit Checkout/Science Verification phase and a subsequent successful operational phase.

Author

*Space Infrared Telescope Facility; Spacecraft Launching; Lessons Learned*

17

**SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING**

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

**20080021209** NASA Glenn Research Center, Cleveland, OH, USA

**High Power and Efficiency Space Traveling-Wave Tube Amplifiers With Reduced Size and Mass for NASA Missions**

Simons, Rainee N.; Wilson, Jeffrey D.; Force, Dale A.; June 15, 2008; 10 pp.; In English; 2008 International Microwave Symposium, 15-20 Jun. 2008, Atlanta, GA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 342556.06.01.10.01.02

Report No.(s): NASA/TM-2008-215220; E-16507; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021209>

Recent advances in high power and efficiency space traveling-wave tube amplifiers (TWTAs) for NASA's space-to-Earth communications are presented in this paper. The RF power and efficiency of a new K-Band amplifier are 40 W and 50 percent and that of a new Ka-Band amplifier are 200 W and 60 percent. An important figure-of-merit, which is defined as the ratio of the RF power output to the mass (W/kg) of a TWT has improved by a factor of ten over the previous generation Ka-Band devices.

Author

*Power Efficiency; Extremely High Frequencies; Traveling Wave Amplifiers; NASA Programs; Microwave Amplifiers*

**20080022163** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; Johns Hopkins Univ., Laurel, MD, USA

**Spacecraft Data and Relay Management using Delay Tolerant Networking**

Torgerson, J. Leigh; Schoolcraft, Joshua B.; Pang, Jackson N.; Segui, John S.; Jennings, Esther H.; Krupiarz, Christopher J.; June 19, 2006; 11 pp.; In English; 9th International Conference on Space Operations (SpaceOps), 19-24 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40805>

NASA's demonstration of the successful transmission of relay data through the orbiting Mars Odyssey, Mars Global Surveyor, and Mars Express by the Mars Exploration Rovers has shown not only the benefit of using a relay satellite for multiple landed assets in a deep space environment but also the benefit of international standards for such architecture. As NASA begins the quest defined in the Vision for Exploration with robotic and manned missions to the Moon, continues its



study of Mars, and is joined in these endeavors by countries world-wide, landed assets transmitting data through relay satellites will be crucial for completing mission objectives. However, this method of delivery of data will result in increased complexity in routing and prioritization of data transmission as the number of missions increases. Also, there is currently no standard method among organizations conducting such missions to return these data sets to Earth given a complex environment. One possibility for establishing such a standard is for mission designers to deploy protocols which fall under the umbrella of Delay Tolerant Networking (DTN). These developing standards include the Bundle Protocol (BP) which provides a standard, secure, store and forward mechanism designed for high latency and asymmetric communication links and the Licklider Transmission Protocol (LTP) which is used to provide a reliable deep space link transmission service.

Author

*Communication Networks; Data Links; Data Transmission; Relay Satellites; Aerospace Environments; Manned Space Flight; Mars Exploration; Asymmetry*

**20080022201** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**On-Orbit Maneuver Calibrations for the Stardust Spacecraft**

Nandi, Sumita; Kennedy, Brian; Williams, Kenneth E.; Byrnes, Dennis V.; August 21, 2006; 5 pp.; In English; AIAA/AAS Astrodynamics Specialist Conference and Exhibit, 21-24 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40778>

The Stardust spacecraft, launched February 7, 1999, successfully delivered its sample return capsule to the Utah Test and Training Range on January 15, 2006. The entry maneuver strategy included a trajectory correction at entry minus 10 days (TCM18) targeted to entry with the inclusion of a final biased fixed direction maneuver at entry minus 29 hours (TCM19). To meet the stringent entry targeting requirements necessary for human safety and capsule integrity, a campaign of maneuver calibrations were undertaken in summers of 2003 and 2005 to improve performance for both maneuvers. The results of the calibration program are reported here. The in-flight calibrations included a series of several turns to various final attitudes via deadband walks about each of the three spacecraft axes, as well as 12 in-place burns with magnitudes between 0.5 and 1.0 m/s, the range initially expected for TCM19. The turn and burn calibrations as well as the performance of TCM 17, 18 and 19 are discussed.

Author

*Sample Return Missions; Stardust Mission; Calibrating*

**20080022245** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Mystic: Implementation of the Static Dynamic Optimal Control Algorithm for High-Fidelity, Low-Thrust Trajectory Design**

Whiffen, Gregory J.; August 21, 2006; 12 pp.; In English; AIAA/AAS Astrodynamics Specialists Conference, 21-24 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40782>

Mystic software is designed to compute, analyze, and visualize optimal high-fidelity, low-thrust trajectories. The software can be used to analyze inter-planetary, planetocentric, and combination trajectories. Mystic also provides utilities to assist in the operation and navigation of low-thrust spacecraft. Mystic will be used to design and navigate the NASA's Dawn Discovery mission to orbit the two largest asteroids. The underlying optimization algorithm used in the Mystic software is called Static/Dynamic Optimal Control (SDC). SDC is a nonlinear optimal control method designed to optimize both 'static variables' (parameters) and dynamic variables (functions of time) simultaneously. SDC is a general nonlinear optimal control algorithm based on Bellman's principal.

Author

*Trajectories; Optimal Control; Dynamic Control; Algorithms; Time Functions; Navigation*

**20080022250** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Considerations for Isochronous Data Services for the Proximity-1 Space Link**

Gao, Jay L.; June 22, 2006; 13 pp.; In English; SpaceOps, Earth, Moon, Mars and Beyond, Rome, 19-23 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40787>

Isochronous means 'having equal time difference'. The term Isochronous describes a system where the time difference between arrival and departure of data is constant. However, one can also consider degrees of 'isochronicity' by measuring the

consistency in the latency of a system. Deterministic systems (such as TDMA) has higher degree of isochronous property because resource assignments are static. For system that dynamically shares resources, variations in latency can still be controlled. Proximity-1 is not a deterministic protocol in the sense that it does not designate specific time slots to the transmissions of data and control messages. However, is it still sufficiently isochronous for carrying real-time traffic?

Derived from text

*Time Division Multiple Access; Real Time Operation; Time Response; Consistency; Protocol (Computers)*

**20080022252** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Technology Developments Integrating a Space Network Communications Testbed**

Kwong, Winston; Jennings, Esther; Clare, Loren; Leang, Dee; June 22, 2006; 16 pp.; In English; 9th International Conference on Space Operations (SpaceOps), 19-24 Jun. 2006, Rome, Italy; Original contains color illustrations; Copyright; Avail.:

Other Sources

ONLINE: <http://hdl.handle.net/2014/40789>

As future manned and robotic space explorations missions involve more complex systems, it is essential to verify, validate, and optimize such systems through simulation and emulation in a low cost testbed environment. The goal of such a testbed is to perform detailed testing of advanced space and ground communications networks, technologies, and client applications that are essential for future space exploration missions. We describe the development of new technologies enhancing our Multi-mission Advanced Communications Hybrid Environment for Test and Evaluation (MACHETE) that enable its integration in a distributed space communications testbed. MACHETE combines orbital modeling, link analysis, and protocol and service modeling to quantify system performance based on comprehensive considerations of different aspects of space missions. It can simulate entire networks and can interface with external (testbed) systems. The key technology developments enabling the integration of MACHETE into a distributed testbed are the Monitor and Control module and the QualNet IP Network Emulator module. Specifically, the Monitor and Control module establishes a standard interface mechanism to centralize the management of each testbed component. The QualNet IP Network Emulator module allows externally generated network traffic to be passed through MACHETE to experience simulated network behaviors such as propagation delay, data loss, orbital effects and other communications characteristics, including entire network behaviors. We report a successful integration of MACHETE with a space communication testbed modeling a lunar exploration scenario. This document is the viewgraph slides of the presentation.

Author

*Communication Networks; Manned Space Flight; Lunar Communication; Spacecraft Communication*

## 18

### SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance*; *39 Structural Mechanics*; and *16 Space Transportation and Safety*.

**20080021600** Orbital Sciences Corp., Dulles, VA, USA

**OrbView-3 Spatial Characterization**

Kohm, Kevin; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 17 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: **A03**, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation provides information on the spatial characterization of OrbView-3 (OV-3). Specifically, it assesses OrbView-3 spatial performance through on-orbit measurement and identifies the on-orbit technique for robust modulation transfer function (MTF) measurement. The OV-3 orbit and sensor characteristics, focal plane and focus optimization are highlighted. MTF measurement is also detailed including slant-edge technique, error estimation, precision and bias adjustment and least squares combination of results. Future work in OV-3 spatial characterization will confirm system performance by periodic measurement, as well as measure at discrete locations across a full array. Findings conclude that OV-3 MTF is characterized by an average of along/scan and cross/scan Nyquist MTF at 0.10 +/- 0.01 (1sigma) without sharpening and 0.15 +/- 0.01 (1sigma) with sharpening.

Derived from text

*Satellites; Satellite Imagery; Spatial Resolution; Characterization*



**20080021601** Space Imaging EOSAT, Thornton, CO, USA

**IKONOS 2004 Calibration and Validation Status**

Dial, Gene; Taylor, Martin; Peterson, Brad; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 28 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation provides the accuracy calibration and validation status for IKONOS 2004, focusing on image quality, radiometry, geometric accuracy, satellite lifetime and collection capacity.

Derived from text

*Satellites; Satellite Imagery; Image Analysis; Calibrating; Proving; Quality Control*

**20080021622** Global Imaging, Inc., Solana Beach, CA, USA

**OrbView-3 Geometric Calibration and Geopositional Accuracy**

Mulawa, David; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 19 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation focuses on the geometric calibration and geopositional accuracy of the OrbView-3 (OV-3) high-resolution imaging satellite. OV-3 specifications and the accuracy evaluation process are described.

Derived from text

*Satellites; Positioning; Accuracy; Calibrating*

**20080022164** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Interoperable Solution for Test Execution in Various I&T Environments**

Lee, Young H.; Bareh, Magdy S.; June 19, 2006; 8 pp.; In English; AIAA 9th International Conference on Space Operations (SpaceOps), 19-24 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.:

Other Sources

ONLINE: <http://hdl.handle.net/2014/40806>

When there is spacecraft collaboration between several industry partners, there is an inherent difference in integration and test (I&T) methodologies, which creates a challenge for verifying flight systems during the development phase. To converge the differing I&T methodologies, considerations were required for multiple project areas such as Flight System Testbed (FST), Assembly, Test, and Launch Operations (ATLO), and Spacecraft Simulator environments. This paper details the challenges and approaches of the JPL's effort in engineering a solution to testing the flight system with the Mission Operations Ground System while maintaining the comparability with testing methods of the industry partners.

Author

*Spacecraft Environments; Spacecraft Launching*

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*.

**20080021314** NASA Langley Research Center, Hampton, VA, USA

**SansEC: A New Dimension to Sensing Electrical Sensors with No Electrical Connections**

[2008]; 2 pp.; In English; Sound, Color; 10:30 min.

Contract(s)/Grant(s): NAS1-02051

Report No.(s): t5034\_hpnc; No Copyright; Avail.: CASI: [C01](#), DVD

This DVD contains an introduction to SansEC, a new electrical sensor technology without electrical connections. This new class of sensors represents a stand-alone 2-dimensional geometric pattern of electrically open circuits without electrical connections. The sensor is powered with an external, harmonic magnetic field and as the property being sensed changes, responds to frequency, amplitude or bandwidth changes. This response is interrogated using an external antenna, a single electrical component having no electrical connections. The sensor can be encased in any nonconductive material to provide protection from its environment. If the container is nonconductive, the sensor can be placed external to the container without

contacting it, making installation very simple. An encased sensor can also be placed inside a container for measuring the level of any fluid or material, including acids. Any readout device can be used with the sensor, including standard or digital gauges. SansEC sensors can be used to measure real-time fluid slosh to determine if a fuel tank's internal structural isogrid can be used to replace some of the baffles surface, thus reducing the overall baffle weight and giving a better understanding of the effect that isogrids have on fluid motion. Any SansEC sensor can also be used for damage or tamper detection. When damaged, torn or tampered with, the measured response shift in frequency is commensurate to the detected damage, with the response frequency increasing with rising damage. The unique sensor design allows it to function even if damaged, because unlike other circuits, there is no single point on the sensor that, if damaged, renders it non-functional. The broad metallic coverage of the array allows the array to be one of many thermal insulation layers. Two such arrays were tested to understand the effects of high velocity damage. Each test article was targeted with metal projectiles emulating micrometeorite or orbital debris impact. Even with the damage that the sensors received every sensor was still functional with the new response baseline, and remained capable of detecting even more damage.

CASI

*Sensors; Circuits; Electric Conductors; Open Circuit Voltage; Magnetic Fields; Technology Assessment; Tolerances (Mechanics); Data Transmission; Wireless Communication; Circuit Reliability*

## 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.*

**20080021546** Air Force Research Lab., Wright-Patterson AFB, OH USA

#### **Reusable Military Launch Systems (RMLS)**

Moster, Gregory E; Feb 2008; 107 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-A03N

Report No.(s): AD-A477059; AFRL-RB-WP-TM-2008-3052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477059>

The Air Force Research Laboratory (AFRL) has developed a design environment (IPAT) and approaches to assess the performance and operational capabilities of reusable launch systems in collaboration with the NASA and industry. This approach uses the AML design environment with parametric geometry modeling. This approach has been used successfully and resulted in the Rocket Boost-Back concept under development by AFRL and SMC under the FAST ground experiment program. The RMLS program has also developed the ability to create discrete-event models and perform operational assessment which includes resource management.

DTIC

*Booster Rocket Engines; Launching*

## 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.*

**20080021302** National Inst. of Aerospace, Hampton, VA, USA; NASA Langley Research Center, Hampton, VA, USA; National Inst. of Aerospace, Hampton, VA, USA; National Inst. of Aerospace, Hampton, VA, USA

#### **Effect of LEO Exposure on Aromatic Polymers Containing Phenylphosphine Oxide Groups**

Lillehei, P. T.; Smith, J. G., Jr.; Connell, J. W.; May 20, 2008; 8 pp.; In English; Ninth International Space Conference on Protection of Materials and Structures from the Space Environment, 20-23 May 2008, Toronto, Ont., Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.15.03; Copyright; Avail.: CASI: **A02**, Hardcopy

As part of the Materials on The International Space Station Experiment (MISSE), aromatic polymers containing phenylphosphine oxide groups were exposed to low Earth orbit for approx.4 years. All of the aromatic polymers containing

phenylphosphine oxide groups survived the exposure despite the high fluence of atomic oxygen that completely eroded other polymer films such as Kapton(TradeMark) and Mylar(Trademark) of comparable or greater thickness. The samples were characterized for changes in physical properties, thermal/optical properties surface chemistry, and surface topography. The data from the polymer samples on MISSE were compared to samples from the same batch of material stored under ambient conditions on Earth. In addition, comparisons were made between the MISSE samples and those subjected to shorter term space flight exposures. The results of these analyses will be presented.

Author

*International Space Station; Kapton (Trademark); Mylar (Trademark); Low Earth Orbits; Exposure; Chemical Reactions; Optical Properties*

**20080021740** VanDeuren (Reinhart Boerner) S.C., Milwaukee, WI, USA

**Branched Peptide Amphiphiles, Related Epitope Compounds and Self Assembled Structures Thereof**

Stupp, S. I., Inventor; Guler, M. O., Inventor; 6 Dec. 04; 14 pp.; In English

Contract(s)/Grant(s): DE-FG02-00ER54810

Patent Info.: Filed Filed 6 Dec. 04; US-Patent-Appl-SN-11-005-314

Report No.(s): PB2007-111078; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Branched peptide amphiphilic compounds incorporating one or residues providing a pendant amino group for coupling one or more epitope sequences thereto, such compounds and related compositions for enhanced epitope presentation.

NTIS

*Patent Applications; Peptides; Sequencing*

**20080021741** Army Soldier and Biological Chemical Command, Natick, MA, USA

**Assembled Hematin, Method for Forming Same and Method for Polymerizing Aromatic Monomers Using Same**

Bruno, F., Inventor; Samuelson, L. A., Inventor; Nagarajan, R., Inventor; Kumar, J., Inventor; Sennett, M., Inventor; 21 Apr. 05; 21 pp.; In English

Patent Info.: Filed Filed 21 Apr. 05; US-Patent-Appl-SN-11-111-566

Report No.(s): PB2007-111072; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An assembled hematin is formed by depositing hematin on an electrically charged substrate in one or more layers alternating with one or more layers of polyelectrolyte, preferably a cationic polymer. In a method for polymerizing an aromatic monomer, the assembled hematin is contacted with the monomer and a template, preferably an anionic polymer. In a method for polymerizing aniline, the aniline, sulfonated multi walled carbon nano tubes, PEG hematin and a reaction initiator are dispersed in water.

NTIS

*Monomers; Patent Applications; Polymerization*

**20080021742** Army Soldier and Biological Chemical Command, Natick, MA, USA

**Assembled Hematin, Method for Forming Same and Method for Polymerizing Aromatic Monomers Using Same**

Bruno, F., Inventor; Samuelson, L. A., Inventor; Nagarajan, R., Inventor; Kumar, J., Inventor; Sennett, M., Inventor; 21 Apr. 05; 21 pp.; In English

Patent Info.: Filed Filed 21 Apr. 05; US-Patent-Appl-SN-11-111-567

Report No.(s): PB2007-111071; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An assembled hematin is formed by depositing hematin on an electrically charged substrate in one or more layers alternating with one or more layers of polyelectrolyte, preferably a cationic polymer. In a method for polymerizing an aromatic monomer, the assembled hematin is contacted with the monomer and a template, preferably an anionic polymer. In a method for polymerizing aniline, the aniline, sulfonated multi walled carbon nano tubes, PEG hematin and a reaction initiator are dispersed in water.

NTIS

*Monomers; Patent Applications; Polymerization*

**20080021762** Media and Process Technology, Inc., Pittsburgh, PA USA

**Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor. Semi-Annual Technical Progress Report Reporting Period: October 1, 2006 to March 31, 2007**

Liu, P. K. T.; Jun. 20, 2007; 13 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT41852

Report No.(s): DE2007-909179; No Copyright; Avail.: Department of Energy Information Bridge

The commercial stainless steel (SS) porous substrate (i.e., ZrO<sub>2</sub>/SS from Pall Corp.) was evaluated comprehensively as substrate for the deposition of the CMS membrane for hydrogen separation. The CMS membrane synthesis protocol we developed originally for the ceramic substrate was adapted here for the stainless steel substrate. Unfortunately no successful hydrogen selective membranes had been prepared during Yr I of this project. The characterization results indicated two major sources of defect present in the stainless steel substrate, which may contribute to the poor CMS membrane quality. They include (i) leaking from the crimp boundary of the stainless steel substrate, and (ii) the delamination of the ZrO<sub>2</sub> layer deposited on the stainless steel substrate during CMS membrane preparation. Recently a new batch of the stainless steel substrate (as the 2nd generation product) was received from the supplier. Our characterization results confirm that leaking of the crimp boundary no longer exists. The thermal stability of the ZrO<sub>2</sub>/stainless steel substrate under the CMS membrane preparation condition will be evaluated during the remaining period of the project. Our goal here is to determine the suitability of the 2nd generation ZrO<sub>2</sub>/SS as substrate for the preparation of the CMS membrane for hydrogen separation by the end of this project period.

NTIS

*Hydrogen Production; Membranes*

**20080021792** Pratt and Whitney Aircraft, East Hartford, CT, USA

**Ti 6-2-4-2 Sheet with Enhanced Cold-Formability**

Hansen, J. O., Inventor; Anderson, D. W., Inventor; 18 May 04; 8 pp.; In English

Contract(s)/Grant(s): AF-F33657-01-C-1240-001

Patent Info.: Filed Filed 18 May 04; US-Patent-Appl-SN-10-847-740

Report No.(s): PB2007-109180; No Copyright; Avail.: CASI: A02, Hardcopy

Systems and methods for enhancing the cold-formability of Ti 6-2-4-2 sheet material are described herein. Embodiments of these methods comprise cold-forming a predetermined, pretreated Ti 6-2-4-2 alloy into a cold-formed shape; subjecting the cold-formed shape to a post-forming annealing cycle comprising: heating the cold-formed shape to about 1450+-.25 .degree. F.; holding the cold-formed shape at about 1450+25.degree. F. for about 15.+-.2 minutes; and cooling the cold-formed shape to room temperature. Embodiments of these methods further comprise subjecting the predetermined Ti 6-2-4-2 alloy to a pre-forming annealing cycle comprising: heating the predetermined alloy to a pre-forming annealing temperature of about 1550-1750.degree. F.; holding the predetermined alloy at the pre-forming annealing temperature for about 30 minutes; and cooling the predetermined alloy to room temperature. These methods allow components comprising 90.degree. bend angles, having a bend factor as low as about 6.2 T, to be achieved.

NTIS

*Cold Working; Titanium*

**20080022006** Michigan Univ., Ann Arbor, MI USA

**Molecular Modeling of Interfacial Behaviors of Nanomaterials**

Kieffer, John; May 2007; 14 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0554

Report No.(s): AD-A477935; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During this project period we focused predominantly on explicit-atom MD simulations and first principles DFT calculations. This involved the force field parameterization for new molecules, i.e., cyclopentene, and the exploration of various DFT codes to identify the one most suitable for our purpose. We conducted several proof of concept studies, concentrating on the structural developments in the immediate vicinity of the surface with which the polymer comes into contact. These studies include: Wetting behavior by non-reactive alkanes of various chain lengths, Deposition of alkane chains with reactive sulfur-bearing end groups, First-principles quantum mechanical calculations predicting density of reactive surface sites for functionalization with benzene molecules, Surface functionalization and co-polymerization of cyclopentene, and Simulations were carried out for (111) and (100) copper surfaces.

DTIC

*Alkanes; Alkenes; Cyclic Hydrocarbons; Molecular Dynamics*

**20080022028** Army Environmental Center, Aberdeen Proving Ground, MD USA

**Demonstration of the Replacement of the Dyes and Sulfur in the M18 Red and Violet Smoke Grenades: Cost & Performance Report**

Rush, Tamera; Jan 2007; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-MM-0122

Report No.(s): AD-A477977; ESTCP-WP-0122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this demonstration was to validate alternative materials and products so that they may be written into new military specifications (MILSPECS), including modified formulations of the smoke grenades to be used in manufacturing. The proposed effort provided production and testing of four potential material substitutions for two smoke munitions items that are considered essential to Army training operations. The potential material replacements included (1) replacing the dye in M18 red grenades, (2) replacing the dye in the M18 violet grenades, (3) an evaluation of the starter patches for use in the colored smoke grenades, and (4) replacing sulfur with a sugar-chlorate formulation. of this program will introduce safer smoke munitions for the soldiers in training and active service. This demonstration included the survey, testing and manufacturing of test, pilot and production runs of these munitions (red and violet smoke grenades) to ensure they met the specifications of their predecessors and the safety requirements for our soldiers to use them safely during training and also in active service. DTIC

*Color; Costs; Dyes; Grenades; Replacing; Smoke; Sulfur*

**20080022031** Oregon State Univ., Corvallis, OR USA

**Push-Pull Tests for Evaluating the Aerobic Cometabolism of Chlorinated Aliphatic Hydrocarbons: Cost & Performance Report**

Semprini, Lew; Sep 2006; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477989; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Aerobic cometabolism is a promising technology for in situ remediation of chlorinated aliphatic hydrocarbons (CAH) at Department of Defense (DoD) sites. Low-cost methods are needed for generating the data required to design field-scale systems. This report describes a newly developed single-well technology for evaluating the feasibility of using in situ aerobic cometabolic processes to treat groundwater contaminated with chlorinated solvent mixtures. The Environmental Security Technology Certification Program (ESTCP) supported a 3-year field study to investigate single-well tests to evaluate the potential for aerobic cometabolism of CAHs. Tests were performed at McClellan Air Force Base (McAFB), California, using propane as the cometabolic substrate, and at Fort Lewis Logistics Center, Washington, using toluene as the cometabolic substrate. McAFB was selected as the demonstration site since it has significant CAH groundwater contamination, and it was the site of the ESTCP demonstration of cometabolic air sparging (CAS) with propane as a growth substrate. In the Fort Lewis demonstration, toluene was evaluated as a cometabolic growth substrate, and different surrogates and inhibitors were evaluated. The single-well test methods were developed and demonstrated to determine (1) the transport characteristics of nutrients, substrates, and CAHs and their transformation products; (2) the capability of indigenous microorganisms to utilize selected substrates and transform targeted contaminants and surrogate compounds; (3) the rates of substrate utilization and contaminant transformation. DTIC

DTIC

*Aerobes; Aliphatic Hydrocarbons; Chlorination; Chlorocarbons; Contamination; Costs; Ground Water; Hydrocarbons*

**20080022046** Environmental Security Technology Certification Program, Arlington, VA USA

**In-situ Substrate Addition to Create Reactive Zones for Treatment of Chlorinated Aliphatic Hydrocarbons: Cost and Performance Report**

Mr Chris, Lutes; Mar 2007; 94 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-9920

Report No.(s): AD-A478051; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Chlorinated solvent contamination of groundwater is a widespread problem at many military and civilian facilities. This class of compounds includes widely used chlorinated aliphatic hydrocarbons (CAH) such as carbon tetrachloride, methylene chloride, trichloroethane, trichloroethene (TCE) and tetrachloroethene. In addition to their roles in many industrial processes, CAHs have been used extensively for cleaning and degreasing. The U.S. Armed Forces are faced with widespread, costly remediation problems related to these compounds. The conventional remedies for CAH contamination in groundwater are groundwater extraction and ex situ treatment, also known as pump and treat, or in situ air sparging. An alternative approach is anaerobic in situ reactive zone (IRZ) technology for the remediation of CAHs and metals. Anaerobic IRZ technology involves the addition of a food grade, soluble carbohydrate substrate, which serves as a supplemental energy source for



microbiological processes in the subsurface. The substrate is typically molasses, but other substrates can be used, including high fructose corn syrup, whey, etc. Through subsurface carbohydrate injection, aerobic or mildly anoxic aquifers can be altered to highly anaerobic reactive zones. This creates suitable conditions for the biodegradation of CAHs and/or the precipitation of selected metals in insoluble forms. This technology is more specifically referred to as enhanced reductive dechlorination (ERD) for CAHs or enhanced anaerobic reductive precipitation (EARP) for metals. The primary benefits of ERD technology include its ease of regulatory acceptance, its in situ nature and its relatively low cost. Benefits of ERD technology include its record of successful application at various constituent concentrations, in varied geologies, and under multiple regulatory programs.

DTIC

*Aliphatic Hydrocarbons; Chlorination; Chlorocarbons; Contamination; Costs; Hydrocarbons; Reactivity; Substrates; Water Pollution*

**20080022190** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Ultra-Low-Temperature Homoepitaxial Growth of Sb-Doped Silicon**

Blacksberg, Jordana; Hoenk, Michael E.; Nikzad, Shouleh; Journal of Crystal Growth; November 04, 2005; Volume 285, Issue 4, pp. 473-480; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40821>; <http://dx.doi.org/10.1016/j.jcrysgro.2005.09.005>

An ultra-low-temperature process for homoepitaxial growth of high-quality, surface-confined, Sb-doped silicon layers is presented. Non-equilibrium growth by molecular beam epitaxy (MBE) is used to achieve dopant incorporation in excess of  $2 \times 10^{14}$  per sq cm in a thin, surface-confined layer. Sb surface segregation larger than expected from theoretical models was observed, in agreement with other experimental works. Furthermore, this work details an entirely low-temperature process (less than 450 degree C) that can be applied to fully processed and aluminum-metallized silicon devices. One application of this process is the formation of a back-surface electrode for back-illuminated high-purity silicon imaging arrays.

Author

*Molecular Beam Epitaxy; Low Temperature; Doped Crystals; Imaging Techniques; Silicon; Crystal Growth*

**20080022202** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Orbiting Carbon Observatory (OCO) Mission**

Miller, Charles E.; May 30, 2006; 34 pp.; In English; 3rd International Workshop on Greenhouse Gas Measurements from Space, 30-31 May 2006, Tsukuba, Japan; Original contains color and black and white illustrations; Copyright; Avail.:

Other Sources

ONLINE: <http://hdl.handle.net/2014/40779>

Science objectives include: Collect the first space-based measurements of atmospheric CO<sub>2</sub> with the precision, resolution, and coverage needed to characterize its sources and sinks on regional scales and quantify their variability over the seasonal cycle. Use independent data validation approaches to ensure high accuracy (1-2 ppm, 0.3% - 0.5%). Reliable climate predictions require an improved understanding of CO<sub>2</sub> sinks. What human and natural processes are controlling atmospheric CO<sub>2</sub>? What are the relative roles of the oceans and land ecosystems in absorbing CO<sub>2</sub>?

Derived from text

*Carbon Dioxide Concentration; Atmospheric Composition; Observatories; Ecosystems; Remote Sensing; Climate*

## 24

### COMPOSITE MATERIALS

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

**20080021267** Michigan Technological Univ., Houghton, MI, USA

**Modeling and Testing of the Viscoelastic Properties of a Graphite Nanoplatelet/Epoxy Composite**

Odegard, Gregory M.; Gates, Thomas S.; March 2006; 24 pp.; In English; Original contains black and white illustrations Contract(s)/Grant(s): 23-064-50; Copyright; Avail.: CASI: A03, Hardcopy

In order to facilitate the interpretation of experimental data, a micromechanical modeling procedure is developed to predict the viscoelastic properties of a graphite nanoplatelet/epoxy composite as a function of volume fraction and nanoplatelet diameter. The predicted storage and loss moduli for the composite are compared to measured values from the same material using three test methods; Dynamical Mechanical Analysis, nanoindentation, and quasi-static tensile tests. In most cases, the model and experiments indicate that for increasing volume fractions of nanoplatelets, both the storage and loss moduli

increase. Also, the results indicate that for nanoplatelet sizes above 15 microns, nanoindentation is capable of measuring properties of individual constituents of a composite system. Comparison of the predicted values to the measured data helps illustrate the relative similarities and differences between the bulk and local measurement techniques.

Author

*Graphite-Epoxy Composites; Viscoelasticity; Micromechanics; Nanoindentation; Concentration (Composition); Static Tests; Tensile Tests*

**20080021431** Maryland Univ., College Park, MD, USA

**Flammability Properties of Clay-Nylon Nanocomposites**

Liu, X.; Quintiere, J. G.; Jun. 2007; 154 pp.; In English

Report No.(s): PB2007-112094; No Copyright; Avail.: National Technical Information Service (NTIS)

The flammability properties of nylon samples with different percentages of clay dispersed on the nanometer (molecular) scale were measured by a fire (cone) calorimeter. Specifically, chemical energy release rate, mass loss rate, and time to ignite (melt and char) were measured. This study consisted of samples of pure Nylon 6 and nylon that contained nanoclay additives at 2% and 5% by weight. In addition, the effect of sample thickness was considered for 1.6 to 24 mm. Data obtained over a range of radiant heat flux (17 to 55 kW/m<sup>2</sup>) were analyzed to illustrate the effect of sample clay loading and thickness on heat of combustion, heat of gasification, and ignition temperature. The findings indicated that the heats of combustion based on mass loss did not change with clay loading, and were 28 (+/-) kJ/g. The critical heat flux for ignition did not appear to be influenced by the clay additive; it decreased from 17.7 for pure nylon to 16.0 with 5% clay addition. These values correspond roughly to an ignition temperature of 430 degrees C, compared to a decomposition temperature range from a thermogravimetric analyzer of 350 degrees to 430 degrees C. However, the addition of the clay could increase the ignition time by 30% to 100% over the pure nylon. This is believed to be due to the increased char residue and the decrease in the mass loss rate.

NTIS

*Clays; Flammability; Nanocomposites; Nylon (Trademark)*

**20080021446** Utah Dept. of Transportation, Salt Lake City, UT, USA; Utah Univ., Salt Lake City, UT, USA

**Time-Dependent Effects from Monitoring of State Street Bridge FRP Composite Retrofit**

Pantelides, C. P.; Reay, J. T.; Reaveley, L. D.; Dec. 2006; 33 pp.; In English

Report No.(s): PB2007-112613; UT-07-01; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This project report summarizes the results of monitoring the State Street Bridge on Interstate 80, which is a reinforced concrete bridge retrofitted with Fiber Reinforced Polymer Composites. Strengthening reinforced concrete bridges by using Fiber Reinforced Polymer (FRP) composites is proving to be a more effective method compared to traditional retrofit methods. FRP composites have a number of advantages over reinforced concrete and structural steel, including their high strength-to-weight ratio and excellent durability, and have been used widely to replace steel in the retrofit of concrete columns. Destructive and nondestructive techniques were employed to evaluate the long-term durability of the Carbon FRP (CFRP) composite and externally CFRP-reinforced concrete of the State Street Bridge on Interstate 80, including the bond-to-concrete capacity of the CFRP composite for three years of exposure. Thermographic imaging was used for detection of voids between CFRP composite and concrete. Although environmental conditions were found to have an effect on the long term durability of the CFRP composite and CFRP-reinforced concrete substrate, no evidence of further steel reinforcement corrosion was observed, and the CFRP composite retrofit is still effective. The research has shown that the seismic performance capability of the bridge did not degrade significantly when compared to the original conditions in 2000 when the retrofit was done. Recommendations for implementation and future research are made.

NTIS

*Composite Materials; Concretes; Fiber Composites; Retrofitting; Streets; Time Dependence*

**20080021745** Lawrence Livermore National Lab., Livermore, CA USA

**Diamond-Silicon Carbide Composite**

Qian, J., Inventor; Zhao, Y., Inventor; 19 Apr. 05; 11 pp.; In English

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

Patent Info.: Filed Filed 19 Apr. 05; US-Patent-Appl-SN-11-110-252

Report No.(s): PB2007-111065; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Fullly dense, diamond-silicon carbide composites are prepared from ball-milled microcrystalline diamond/amorphous

silicon powder mixture. The ball-milled powder is sintered (P=5-8 GPa, T=1400K-2300K) to form composites having high fracture toughness. A composite made at 5 GPa/1673K had a measured fracture toughness of 12 MPa.m<sup>(sup)</sup>1/2. By contrast, liquid infiltration of silicon into diamond powder at 5 GPa/1673K produces a composite with higher hardness but lower fracture toughness. X-ray diffraction patterns and Raman spectra indicate that amorphous silicon is partially transformed into nanocrystalline silicon at 5 GPa/873K, and nanocrystalline silicon carbide forms at higher temperatures.

NTIS

*Composite Materials; Diamonds; Silicon Carbides*

**20080021763** SRI International Corp., Menlo Park, CA, USA; National Energy Technology Lab., Pittsburgh, PA USA  
**Diffusion Coatings for Corrosion-Resistant Components in Coal Gasification Systems. Quarterly Technical Progress Report No. 15 covering the Period January 1, 2007 through March 31, 2007**

Krishnan, G. N.; Malhotra, R.; Alvarez, E.; Lau, K. H.; Mariano, J. P.; Apr. 2007; 22 pp.; In English  
Report No.(s): DE2007-909178; No Copyright; Avail.: National Technical Information Service (NTIS)

Heat-exchangers, particle filters, turbines, and other components in integrated coal gasification combined cycle system must withstand the highly sulfiding conditions of the high-temperature coal gas over an extended period of time. The performance of components degrades significantly with time unless expensive high alloy materials are used. Deposition of a suitable coating on a low-cost alloy may improve its resistance to such sulfidation attack, and decrease capital and operating costs. The alloys used in the gasifier service include austenitic and ferritic stainless steels, nickel-chromium-iron alloys, and expensive nickel-cobalt alloys. During this period, we analyzed several 409 low alloy steel samples after coating them in our fluidized bed reactor and also after exposing them to our corrosion test.

NTIS

*Coal Gasification; Corrosion Resistance; Diffusion; Protective Coatings*

**20080021878** Army Tank-Automotive Research and Development Command, Warren, MI USA

**The Use of Fiber-Reinforced Polymer-Matrix Composites in Army Ground Vehicles**

Socks, Adria N; Apr 7, 2005; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477758; TARDEC-14816; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477758>

Polymer-matrix composites have been researched and studied for over 20 years regarding their applications to Army ground vehicles. Although much research has been performed only a few fiber-reinforced polymer-matrix composites are actually in service today. Evolving vehicle requirements however, will necessitate the implementation of these composites. This paper provides information regarding past, present and future applications for fiber-reinforced polymer-matrix composites.

DTIC

*Fiber Composites; Polymer Matrix Composites*

**20080021987** New Mexico Univ., Albuquerque, NM USA

**Micromechanics of Smart Materials for Large Deployable Mirrors**

Maji, Arup K; Nov 10, 2006; 17 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0252

Report No.(s): AD-A477887; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this research was to investigate the micro-mechanical behavior of a new type of smart material that could enable the accurate deployment of large sensors and structures in space, Elastic Memory Composites (EMC). The basic science aspect of this study involved understanding how the properties of the constituents (matrix and fiber) affect the deployment rate, deployment accuracy and failure of these smart composites. The experimental program and analytical model for deployment rate is presented first followed by that for the deployment accuracy and failure.

DTIC

*Deployment; Micromechanics; Mirrors; Plastics; Smart Materials*

**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*.

**20080021552** Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

**Evaluation of Viking 573 GC/MS System and Chemical Warfare Agent (CWA) Detection**

Austin, Earl; Hoang, Kenneth T; Dec 2007; 23 pp.; In English

Report No.(s): AD-A477098; ECBC-TR-593; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477098>

The Mobile Laboratories & Kits (ML&K) Team, U.S. Army Edgewood Chemical Biological Center, was funded by the New York City Department of Environmental Protection (NYCDEP) to evaluate a portable Gas Chromatography/Mass Spectrometry (GC/MS) system that they routinely use in mobile laboratory applications. The NYCDEP provided a Bruker Viking 573 GC/MS system, which was verified according to manufacturer's recommendations. Members of the ML&K Team developed methods to evaluate the capabilities of the system against six chemical warfare agents (CWAs), including the Limit of Detection (LOD) and dynamic range for all six CWA compounds in organic solvent and soil matrices.

DTIC

*Chemical Warfare; Chromatography; Detectors; Gas Chromatography; Mass Spectroscopy; Viking Mars Program*

**20080021747** Innovene USA, LLC, Chicago, IL, USA

**Cyclopentadienyl-Containing Low-Valent Early Transition Metal Olefin Polymerization Catalysts**

Marks, T. J., Inventor; Luo, L., Inventor; Yoon, S. C., Inventor; 4 May 05; 11 pp.; In English

Contract(s)/Grant(s): DE-86 ER 13511

Patent Info.: Filed Filed 4 May 05; US-Patent-Appl-SN-11-121-775

Report No.(s): PB2007-110907; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This invention relates to a cyclopentadienyl-containing low-valent transition metal catalyst that is useful in polymerizing and co-polymerizing polar and non-polar olefin monomers, and more particularly relates to an in situ reduced Group 4 metal polymerization catalyst that is capable of forming polymers and copolymers of conjugated monomers such as methyl methacrylate (MMA) and styrene.

NTIS

*Alkenes; Catalysts; Hydrocarbons; Polymerization; Transition Metals; Chemical Compounds; Metals*

**20080021755** Bureau of Reclamation, Denver, CO, USA

**Final Report for the Enhanced Anaerobic Bioremediation Pilot Test, Bountiful/Woods Cross Superfund Site, Bountiful, Utah**

Dec. 2006; 66 pp.; In English

Report No.(s): PB2007-109562; No Copyright; Avail.: National Technical Information Service (NTIS)

The pilot test consisted of three side-by-side treatment cells designed to compare the performance of three different electron donors at the site. Sodium lactate, the aqueous electron donor was compared to two slow-release electron donors. Based on the results of the pilot test, emulsified oil (e.g. EOS) is recommended as the electron donor to be used for the full-scale remediation at the site.

NTIS

*Electron Transfer; Donor Materials; Cells (Biology); Hypoxia; Stress (Physiology); Biodegradation; Contaminants; Acceptor Materials; Oils; Bacteria*

**20080021777** Utah Univ., Salt Lake City, UT, USA

**B-Superfamily Conotoxins**

Jones, R. M., Inventor; Olivera, B. M., Inventor; Watkins, M., Inventor; Garrett, J. E., Inventor; 8 Aug 05; 165 pp.; In English

Contract(s)/Grant(s): NIH-GMS-PO1 GM48677

Patent Info.: Filed Filed 8 Aug 05; US-Patent-Appl-SN-11-198-847

Report No.(s): PB2007-109276; No Copyright; Avail.: CASI: [A08](#), Hardcopy

The present invention is directed to (beta)-superfamily conotoxin peptides, derivatives or pharmaceutically acceptable salts thereof. The present invention is further directed to the use of this peptide, derivatives thereof and pharmaceutically

acceptable salts thereof for the treatment of disorders associated with voltage-gated ion channels, ligand gated channels and other receptors. The invention is further directed to nucleic acid sequences encoding the (beta)-superfamily conotoxin peptides and encoding (beta)-superfamily conotoxin propeptides, as well as the (beta)-superfamily conotoxin propeptides.

NTIS

*Peptides; Toxins and Antitoxins; Ligands*

**20080021778** Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C., Boston, MA, USA

**Alpha-Fetoprotein Peptides and Uses Thereof**

Andersen, T. T., Inventor; Bennett, J. A., Inventor; Jacobson, H. I., Inventor; Mesfin, F. B., Inventor; 16 Nov 04; 33 pp.; In English

Contract(s)/Grant(s): NIH-CA 87434; DAMD 17-99-1-9054

Patent Info.: Filed Filed 16 Nov 04; US-Patent-Appl-SN-10-990-877

Report No.(s): PB2007-109275; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The subject invention addresses the need for methods of treatment and prevention of breast cancer, and other cancers, by providing a peptide of eight to twenty amino acids in length which comprises a hydrophilic analog of an alpha-fetoprotein peptide having SEQ ID NO:6: EMTPVNPNG. The peptides may be linear, but are preferably cyclic. The peptides may be provided as dimers or other multimers. A composition comprising the peptide, an antibody that specifically binds to the peptide, a method of reducing estrogen-stimulated growth of cells using the peptide, as well as a method of treating or preventing cancer, such as breast cancer, are also provided. The treatment or prevention method can include the use of tamoxifen therapy in combination with the peptide therapy.

NTIS

*Cancer; Peptides; Prevention; Mammary Glands; Proteins*

**20080021779** Johns Hopkins Hospital, Baltimore, MD, USA

**Design and Synthesis of Renal Dipeptidase Inhibitors**

Khan, S. R., Inventor; Vogelssstein, B., Inventor; Kinzler, K. W., Inventor; Gurulingappa, H., Inventor; Bachhaults, P., Inventor; 7 Jul 05; 12 pp.; In English

Contract(s)/Grant(s): NIH-CA 57345; NIH-CA 69224

Patent Info.: Filed Filed 7 Jul 05; US-Patent-Appl-SN-11-175-478

Report No.(s): PB2007-109274; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Aminophosphinic acid derivatives were synthesized as potential inhibitors of renal dipeptidase, an enzyme overexpressed in benign and malignant colon tumors. Several compounds showed potent enzyme-inhibitory activity. These compounds can be used therapeutically and diagnostically for treatment and detection of tumors.

NTIS

*Inhibitors; Synthesis (Chemistry); Renal Function; Enzymes*

**20080021787** Haynes and Boone, LLP, Dallas, TX, USA

**RAAV-Nepriylsin Compositions and Methods of Use**

Nash, K. R., Inventor; Burger, C., Inventor; 2 Mar 05; 67 pp.; In English

Contract(s)/Grant(s): NIH-2906082-03

Patent Info.: Filed Filed 2 Mar 05; US-Patent-Appl-SN-11-070-627

Report No.(s): PB2007-109278; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Disclosed are methods for the use of neprilysin-encoding polynucleotides in the creation of transformed host cells and transgenic animals. In particular, the use of recombinant adeno-associated viral (rAAV) vector compositions comprising polynucleotide sequences that express one or more biologically-active mammalian neprilysin polypeptides is described. Also disclosed are medicaments and methods for the treatment and amelioration of symptoms of a variety of conditions and neprilysin deficiencies in an animal, including, for example, Alzheimer's disease, and related disorders, as well as neurological and musculoskeletal disorders, including for example, diseases caused by the accumulation of .beta.-amyloid protein in the cells and tissues of affected animals.

NTIS

*Coding; Patent Applications; Polynucleotides; Viruses*



**20080021793** Geological Survey, Reston, VA USA; Minnesota Pollution Control Agency, Saint Paul, MN, USA  
**Nutrients, Suspended Sediment, and Pesticides in Water of the Red River of the North Basin, Minnesota and North Dakota, 1990-2004**

Christensen, V. G.; January 2007; 46 pp.; In English

Report No.(s): PB2007-112979; USGS-SIR-2007-5065; No Copyright; Avail.: National Technical Information Service (NTIS)

Nutrient, suspended sediment, and pesticide data from 1990 through 2004 in the Red River of the North Basin were compiled, summarized, and compared to historical data. Streamflow varied widely throughout the basin during the 1990-2004 study period. For 19 of 22 streamflow sites, median annual streamflow during the study period exceeded the long-term average streamflow. High streamflow can have a substantial effect on water quality. In water samples from selected surface-water sites, nitrite plus nitrate concentrations ranged from less than 0.005 to 7.7 milligrams per liter; total Kjeldahl nitrogen concentrations ranged from 0.1 to 7.5 milligrams per liter; total phosphorus concentrations ranged from less than 0.005 to 4.14 milligrams per liter; and dissolved phosphorus concentrations ranged from 0.003 to 4.13 milligrams per liter. Surface-water samples from the Pembina River Basin generally had higher nitrite plus nitrate, total phosphorus, and suspended sediment concentrations compared to samples from other Red River Basin sites. Historical data from 1970 through 1990 showed relatively high nitrite plus nitrate and suspended sediment concentrations in samples from some Pembina River sites; in contrast to the 1990-2004 period, total phosphorus concentrations from the 1970-90 period generally were highest at Red River of the North sites. Nitrate concentrations in ground-water samples for the 1990-2004 period were highest in Sheridan County, North Dakota and Marshall and Otter Tail Counties in Minnesota. Concentrations of nitrate in ground water in Marshall and Otter Tail Counties corresponded to relatively high reported fertilizer applications during 2002; however, Sheridan County did not have the high fertilizer applications in 2002 compared to other North Dakota and Minnesota counties. The most frequently detected pesticides or pesticide metabolites were 2,4-D, bentazon, de-ethylatrazine, metolachlor, picloram, and triallate in surface water and alachlor ethanesulfonic acid (ESA), atrazine, de-ethylatrazine, picloram, and triazine in ground water. None of the most frequently detected pesticides or metabolites sampled and analyzed by the U.S. Geological Survey or available in the U.S. Environmental Protection Agency Storage and Retrieval System (STORET) during 1990-2004 were detected frequently during 1970-90, with the exception of 2,4-D.

NTIS

*Pesticides; River Basins; Rivers; Sampling; Sediments; Water; Water Pollution*

**20080021840** Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA  
**Proceedings of the Air Force High Energy Density Materials Contractors Conference (2nd) Held in Newport Beach, CA, on 28 Feb-2 Mar 1988**

May 27, 1988; 257 pp.; In English

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

Report No.(s): AD-A477657; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477657>

This report documents presentations given by contractors and in-house researchers at the second High Energy Density Materials held at Newport Beach, CA, on 28 Feb-2 Mar 1988. It consists of extended abstracts from each of the presentations.  
DTIC

*Conferences; Contractors*

**20080021894** Sandia National Labs., Livermore, CA, USA

**Gasless and Gas Bubble-Free Electrodes**

Mosier, B. P., Inventor; Crocker, R. W., Inventor; 17 May 04; 14 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Patent Info.: Filed 17 May 04; US-Patent-Appl-SN-10-848 196

Report No.(s): PB2007-109119; No Copyright; Avail.: CASI: A03, Hardcopy

Gas bubble-free electrodes are necessary for stable long-term operation of millimeter-scale electrokinetic (EK) pumps when currents exceed 10-50  $\mu$ A. An accompanying Technical Advance describes EK pumps that draw 1-3 mA. We have developed gasless and gas bubble-free electrodes that can run millimeter-scale (and smaller) EK pumps continuously at high current densities. Two types of gasless electrodes based on porous carbon and ruthenium/tantalum-on-titanium oxides have been developed that are supercapacitors which store ions from a fluid electrolyte. The gas bubble-free electrodes isolate gas generated by water electrolysis of the pump fluid from the fluid channels by means of an electrically-conductive polymer. Nafion.RTM. tubing is a cationic-selective polymer that is used to pass currents and water for electrolysis at titanium and

platinum surfaces. The gas bubble-free electrodes are easy to fabricate and can operate well even with typical, low-conductivity electrolytes. The gas bubble-free cathode seals to 1500 psi for high-pressure microhydraulic actuation.

NTIS

*Bubbles; Electrodes; Electrokinetics; Pumps*

**20080021988** Air Force Research Lab., Edwards AFB, CA USA

**Intermolecular Interactions in Crystalline Pentafluoropyridine Under High Pressure: Structure and Compressibility at 0.3 and 1.1 GPa (Preprint)**

Olejniczak, Anna; Vij, Andrzej; atrusiak; shwani; May 25, 2007; 11 pp.; In English

Contract(s)/Grant(s): FA8655-06-1-3039

Report No.(s): AD-A477894; AFRL-PR-ED-JA-2007-290; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Pentafluoropyridine has been in-situ pressure crystallized in a diamond-anvil cell (DAC) and its structure determined at 0.30(5) GPa and 1.10(5) GPa and at room temperature by single-crystal X-ray diffraction. The freezing pressure of pentafluoropyridine has been determined to be 0.10(5) GPa. The crystals are monoclinic, space group P21/c. The crystal packing is governed by F...F and C/N...F van der Waals contacts, but no ring stacking is observed. The intermolecular interactions are non-directional, and the crystal compresses nearly isotropically between 0.3 and 1.1 GPa.

DTIC

*Compressibility; Crystal Growth; Crystal Structure; Crystallinity; High Pressure; Molecular Interactions; Pyridines*

**20080022001** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Secondary Batteries: Lead Acid Battery Thermal Runaway**

Catherino, Henry A; Nov 13, 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477925; TARDEC-18509-RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The thermal runaway effect observed in sealed lead acid batteries is reviewed and reassessed as a means for understanding the effect at a more fundamental level. It is to be noted that a popular explanation for the heat generated when a sealed cell is overcharged is that the oxygen recombination taking place at the negative electrode is an exothermic process. Although it is a fact that this recombination reaction is exothermic, the first law of thermodynamics mandates that the net enthalpy of the closed cycle oxygen recombination process is exactly zero (also known as Hess's Law). Since the closed oxygen cycle cannot produce any enthalpic heat, the heat generated must be entirely of Joule origin. In view of this apparent dilemma, an alternative mechanism is developed and discussed that the gas evolution process displaces the electrolyte in the intercell gap. By doing that, this electrolyte displacement causes a substantial increase in the internal resistance of the cell. The consequence of this resistance increase in the presence of current passing through the cell is a significant contributor to the observed heat generation. This paper presents data and discussions that support this interpretation. This mechanistic interpretation has some notable implications. That is, the heat generation process is largely chemistry independent (i.e., it is common to all sealed cell designs), is the consequence of the ability of the separator to manage the electrolyte distribution within the cell and can thermally accelerate thermodynamically spontaneous processes that have slow kinetics under normal ambient conditions. To add additional credibility to the interpretation, the analysis of the thermal runaway that takes place in lithium ion cells is attempted by building on the model developed for lead acid thermal runaway.

DTIC

*Enthalpy; Lead Acid Batteries; Storage Batteries*

**20080022056** Naval Research Lab., Washington, DC USA

**The Silver Oxide-Zinc Alkaline Primary Cell. Part 2. Effects of Various Types of Negative Electrodes on Cell Characteristics**

Shepherd, C M; Dec 20, 1951; 42 pp.; In English

Report No.(s): AD-A478101; NRL-3876; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The silver oxide-zinc alkaline primary cell consists of a negative electrode of zinc, a positive electrode of silver peroxide, and an alkaline electrolyte (generally a potassium hydroxide solution). During discharge, the silver peroxide in the positive electrode is reduced to metallic silver and the metallic zinc in the negative electrode is oxidized either to zinc oxide or to a complex zincate ion. The reactions involved have not been fully determined and may prove to be fairly complex. Because of its many desirable characteristics, an appreciable demand has arisen for this cell. It is a constant voltage, primary cell of low weight and volume, capable of operating at high current densities over a wide range of temperatures. Wherever the demand

for the cell is based on minimization of weight or volume, a separate design generally will be needed for each set of conditions. Such a design will require more detailed information than is necessary for the construction of ordinary types of batteries.  
DTIC

*Alkaline Batteries; Alkalinity; Electrodes; Silver; Silver Oxides; Zinc; Zinc Oxides*

**20080022158** Michigan Univ., Ann Arbor, MI, USA

**Pd-Based Metallic Membranes for Hydrogen Separation: First Principles Studies of Separation Mechanisms Aimed at Knowledge-Based Rational Formulations of Improved Materials**

Linic, S.; Nov. 2006; 19 pp.; In English

Contract(s)/Grant(s): DE-PC26-05NT424409

Report No.(s): DE2007-909268; No Copyright; Avail.: National Technical Information Service (NTIS)

The focus in this project was to employ first principles computational methods to study the underlying molecular elementary processes that govern hydrogen diffusion through Pd membranes as well as the elementary processes that govern the CO- and S-poisoning of these membranes. Our computational methodology integrated a multiscale hierarchical modeling approach, wherein a molecular understanding of the interactions between various species is gained from ab-initio quantum chemical Density Functional Theory (DFT) calculations, while a mesoscopic statistical mechanical model like Kinetic Monte Carlo is employed to predict the key macroscopic membrane properties such as permeability.

NTIS

*Hydrogen; Knowledge Based Systems; Membranes; Metallic Hydrogen*

**20080022234** US Chemical Safety and Hazard Investigation Board, Washington, DC, USA

**Case Study: Runaway Chemical Reaction and Vapor Cloud Explosion, Worker Killed, 14 Injured. Synthron, LLC, Morganton, NC., January 31, 2006**

Jan. 31, 2007; 17 pp.; In English

Report No.(s): PB2007-112884; REPT-2006-04-I-NC; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This Case Study describes a runaway chemical reaction and subsequent vapor cloud explosion and fires that killed one worker and injured 14 (two seriously). The explosion destroyed the facility and damaged structures in the nearby community. The incident occurred at the Synthron, LLC facility in Morganton, North Carolina, on January 31, 2006. The CSB issues this Case Study to emphasize the importance of implementing comprehensive safety management practices to control reactive hazards.

NTIS

*Accident Investigation; Chemical Reactions; Clouds; Explosions; Gas Explosions; Injuries; Vapors*

**20080022235** Transportation Research Board, Washington, DC, USA; Association of American Railroads, Pueblo, CO, USA

**Rail Base Corrosion Detection and Prevention**

Hernandez, F. C. R.; Koch, K.; Barrera, G. P.; Mar. 2007; 129 pp.; In English

Report No.(s): PB2007-112749; TCRP-37; Copyright; Avail.: National Technical Information Service (NTIS)

Under Transit Cooperative Research Program (TCRP) Project D-7, the Transportation Technology Center, Inc., (TTCI) studied the effects and prevention of rail base corrosion. The following tasks were accomplished: Distributed questionnaire to various transit agencies in order to identify the major problems associated with rail base corrosion and actions taken by them. Completed a metallurgical examination of rails with corrosion present, including an electrochemical study of the rails under different corrosive environments (i.e., chlorides (KCl), sulfates (NaSO<sub>4</sub>)) and direct current (DC) conditions. Created a Finite Element Analysis (FEA) model using ANSYS to determine the state of stresses created by the localized corrosion and assess the risk of failure. Developed a draft recommended industry practice for rail base corrosion detection and prevention.

NTIS

*Corrosion; Corrosion Prevention; Rail Transportation; Rails*

**20080022259** Army Research Development and Engineering Command, Warren, MI USA

**Quantifying the Effects of the Influence of a Tungsten Long-rod Projectile into Confined Ceramics at High-velocity Impact**

Gorsich, Tara J; Templeton, Douglas W; Jan 29, 2008; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478030; 18527; No Copyright; Avail.: Defense Technical Information Center (DTIC)

High performance modeling of brittle materials is an efficient, inexpensive, time-saving solution for optimal design of

armor systems. Quantifying the effects of high-velocity projectiles into brittle materials provides an armor resolution for the critical need of ballistic protection against lethal threats. The analysis modeled a cylindrical, tungsten carbide blunt projectile into four confined, ceramic materials at a high velocity impact. The finite element simulations were performed using Elastic Plastic Impact Code (EPIC) [Johnson (2006)], which simulates the failure and particle breakup of the target once the long-rod penetrator strikes at high-velocity impact. The history of the nose penetration of the projectile will be computed to establish the most advantageous design condition for future vehicle development. Damage computations will also be conducted to demonstrate how the confined, brittle samples behave. The study shows that silicon carbide and boron carbide are the optimal candidates to consider when selecting the best armor performance from the four configurations. A numerical comparison was made between a pyroceram confined and unconfined configuration and ascertains approximately a twelve percent increase in ballistic performance of the confined sample. The computations will offer the researcher data to accurately formulate armor to protect the survivability of the ground vehicle, and most importantly, the soldier.

DTIC

*Armor; Ceramics; Confinement; Finite Element Method; High Speed; Projectiles; Rods; Tungsten; Tungsten Carbides*

## 26

### METALS AND METALLIC MATERIALS

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

**20080020585** Technical Management Concepts, Inc., Beavercreek, OH USA

#### **Materials Processing Technology Initiatives. Delivery Order 0019-08: Material Behavior Modeling for Optimization of Thermomechanical Processes**

Tamirisakandala, S; Nov 2000; 99 pp.; In English

Contract(s)/Grant(s): F33615-96-D-5835-0019; Proj-4347

Report No.(s): AD-A477358; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the important results obtained on the material modeling behavior of the most important titanium alloy, Ti-6Al-4V. Detailed experiments were conducted to characterize the deformation behavior, and the influence of process parameters on the thermomechanical processing was studied. Microstructural mechanisms over wide temperature and strain rate ranges have been identified, and optimum conditions for safe processing were established. The results are reported in the form of publications which were published in international journals.

DTIC

*Manufacturing; Microstructure; Optimization; Strain Rate; Thermodynamics; Titanium Alloys*

**20080021187** QuesTek Innovations, LLC, Evanston, IL, USA

#### **Microstructure Modeling of 3rd Generation Disk Alloy**

Jou, Heng-Jeng; April 2008; 28 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07CB01C; WBS 698259.02.07.03.03.02

Report No.(s): NASA/CR-2008-215199; E-16471; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021187>

The objective of this initiative, funded by NASA's Aviation Safety Program, is to model, validate, and predict, with high fidelity, the microstructural evolution of third-generation high-refractory Ni-based disc superalloys during heat treating and service conditions. This initiative is a natural extension of the DARPA-AIM (Accelerated Insertion of Materials) initiative with GE/Pratt-Whitney and with other process simulation tools. Strong collaboration with the NASA Glenn Research Center (GRC) is a key component of this initiative and the focus of this program is on industrially relevant disk alloys and heat treatment processes identified by GRC. Employing QuesTek's Computational Materials Dynamics technology and PrecipiCalc precipitation simulator, physics-based models are being used to achieve high predictive accuracy and precision. Combining these models with experimental data and probabilistic analysis, 'virtual alloy design' can be performed. The predicted microstructures can be optimized to promote desirable features and concurrently eliminate nondesirable phases that can limit the reliability and durability of the alloys. The well-calibrated and well-integrated software tools that are being applied under the proposed program will help gas turbine disk alloy manufacturers, processing facilities, and NASA, to efficiently and effectively improve the performance of current and future disk materials.

Author

*Heat Resistant Alloys; Microstructure; Flight Safety; Heat Treatment; Aircraft Safety; Computerized Simulation*

**20080021198** Ohio Aerospace Inst., Brook Park, OH, USA

**GRCop-84 Rolling Parameter Study**

Loewenthal, William S.; Ellis, David L.; May 2008; 57 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNC05AA23; WBS 599489.02.07.03.02.04.01

Report No.(s): NASA/TM-2008-215213; E-16491; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021198>

This report is a section of the final report on the GRCop-84 task of the Constellation Program and incorporates the results obtained between October 2000 and September 2005, when the program ended. NASA Glenn Research Center (GRC) has developed a new copper alloy, GRCop-84 (Cu-8 at.% Cr-4 at.% Nb), for rocket engine main combustion chamber components that will improve rocket engine life and performance. This work examines the sensitivity of GRCop-84 mechanical properties to rolling parameters as a means to better define rolling parameters for commercial warm rolling. Experiment variables studied were total reduction, rolling temperature, rolling speed, and post rolling annealing heat treatment. The responses were tensile properties measured at 23 and 500 C, hardness, and creep at three stress-temperature combinations. Understanding these relationships will better define boundaries for a robust commercial warm rolling process. The four processing parameters were varied within limits consistent with typical commercial production processes. Testing revealed that the rolling-related variables selected have a minimal influence on tensile, hardness, and creep properties over the range of values tested. Annealing had the expected result of lowering room temperature hardness and strength while increasing room temperature elongations with 600 C (1112 F) having the most effect. These results indicate that the process conditions to warm roll plate and sheet for these variables can range over wide levels without negatively impacting mechanical properties. Incorporating broader process ranges in future rolling campaigns should lower commercial rolling costs through increased productivity.

Author

*Copper Alloys; Tensile Properties; Mechanical Properties; Combustion Chambers; Creep Properties; Tensile Creep; Engine Parts; Rocket Engines*

**20080021206** NASA Glenn Research Center, Cleveland, OH, USA

**NASA and Superalloys: A Customer, a Participant, and a Referee**

Nathal, Michael V.; September 14, 2008; 7 pp.; In English; 11th International Symposium on Superalloys, 14-18 Sept. 2008, Champion, PA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.02; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021206>

NASA has had a long history of research and development in the field of superalloys. These efforts have continued today, where the latest advancements in turbine disk and blade technologies are being developed. Although NASA does support military flight systems, its predominant role is in supporting civilian air transportation systems, and thus has goals for improving fuel efficiency, emissions, noise, and safety of today's aircraft. NASA has traditionally served several distinct but complimentary roles as participants in multi-disciplinary research teams, as customers who fund research and development efforts at industry and universities, and as referees who can address broad issues that affect the entire aeronautics community. Because of our longer range viewpoint, we can take on higher risk, higher reward research topics. NASA can also serve as an intermediary between the basic research performed primarily at universities and the development efforts emphasized by industry. By interacting with individual companies, NASA can identify areas of general interest and problems common to a large portion of the aeronautics community, and devise programs aimed at solving these problems. In space missions, NASA is a direct customer responsible for developing vehicles. In the case of the Space Shuttle, NASA has worked with various contractors to design and build numerous components out of superalloys. Another fascinating area for the use of superalloys is in power systems for long life applications in space. Potential missions include providing electric power for deep space missions, surface rovers, including lunar and Mars, and stationary power generators on the lunar surface.

Author

*Heat Resistant Alloys; Support Systems; Electric Generators; Roving Vehicles; Turbine Blades*

**20080021301** NASA Langley Research Center, Hampton, VA, USA

**Electron Beam Freeform Fabrication: A Fabrication Process that Revolutionizes Aircraft Structural Designs and Spacecraft Supportability**

Taminger, Karen M.; May 22, 2008; 59 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 5616581.02.08.07.15.03; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021301>

The technological inception and challenges, as well as current applications of the electron beam freeform fabrication



(EBF3) process are outlined. The process was motivated by the need for a new metals technology that would be cost-effective, enable the production of new alloys and that would could be used for efficient, lightweight structures. EBF3 is a rapid metal fabrication, layer-additive process that uses no molds or tools and which yields properties equivalent to wrought. The benefits of EBF3 include it near-net shape which minimizes scrap and reduces part count; efficiency in design which allows for lighter weight and enhanced performance; and, its 'green' manufacturing process which yields minimal waste products. EBF3 also has a high tensile strength, while a structural test comparison found that EBF3 panels performed 5% lower than machined panels. Technical challenges in the EBF3 process include a need for process control monitoring and an improvement in localized heat response. Currently, the EBF3 process can be used to add details onto forgings and to construct and form complex shapes. However, it has potential uses in a variety of industries including aerospace, automotive, sporting goods and medical implant devices. The novel structural design capabilities of EBF3 have the ability to yield curved stiffeners which may be optimized for performance, low weight, low noise and damage tolerance applications. EBF3 has also demonstrated its usefulness in 0-gravity environments for supportability in space applications.

Derived from text

*Electron Beams; Fabrication; Metals; Technology Utilization; Aircraft Design; Spacecraft Design; Structural Design; Mechanical Properties; Forming Techniques*

**20080021748** Hoag (Foley), LLP, Boston, MA, USA

**Main-Group Metal-Based Asymmetric Catalysts And Applications Thereof**

Jacobsen, E. N., Inventor; Sigman, M. S., Inventor; 4 Jun 05; 196 pp.; In English

Patent Info.: Filed Filed 4 Jun 05; US-Patent-Appl-SN-11-029-183

Report No.(s): PB2007-110906; No Copyright; Avail.: CASI: [A09](#), Hardcopy

The present invention relates to a method and catalysts for the stereoselective addition of a nucleophile to a reactive ( $\pi$ )-bond of a substrate. The chiral, non-racemic catalysts of the present invention constitute the first examples of catalysts for nucleophilic additions that comprise a main-group metal and a tri- or tetra-dentate ligand.

NTIS

*Asymmetry; Catalysts; Metals; Nucleophiles; Chemical Bonds*

**20080021757** Second Sight Medical Products, Inc., Sylmar, CA, USA

**Platinum Surface Coating and Method for Manufacturing the Same**

Zhou, D. M., Inventor; 4 Aug 05; 12 pp.; In English

Contract(s)/Grant(s): NIH-R24EY12893-01

Patent Info.: Filed Filed 4 Aug 05; US-Patent-Appl-SN-11-198-361

Report No.(s): PB2007-109293; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An improved platinum surface coating and method for manufacturing the improved platinum surface coating wherein the platinum surface coating having a fractal surface coating of platinum ('platinum gray') with an increase in surface area of at least 5 times when compared to shiny platinum of the same geometry and also having improved resistance to physical stress when compared to platinum black having the same surface area. The process of electroplating the surface coating of platinum gray comprising plating at a moderate rate, i.e., at a rate that is faster than the rate necessary to produce shiny platinum and that is less than the rate necessary to produce platinum black.

NTIS

*Coating; Manufacturing; Patent Applications; Platinum*

**20080022159** Pacific Northwest National Lab., Richland, WA, USA

**Organics Verification Study for Sinclair and Dye Inlets, Washington**

Kohn, N. P.; Niewolny, L. A.; Brandenberger, J. M.; Johnston, R. K.; Sep. 2006; 117 pp.; In English

Report No.(s): DE2007-909254; PNNL-16070; No Copyright; Avail.: National Technical Information Service (NTIS)

Sinclair and Dyes Inlets near Bremerton, Washington, are on the State of Washington 1998 303(d) list of impaired waters because of fecal coliform contamination in marine water, metals in sediment and fish tissue, and organics in sediment and fish tissue. Because significant cleanup and source control activities have been conducted in the inlets since the data supporting the 1998 303(d) listings were collected, two verification studies were performed to address the 303(d) segments that were listed for metal and organic contaminants in marine sediment. The Metals Verification Study (MVS) was conducted in 2003; the final report, Metals Verification Study for Sinclair and Dyes Inlets, Washington, was published in March 2004 (Kohn et al. 2004). This report describes the Organics Verification Study that was conducted in 2005. The study approach was similar

to the MVS in that a large number of surface sediment samples were screened for the major classes of organic contaminants, and then the screening results and other available data were used to select a subset of samples for quantitative chemical analysis. Because the MVS was designed to obtain representative data on concentrations of contaminants in surface sediment throughout Sinclair Inlet, Dyes Inlet, Port Orchard Passage, and Rich Passage, aliquots of the 160 MVS sediment samples were used in the analysis for the Organics Verification Study.

NTIS

*Dyes; Organic Compounds; Pollution Monitoring; Water Pollution*

**20080022269** Twin City Die Castings Co., Minneapolis, MN, USA

**Energy and Technology Assessment of Zinc and Magnesium Die Casting Plants. Technical Report Close-Out**

Heider, T.; Aug. 25, 2006; 56 pp.; In English

Contract(s)/Grant(s): DE-FG36-05GO15097

Report No.(s): DE2007-909329; No Copyright; Avail.: Department of Energy Information Bridge

Twin City Die Castings Company of Minneapolis, Minnesota, Twin City Die Castings Company was awarded project No. DE-FG36-05GO15097 to perform plant wide assessments of ten (10) die casting facilities that produce zinc and magnesium alloy castings in order to determine improvements and potential cost savings in energy use. Mr. Heider filled the role of team leader for the project and utilized the North American Die Casting Association (NADCA) to conduct audits at team participant plants so as to hold findings specific to each plant proprietary. The term of the project was one year and the amount of the U.S. Department of Energy funding totaled \$100,000. Industry provided \$113,113 of in-kind funding support. The intended benefits of the project were to improve energy use through higher operational and process efficiency for the plants assessed. An improvement in energy efficiency of 5 - 15% was targeted. The primary objectives of the project was to: (1) Expand an energy and technology tool developed by the NADCA under a previous DOE project titled, Energy and Technology Assessment for Die Casting Plants for assessing aluminum die casting plants to be more specifically applicable to zinc and magnesium die casting facilities. (2) Conduct ten (10) assessments of zinc and magnesium die casting plants, within eight (8) companies, utilizing the assessment tool to identify, evaluate and recommend opportunities to enhance energy efficiency, minimize waste, and improve productivity. (3) Transfer the assessment tool to the die casting industry at large.

NTIS

*Casting; Castings; Dies; Energy Consumption; Energy Technology; Industries; Magnesium; Technology Assessment; Zinc*

## 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*.

**20080021758** Colburn (Cantor), LLP, Bloomfield, CT, USA

**Abrasion Resistant Coatings**

Hong, S. C., Inventor; 24 May 05; 20 pp.; In English

Contract(s)/Grant(s): F33615-99-C-5016; F33615-01-5005

Patent Info.: Filed Filed 24 May 05; US-Patent-Appl-SN-11-136-827

Report No.(s): PB2007-109289; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of protecting a substrate against damage comprising disposing on a substrate one or more coatings, wherein one coating comprises an isocyanate-terminated polyurethane prepolymer and a curing agent; wherein the curing agents comprise polyaspartic esters, ketimines, aldimines, or a combination comprising at least one of the foregoing curing agents; reacting the isocyanate-terminated polyurethane prepolymer with a curing agent; wherein the reacting can optionally be carried out in the presence of moisture or heat; and curing the isocyanate-terminated polyurethane prepolymer to form the coating.

NTIS

*Protective Coatings; Abrasion Resistance*

**20080021887** Aerospace Corp., El Segundo, CA USA

**The Effect of Teflon Emulsion on Hydrogen Electrode Properties and Performance in Nickel-Hydrogen Cells**

Wasz, Margot; Zimmerman, Albert; Jan 30, 2008; 44 pp.; In English

Report No.(s): AD-A477790; AEROSPACE-TR-2008-8555-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477790>

The traditional T30 Teflon emulsion used in nickel-hydrogen battery cells is being phased due to EPA concerns with two of its minority components. This presentation reviews work done to date by The Aerospace Corporation to better understand the relationship between the properties of the hydrogen electrode affected by the Teflon emulsion and cell performance. Special cycling tests have been derived to selectively stress the hydrogen electrode with minimum stress to the nickel electrode. Results from these tests performed on cells constructed with T30 and an alternative emulsion, TE3859, are presented. The Aerospace Corporation is gratefully acknowledged for supporting this work as part of the Aerospace Mission-Oriented Investigation and Experimentation (MOIE) program.

DTIC

*Electrodes; Emulsions; Hydrogen; Infrared Spectra; Resins; Teflon (Trademark)*

**20080022052** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Evaluation of Sensors for On-Board Diesel Oil Condition Monitoring of U.S. Army Ground Equipment**

Schmitgal, Joel; Moyer, Steve; Jan 4, 2005; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478089; TARDEC-14113; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC) recently completed a Science and Technology Objective (STO) to develop and demonstrate a compact on-board smart sensor system for monitoring the operational condition of in-service diesel engine oils. The goal of such technologies is to reduce or eliminate the Army's dependence on traditional oil analysis methods, by providing real-time condition monitoring and to project the remaining usable life of the lubricant. Commercially available and prototype sensors were obtained and evaluated on a diesel test engine. Algorithms were then developed from the sensor and laboratory data to determine the real-time condition of the oil and to calculate the remaining usable life of the oil.

DTIC

*Detectors; Diesel Engines; Diesel Fuels; Ground Support Equipment; Lubricating Oils*

**20080022270** BBWI, Idaho Falls, ID, USA

**Filter and Method of Forming a Filter**

Mann, N. R., Inventor; Herbst, R. S., Inventor; Kochergin, V., Inventor; Trowbridge, T. L., Inventor; 17 May 04; 9 pp.; In English

Contract(s)/Grant(s): DE-AC07-99ID13727

Patent Info.: Filed Filed 17 May 04; US-Patent-Appl-SN-10-848-482

Report No.(s): PB2007-109089; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A filter and method of forming a filter is described and which includes a porous inorganic substrate having a plurality of pores, and which permits the passage of a fluid therethrough, and a ceramic filtration media formed of particles having a particle size which permits the ceramic filtration media to be embedded in at least some of the porous inorganic substrate and positioned at and/or below the top surface of the inorganic substrate.

NTIS

*Ceramics; Patent Applications; Filters*

## 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*.

**20080021430** William J. Hughes Technical Center, Atlantic City, NJ, USA

### **Jet A Volatility Survey**

Byrnes, S.; Jul. 2007; 30 pp.; In English

Report No.(s): PB2007-112095; DOT/FAA/AR-07/30; No Copyright; Avail.: National Technical Information Service (NTIS)

In response to the July 1996 TWA Flight 800 disaster, the Federal Aviation Administration (FAA) collected jet fuel samples from domestic and international flights to determine the actual flash point of jet fuel in service. This data was collected to help determine whether any change in the ASTM D1655 turbine fuel specification would help prevent any future such incident and to use in fuel tank flammability assessments. This report details the flash point results from 293 jet fuel samples collected from April 1998 through September 1999. The results found no fuel samples to be out of specification. Samples were retrieved at the end of flights, before refueling, that ended in Philadelphia, PA; New York, NY (JFK); and Newark, NJ. These locations provided convenient locations for FAA technicians to be able to obtain samples from fuel from all over the US and abroad. The results helped determine that no change in the turbine fuel specification was required. The flashpoint distribution from the survey was also used in the harmonized FAA special conditions issued for the B-747 and B-737 fuel tank flammability reduction means and in the proposed Title 14 Code of Federal Regulations Part 25 Appendix L that was published in the Notice of Proposed Rulemaking titled, 'Reduction of Fuel Tank Flammability in Transport Category Airplanes' (docket number FAA-2005-22997).

NTIS

*Surveys; Volatility; Jet Engine Fuels; Flammability; Aeronautical Engineering*

**20080021756** National Inst. of Standards and Technology, Boulder, CO, USA

### **Properties of a 50/50 Mixture of Jet-A + S-8**

Bruno, T. J.; Laesecke, A.; Outcalt, S. L.; Seelig, H. D.; Smith, B. L.; Mar. 2007; 36 pp.; In English

Report No.(s): PB2007-109555; NISTIR-6647; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes measurement efforts performed on mixture(s) of aviation fuels: Jet-A + S-8. The primary mixture is a 50/50 (vol/vol) combination of the two fuels. Measurements include chemical analysis, density, and viscosity, speed of sound and vapor pressure (by distillation curve measurement). This document compiles in one source the available measured data for the mixture.

NTIS

*Aircraft Fuels; Jet Engine Fuels; Propellant Properties*

**20080021843** Army Tank-Automotive Research and Development Command, Warren, MI USA

### **The 21st Century - Barrels of Alternative Fuels**

Sattler, Eric; Aug 8, 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477664; TARDEC-17532-RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477664>

Executive Order 13423 requires all federal agencies with fleets of 20 or more vehicles to reduce petroleum consumption 2% annually through FY 2015. The Department of Defense is a leader in fuel efficiency and use of alternative sources. This briefing looks at the military's response.

DTIC

*Energy Policy; Fuel Consumption; Research Management*

**20080021891** Department of Defense, Washington, DC USA

### **Synthetic Fischer-Tropsch (FT) JP-5/JP-8 Aviation Turbine Fuel Elastomer Compatibility**

Muzzell, Pat; Stavinoha, Leo; Chapin, Rebecca; Feb 2005; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477802; TARDEC-TR-15043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477802>

When some elastomer (rubber) compounds, and specifically those used for seals in fuel-wetted components of vehicles

and equipment, are suddenly 'switch-loaded' from one kind of fuel to another, swell/shrink issues relating to seal performance may arise, possibly leading to fuel leakage. The key objective of this study was to compare and contrast the material compatibility of nitrile coupons and O-rings with selected petroleum-derived fuels, Fisher-Tropsch (FT) synthetic JP-5/JP-8 fuel, and blends of FT JP-5/JP-8 with various amounts of aromatic blend stock. This study provided a baseline for predicting the effects of static elastomer swell to the potential degree of swell/shrink that can be expected when fuels are 'switch-loaded' and a comparison of effects on coupons as well as O-rings which indicated similar overall trends and were in agreement with prior work. The use of an aromatic concentrate as a surrogate source of aromatics did not reveal any significant bias when compared to petroleum derived JP-5 and diesel fuel, although it was shown to have a reduced effect on elastomer change as compared to the petroleum fuels.

DTIC

*Aircraft Fuels; Compatibility; Elastomers; Fischer-Tropsch Process; Hydrocarbons; Turbines*

**20080022036** Army Tank-Automotive Research and Development Command, Warren, MI USA

**U.S. Army/TACOM LCMC Path Forward for Heavy Duty Diesel Vehicles/Engines**

Schihl, Peter; Khabra, Parminder; Villahermosa, Luis; Oct 27, 2005; 33 pp.; In English

Report No.(s): AD-A478007; TARDEC-15277-RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Environmental Protective Agency (EPA) finalized motor vehicle diesel fuel regulations and the heavy duty diesel on-road exhaust emissions regulations in January 2001. These regulations required a reduction in diesel fuel sulfur content starting in June 2006 and established stringent exhaust standards effective January 2007. This briefing looks at the impact of these regulations on the Department of Defense (DoD) and how DoD is meeting these challenges.

DTIC

*Diesel Engines; Diesel Fuels*

## 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*.

**20080021386** Office of the Secretary of Defense, Washington, DC, USA

**Handheld Standoff Mine Detection System (HSTAMIDS) Field Evaluation in Thailand**

Doheny, Robert C; Burke, Sean; Cresci, Roger; Ngan, Peter; Walls, Richard; Mar 28, 2005; 13 pp.; In English

Report No.(s): AD-A476716; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA476716>

The Humanitarian Demining Research and Development Program of Night Vision and Electronic Sensors Directorate (NVESD), under the direction of the Office of Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict (OASD/SOLIC) and with participation from the International Test and Evaluation Project (ITEP) for Humanitarian Demining, conducted an in-country field evaluation of HSTAMIDS in the region of Humanitarian Demining Unit #1 (HMAU1) in Thailand. Participants included the US Humanitarian Demining Team of NVESD, ITEP personnel, Thailand Mine Action Center (TMAC), HALO Trust organization from Cambodia, and CyTerra Corporation. The primary objectives were to demonstrate the performance of the U.S. Army's latest handheld multisensor mine detector, the AN/PSS-14, in a demining environment in comparison to the performance of the metal detector being used by the local deminers and also to assess the performance of the trained deminers after limited experience and training with the HSTAMIDS.

DTIC

*Detection; Mine Detectors; Mines (Ordnance); Portable Equipment; Systems Analysis; Thailand*

**20080021732** California Univ., Riverside, CA, USA

**Analysis of GPS-Based Data for Light Duty Vehicles**

Barth, M.; Jan. 2007; 216 pp.; In English

Contract(s)/Grant(s): CARB-04-327

Report No.(s): PB2007-109589; No Copyright; Avail.: CASI: A10, Hardcopy

Understanding vehicle activity patterns both spatially and temporally is critical for building accurate mobile source emissions inventories. Vehicle activity has frequently been characterized using average speed and vehicle miles traveled (VMT), however advances in modeling of mobile sources have increased the resolution in vehicle activity necessary for using



the new models to their full capabilities. Recently, two GPS (Global Positioning System)-based vehicle activity datasets have become available from several different research programs. In 2001, the California Department of Transportation (Caltrans) conducted their 2001 California Statewide Household Travel Survey Program, which contains GPS-based data sets from across the state. This data set is approximately 125 MB in size and represents about 272 households. This database was divided into two parts, one corresponding to Northern California trips and the other corresponding to Southern California trips. Further, the Southern California Association of Governments (SCAG) carried out a post-census travel survey in 2001, which contains a number of GPS-data logger datasets. This data set represents approximately 467 households.

NTIS

*Global Positioning System; Surveys; Census*

**20080021735** Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

**Journal of the Chinese Institute of Engineers, Vol. 30, No.2, March 2007. Transactions of the Chinese Institute of Engineers, Series A**

Chen, S. S.; Mar. 2007; 184 pp.; In English

Report No.(s): PB2007-109570; Copyright; Avail.: National Technical Information Service (NTIS)

;Partial Contents: Pseudo-Model Technique of Biological Tissues for the Development of NIR Diffuse Optical Tomography; An Improved Estimator Using Multiple Sensor Data Fusion for Radar Maneuvering Target Tracking Systems; On Tool-Chip Interface Stress Distributions Ploughing Force and Size Effect in Machining Inconel-718 and AISI4340; Regularization of Nearly Singular Integrals in the Boundary Element Analysis for Interior Anisotropic Thermal Field Near the Boundary; Buckling of Thin Plates with V-Grooves under Axial impact; On Analysis of Passive Underwater Acoustic Damping Materials; Improving the Reliability and Usability of Structural Shaping Optimization - The Contour Natural Shape Function; Evaluation of Environmental Effects on Mechanical Properties and Characterization of Creep Behavior of PMMA; Shear-Thinning Effects in Annular-Orifice Viscous Fluid Dampers; Reinforced Reactive Powder Concrete Plate under Cyclic Loading; Controlling Information Access in Workflow Management Systems Using RBAC-Based Model; Block Attacks on Gollmann Cascades; A Dual-Purpose Signature for Authentication on UMTS; Numerical Evaluation of Thermal Cycling Reliability of High Performance Flip-Chip Package Assembly Using Submodeling Analysis; Studying an Approach Solution of I/O Buffer Information Specification (IBIS) Model; Evaluation Taiwan's Air Quality Variation Trends Using Grey System Theory.

NTIS

*China; Engineers*

**20080021824** Air Force Academy, Colorado Springs, CO USA

**Comparison of Wired and Wireless Bio-Electrical Impedance Fluid Status Monitoring Devices and Validation to Body Mass and Urine Specific Gravity Changes Following Mild Dehydration**

Doan, Brandon; Brothers, Michael; Terry, Mary; McLean, Rebecca; Kozlowski, Eric; Wile, Al; Jan 18, 2008; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477629; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477629>

Dehydration is a major health and performance risk in military operations and there is a need for rapid, non-invasive and early detection. A fluid status assessment method, ZOE2, is FDA approved for fluid status monitoring. The ZOE2 measures thoracic bio-electrical impedance. A new wireless version of the ZOE2, the ZOE wireless (ZOEW), has been developed and proposed for assessment of fluid status in the field. Some investigations have reported impedance as a valid measure of hydration status in clinical or controlled settings. However, there is speculation as to the utility of bio-electrical impedance post-exercise or in a field setting. The objectives of this study were fourfold: 1) to compare biological measurements of the new ZOEW monitor with the FDA approved and patented ZOE2 monitor currently being used in the healthcare market; 2) to assess the test-retest reliability of the ZOEW monitor; 3) to compare the sensitivity and validity of the ZOEW monitor and the ZOE2 monitor to assess mild hydration status changes post-exercise in a field setting; 4) to assess the usability of the ZOEW monitor. Thirty-two participants from the USAFA Wrestling Team were recruited. Nude body weight, urine specific gravity, ZOE2 and ZOEW measurements were taken before and after a typical 90-minute wrestling practice session. Usability was tested when participants were asked to complete a survey to assess perceptions of ease of use. Similar values were obtained from the ZOE2 and ZOEW monitors. Although both body weight and urine specific gravity changes were significantly different from pre- to post-practice indicating mild dehydration, no significant differences were detected between pre- to post-practice for the ZOE2 or ZOEW device. Bio-electrical impedance, as measured by the ZOEW monitor and the

ZOE2 monitor in this study, does not appear to be a valid measure of mild, post-exercise hydration status change as compared to body weight and urine specific gravity.

DTIC

*Body Fluids; Dehydration; Density (Mass/Volume); Electrical Impedance; Monitors; Urine*

**20080021889** Naval Surface Warfare Center, Dahlgren, VA USA

**Radiation Facilities at NSWC (Naval Surface Warfare Center)**

Jan 1989; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477800; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477800>

The requirement for nuclear hardened equipment and systems creates a new and unique challenge for all developers of new systems. At the Naval Surface Warfare Center (NSWC), a solid base of technology exists for hardening strategic and tactical systems. This brochure describes the machines and facilities available at NSWC for conducting initial nuclear radiation (INR) and Transient Radiation Effects on Electronics (TREE) experiments and tests. The facilities at NSWC are primarily dedicated to the study of the effects of prompt gamma and x-rays on electronic components, circuits, and equipment. Both tactical and strategic electronics may be tested at NSWC. The facilities feature a complete range of flash x-ray and pulsed electron beam machines including the Defense Nuclear Agency's (DNA) Casino and Phoenix machines. A 2,000-Curie Co60 source is also available for total ionizing dose tests on components and small circuits. The majority of the facilities described in this brochure are located in a two-building nuclear effects complex located at the White Oak, Maryland, laboratory which includes the Navy's Nuclear Vulnerability and Hardening Building and the DNA Electronics Hardening Building. The facilities may be used by any agency of the U.S. Government and by commercial companies engaged in effects work for the Department of Defense (DOD).

DTIC

*Military Technology; Navy; Organizations; Radiation Effects; Research and Development; Warfare*

**20080021998** Air Force Research Lab., Edwards AFB, CA USA

**Coaxial Jets at Supercritical Conditions in a Variable Transverse Acoustic Field (Preprint)**

Leyva, Ivett A; Rodriguez, Juan; Chehroudi, Bruce; May 24, 2007; 6 pp.; In English

Contract(s)/Grant(s): Proj-23080533

Report No.(s): AD-A477921; AFRL-PR-ED-XA-2007-292; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experimental study on the effects of the relative position of a coaxial jet with respect to an externally-imposed transverse acoustic field is presented. A thorough investigation on the effects of chamber pressure, outer to inner jet velocity ratio (VR), and outer to inner momentum flux ratio (MR) on a coaxial jet subject to a fixed transverse acoustic field has been completed by this group [1-3]. However, the jet was located at a pressure node and its location was fixed. The main objective of this study is to investigate the effects on the dark-core length and its standard deviation of varying acoustic pressure and velocity fields at the coaxial jet center. The first resonant transverse frequency for this system is about 3 kHz and it is fixed throughout the study. The chamber reduced pressure,  $P_r$ , is about 1.5. At a pressure antinode, the maximum  $p'$  is about 6% of the chamber pressure. The shear coaxial injector used here is similar to those used in cryogenic liquid rockets. The working fluid for the inner and outer jet and the chamber pressurant is N<sub>2</sub> to separate chemistry effects from the effects of a transverse acoustic on non-combusting phenomena such as jet mixing, atomization, and vaporization. Such interactions are thought to play an important role on liquid rocket combustion instabilities. Furthermore, by using a single fluid, ambiguities associated with composition dependence on mixtures critical properties are eliminated.

DTIC

*Acoustics; Sound Fields; Supercritical Flow*

**20080022030** Texas Univ., Austin, TX USA

**Experimental Studies of Transitional Boundary Layer Shock Wave Interactions**

Clemens, N T; Dolling, D S; Murphree, Z R; Yucecil, K B; Dec 2006; 14 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0112

Report No.(s): AD-A477982; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Transitional shock wave/boundary layer interactions are studied with planar imaging techniques. The interaction is generated by a cylinder mounted on a flat plate in a Mach 5 flow. Planar laser scattering (PLS) and particle image velocimetry

(PIV) are used to visualize the flow structure. Images are obtained in streamwise-spanwise planes (plan view). Earlier work focused on investigating similar interactions with tripped boundary layers, whereas the current work focuses on the case where transition occurs naturally. One goal of this preliminary study was to see if repeatable interactions could be generated. Imaging was conducted for three downstream locations of the cylinder. The PLS imaging revealed that the transitional interactions resulting from an untripped boundary layer are similar to those generated by tripping. In general it is observed that the separated flow region of transitional interactions exhibits larger variations in their scale and shape than fully turbulent interactions. When the cylinder is farthest upstream (5.3 diameters from leading edge) two types of separation shock are seen: an apparently laminar shock along the plate centerline and a turbulent one in the outboard region. As the cylinder is moved downstream (10.7 diameters), this dual structure is not as apparent, which is consistent with the upstream boundary layer becoming more turbulent. Finally, at 16 diameters downstream the interaction exhibits extreme variations in its shape, which we believe to be caused by sidewall interference. The PIV measurements largely confirm these qualitative observations.

DTIC

*Boundary Layers; Particle Image Velocimetry; Shock Wave Interaction; Shock Waves*

**20080022037** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Assured Mobility Simulator**

Kamysiak, Keith; Mar 8, 2004; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478012; 16121; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The assured mobility simulator is a high resolution, real time simulator environment used to simulate the SABRE system in various mission scenarios for engineering and training purposes. The simulator provides both visual and haptic (motion based) simulation of the SABRE system. The full spectrum route clearance simulator (FSRC Sim) was developed as an update to an existing simulator, the Grizzly Engineering and Training Simulator (GETS).

DTIC

*Mobility; Simulation; Simulators*

**20080022069** Defense Science Board, Washington, DC USA

**Deployment of Members of the National Guard and Reserve in the Global War on Terrorism**

Pilling, Donald; Williams, Michael; Sep 2007; 52 pp.; In English

Report No.(s): AD-A478163; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Use of the reserve components in support of overseas contingencies has increased significantly since September 11, 2001 and the U.S. invasion of Afghanistan and Iraq. Although the number of reserve component members on active duty has declined over the past few years, from a peak in May 2003, the current level still remains far higher than in decades past. This level of effort is expected to continue as long as the reserves are used as part of the rotational force supporting these ongoing operations. These circumstances have evoked considerable concern over whether such use can be sustained by the service members called to duty and, equally important, whether such use might affect the viability of the all-volunteer force over the long run. Thus, the Defense Science Board, under direction by Congress, examined the issue of length and frequency of the deployment of members of the National Guard and reserves in the global war on terrorism. The findings and recommendations resulting from this study are as follows: \* The task force was impressed with the dedication and professionalism of the members of the National Guard and reserves. They are performing to a very high standard under great strain. The task force is very concerned for their future if the strain is not relieved. \* Given current levels of operational demand, today's Army active, National Guard, and reserve force structure will not support DOD's policy mandating dwell times of one year deployed and two years not deployed (1:2) for the active force and one year mobilized and five years not mobilized (1:5) for the reserve components. End-strength increases currently authorized will not be sufficient to meet the established goals. \* Task force discussions with representatives of the National Guard, the reserves, employers, family members, and the state governors demonstrated a consensus that 1:5 dwell time would satisfy their needs for predictability and sustainability.

DTIC

*Armed Forces (United States); Deployment; Dwell; Employment; Reserves; Terrorism; Warfare*

## 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*.

**20080021221** Alaska Univ., Fairbanks, AK, USA

**Modeling of Ionospheric Refraction of UHF Radar Signals at High Latitudes**

Watkins, Brenton; Maurits, Sergei; Kulchitsky, Anton; Characterising the Ionosphere; June 2006, pp. 19-1 - 19-14; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 19; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A three-dimensional ray-tracing code has been developed to run in-conjunction with the University of Alaska polar ionospheric model. The ionospheric model may be run in a real-time predictive mode and its outputs have been used as an input to the ray tracing code. The objective of this work is to compute refractive effects on UHF radar signals due to time-varying ionospheric structures at high latitudes. Radar range and pointing errors are calculated continuously during two 24-hour periods in this paper to demonstrate the effects from a time-varying ionosphere during quiet and moderately disturbed geomagnetic conditions. Radar pointing errors that correspond to target errors up to about 500m have been found for low antenna elevation radar pointing directions during moderately disturbed geomagnetic conditions.

Author

*Ray Tracing; Ultrahigh Frequencies; Radar Range; Earth Ionosphere; Refraction; Geomagnetism; Radar Signatures; Atmospheric Models*

**20080021231** Defence Research and Development Canada, Ottawa, Ontario, Canada

**Mitigation of Ionospheric Effects on High Frequency Surface Wave Radar**

Riddolls, Ryan J.; Characterising the Ionosphere; June 2006, pp. 20-1 - 20-6; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 20; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

High Frequency Surface Wave Radar (HFSWR) takes advantage of the diffraction of electromagnetic waves over the conducting ocean surface to detect, locate, and track surface vessels beyond the line-of-sight horizon of the earth. However, long-range surface vessel detection is often confounded by radar clutter comprising echoes from the ionospheric plasma. In this paper, we characterize the angular spectrum of these reflections, and from this information deduce the signal-to-clutter processing gain that can be realized by various adaptive receive antenna array configurations. In particular, it is shown that there is advantage to be realized by sampling ionospheric echoes with a planar two-dimensional array rather than a conventional linear one-dimensional HFSWR array. Using a planar array, the radar can distinguish high-elevation ionospheric clutter signals from low-elevation surface target echoes.

Author

*Antenna Arrays; High Frequencies; Signal Processing; Wave Diffraction; Ionospheric Propagation; Atmospheric Attenuation; Radar; Electromagnetic Wave Transmission*

**20080021236** Defence Science and Technology Organisation, Edinburgh, Australia

**Characterisation of Narrowband HF Channels in the Mid and Low Latitude Ionosphere**

Harris, T. J.; Scholz, M. L.; Characterising the Ionosphere; June 2006, pp. 17-1 - 17-14; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 17; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The performance of an HF digital radio system is strongly affected by the response of its various protocols to short-term (sub-hourly) variations in the ionosphere. There is a very limited choice of models of this variation. Channel simulators based on the Watterson 2-path model (ITU-R F.1487) are commonly relied upon for modem testing, system design and modelling. Limited DSTO trials in the past have cast doubt on the validity of the Watterson model in the Australian mid-latitude region. In addition to fading errors, the Watterson model introduces further errors by ignoring variations in the group delay due to diffuse multipath propagation. These concerns provided the impetus to conduct an extensive and rigorous trial to measure the narrowband channel impulse response (CIR) at mid latitudes as well as the highly dynamic low latitude region of the



ionosphere. A variety of low and mid-latitude narrowband HF channels were probed during a 14 day campaign in April 2006. Channel response measures such as Doppler shift and spread, group-delay spread, and signal fading statistics were used to identify a small set of similar channels by fuzzy clustering the response variables. By including or omitting other factors such as the carrier frequency, time of day, path information, ionospheric electron density profile parameters, and the maximum usable frequency from oblique ionospheric sounding on coincident paths, it is possible to establish various physical dependencies and derive a small selection of typical CIR records that define the cardinal channel types in the geographic region. In this paper the authors describe the trial, the measurements and the analysis methods used to characterize and statistically analyse the short-term properties of individual channel records and to cluster the channels into a manageable set of cardinal channel types. Important analysis results from the first campaign are presented.

Author

*Ionospheric Sounding; Radio Communication; Narrowband; Maximum Usable Frequency; Carrier Frequencies; Ionospheric Electron Density; Digital Systems*

**20080021241** Communications Research Centre, Ottawa, Ontario, Canada

#### **A Digital Radio Receiver for Ionospheric Research**

James, H. Gordon; Characterising the Ionosphere; June 2006, pp. 23-1 - 23-16; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 23; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Compared with the experience of the past few decades, ionospheric research in the near future will depend less on new science-dedicated orbital platforms and more on networks of ground facilities. An important role of scientific spacecraft in this context will be to provide space perspectives, as part of space-ground coordinated studies. The enhanced Polar Outflow Probe (ePOP) instrument suite will be launched on the Canadian CASSIOPE spacecraft in early 2008 for space-ground coordinated research. This low-earth-orbit payload will include three instruments for radio-scientific investigation of the ionosphere. One of the radio instruments is a four-channel digital Radio Receiver Instrument (RRI). RRI will be fed by four 3-metre monopoles, arranged in a crossed configuration, each connected to a high-input impedance preamplifier. The RRI bandwidth will extend from 10 Hz to 18 MHz. RRI will measure the electric fields of either spontaneous waves or waves created by ground transmitters, such as ionosondes, high-frequency radars and ionospheric heaters. A review of the design features of the RRI reflects the observational requirements. Accurate measurements of the intensity, frequency, direction of propagation, and signal delay of such fields over the broad frequency range will be accomplished using modern digital receiver techniques. The amplified signals from the monopoles will be digitized at a rate of 40 megasamples per second, and from there, the signal will be down-converted, filtered, time-stamped, and communicated purely in digital form. The major features of the RRI are described in the light of the measurement goals that inspired them. Results of recent end-to-end tests of the RRI protoflight model are followed by an outline of the operating modes of the instrument.

Author

*Radio Receivers; Digital Systems; Ionospheres; Low Earth Orbits; Radio Communication; Ionosondes; Frequency Ranges; Digital Techniques*

**20080021406** Air Univ., Maxwell AFB, AL USA

#### **Proctoring the Joint Force: Networks, Hierarchy, and 21st Century Warfare**

Tippett, Daniel W; Jun 2005; 85 pp.; In English

Report No.(s): AD-A477001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477001>

This study analyzes the prospects for a joint center to exercise command and control (C2) over USA (U.S.) Joint Forces. The idea for such a center emanates from the need for joint warfighting efficiency and the emergence of the Standing Joint Force Headquarters (SJFHQ). The study assesses the compatibility of a joint center with individual service doctrines as well as net-centric environments (NCE) and net-centric operations (NCO). It concludes that a joint C2 center is incompatible with the preponderance of service doctrine, and is diametrically opposed to the concept of NCO. Instead, a Joint Planning and Monitoring Center (JPMC) could plan and monitor the joint fight, accomplishing many of the same goals of efficiency that a C2 center might. In execution, the Joint Force would conduct net-centric warfare (NCW) wherein subordinate empowerment prevails on the battlefield, focused by mission-orders and commander's intent. The paper concludes with recommendations to field the NCE, create the JPMC, and adapt service doctrine to operate in NCEs and conduct NCW.

DTIC

*Command and Control; Hierarchies; Management Planning; Military Operations; Warfare*



**20080021576** Tellabs Operations, Inc., Naperville, IL, USA

**Multichannel Ring and Star Networks with Limited Channel Conversion**

Ranaswami, R., Inventor; Sasaki, G. H., Inventor; 16 May 05; 20 pp.; In English

Contract(s)/Grant(s): MDA972-95-C-0001

Patent Info.: Filed Filed 16 May 05; US-Patent-Appl-SN-11-131-056

Report No.(s): PB2007-110125; No Copyright; Avail.: CASI: **A03**, Hardcopy

A ring communication network comprising a plurality of nodes in which a single one of the nodes is configured for full channel conversion and the remaining nodes, other than the single node, are configured for no channel conversion. Links comprising no more than  $W$  channels couple the nodes. The ring communication network also may comprise  $N$  nodes and links coupling the nodes for carrying data in  $W$  channels such that  $N \geq 2 \log_2 W - 1$  where  $W$  is a power of 2. Each of the  $N$  nodes comprises switches connected such that each channel of a first one of the links adjacent any one of the  $N$  nodes can be switched to no more than  $W - 1$  channels of another one of the links adjacent any one node.

NTIS

*Communication Networks; Network Control; Networks*

**20080021653** DigitalGlobe, Bay Saint Louis, MS, USA

**QuickBird Post Launch Geopositional Characterization Update**

Kudola, Robert; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 12 pp.;

In English; See also **20080021597**; Original contains color illustrations; Copyright; Avail.: CASI: **A03**, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation discusses post-launch geopositional characterization of the QuickBird product. The QuickBird products currently satisfy 23m CE90 specifications at nadir, excluding terrain. Primary efforts to enhance QuickBird geolocation accuracy include improving attitude determination refinement and ephemeris determination refinement.

Derived from text

*Satellites; Positioning*

**20080021859** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Woolf, Amy F; Nov 5, 2001; 20 pp.; In English

Report No.(s): AD-A477721; CRS-IB98038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477721>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, which were deployed on the territories of several of the former Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and as many as 12,000 warheads for nonstrategic nuclear weapons. Many analysts in the USA and Russia have expressed concerns about the safety, security, and control over these weapons. Some of these concerns focus on Russia's nuclear command and control (C2) structure. Financial constraints have slowed the modernization and replacement of many aging satellites and communications links, raising the possibility that Russia might not be able to identify a potential attack or communicate with troops in the field if an attack were underway. Some fear that the misinterpretation of an ambiguous event might lead to the launch of nuclear weapons. Concerns also are focused on the safety and security of nuclear warheads in storage facilities in Russia. Reports of Russian nuclear materials for sale on the black market, when combined with evidence of weaknesses in security systems, have raised concerns about the possible theft or diversion of nuclear materials from these facilities. The USA and Russia are cooperating in many fora to improve the safety, security, and control over Russia's nuclear weapons and materials. Through the Nunn-Lugar Cooperative Threat Reduction Program, the U.S. Department of Defense has provided assistance worth nearly \$2 billion to help Russia, Ukraine, Kazakhstan, and Belarus safely transport and store weapons and eliminate launchers under the START Treaties. Also, the Department of Energy's Materials Protection, Control and Accounting Program is helping Russia and other former Soviet republics secure nuclear materials at research and other facilities in the former Soviet Union.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security; United States*

**20080021860** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Woolf, Amy F; Mar 13, 2002; 20 pp.; In English

Report No.(s): AD-A477722; CRS-IB98038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477722>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, which were deployed on the territories of several of the former Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and as many as 12,000 warheads for nonstrategic nuclear weapons. Many analysts in the USA and Russia have expressed concerns about the safety, security, and control over these weapons. Some of these concerns focus on Russia's nuclear command and control (C2) structure. Financial constraints have slowed the modernization and replacement of many aging satellites and communications links, raising the possibility that Russia might not be able to identify a potential attack or communicate with troops in the field if an attack were underway. Some fear that the misinterpretation of an ambiguous event might lead to the launch of nuclear weapons. Concerns also are focused on the safety and security of nuclear warheads in storage facilities in Russia. Reports of Russian nuclear materials for sale on the black market, when combined with evidence of weaknesses in security systems, have raised concerns about the possible theft or diversion of nuclear materials from these facilities. The USA and Russia are cooperating in many fora to improve the safety, security, and control over Russia's nuclear weapons and materials. Through the Nunn-Lugar Cooperative Threat Reduction Program, the U.S. Department of Defense has provided assistance worth nearly \$2 billion to help Russia, Ukraine, Kazakhstan, and Belarus safely transport and store weapons and eliminate launchers under the START Treaties. Also, the Department of Energy's Materials Protection, Control and Accounting Program is helping Russia and other former Soviet republics secure nuclear materials at research and other facilities in the former Soviet Union.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security; United States*

**20080021861** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Woolf, Amy F; Apr 12, 2002; 21 pp.; In English

Report No.(s): AD-A477723; CRS-IB98038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477723>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, which were deployed on the territories of several of the former Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and as many as 12,000 warheads for nonstrategic nuclear weapons. Many analysts in the USA and Russia have expressed concerns about the safety, security, and control over these weapons. Some of these concerns focus on Russia's nuclear command and control (C2) structure. Financial constraints have slowed the modernization and replacement of many aging satellites and communications links, raising the possibility that Russia might not be able to identify a potential attack or communicate with troops in the field if an attack were underway. Some fear that the misinterpretation of an ambiguous event might lead to the launch of nuclear weapons. Concerns also are focused on the safety and security of nuclear warheads in storage facilities in Russia. Reports of Russian nuclear materials for sale on the black market, when combined with evidence of weaknesses in security systems, have raised concerns about the possible theft or diversion of nuclear materials from these facilities. The USA and Russia are cooperating in many fora to improve the safety, security, and control over Russia's nuclear weapons and materials. Through the Nunn-Lugar Cooperative Threat Reduction Program, the U.S. Department of Defense has provided assistance worth nearly \$2 billion to help Russia, Ukraine, Kazakhstan, and Belarus safely transport and store weapons and eliminate launchers under the START Treaties. Also, the Department of Energy's Materials Protection, Control and Accounting Program is helping Russia and other former Soviet republics secure nuclear materials at research and other facilities in the former Soviet Union.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security; United States*

**20080021862** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Woolf, Amy F; Jul 11, 2002; 20 pp.; In English

Report No.(s): AD-A477724; CRS-IB98038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477724>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, which were

deployed on the territories of several of the former Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and as many as 12,000 warheads for nonstrategic nuclear weapons. Many analysts in the USA and Russia have expressed concerns about the safety, security, and control over these weapons. Some of these concerns focus on Russia's nuclear command and control (C2) structure. Financial constraints have slowed the modernization and replacement of many aging satellites and communications links, raising the possibility that Russia might not be able to identify a potential attack or communicate with troops in the field if an attack were underway. Some fear that the misinterpretation of an ambiguous event might lead to the launch of nuclear weapons. Concerns also are focused on the safety and security of nuclear warheads in storage facilities in Russia. Reports of Russian nuclear materials for sale on the black market, when combined with evidence of weaknesses in security systems, have raised concerns about the possible theft or diversion of nuclear materials from these facilities. The USA and Russia are cooperating in many fora to improve the safety, security, and control over Russia's nuclear weapons and materials. Through the Nunn-Lugar Cooperative Threat Reduction Program, the U.S. Department of Defense has provided assistance worth nearly \$2 billion to help Russia, Ukraine, Kazakhstan, and Belarus safely transport and store weapons and eliminate launchers under the START Treaties. Also, the Department of Energy's Materials Protection, Control and Accounting Program is helping Russia and other former Soviet republics secure nuclear materials at research and other facilities in the former Soviet Union.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security; United States*

**20080021863** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Wolf, Amy F; Aug 5, 2002; 20 pp.; In English

Report No.(s): AD-A477725; CRS-IB98038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477725>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, which were deployed on the territories of several of the former Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and as many as 12,000 warheads for nonstrategic nuclear weapons. Many analysts in the USA and Russia have expressed concerns about the safety, security, and control over these weapons. Some of these concerns focus on Russia's nuclear command and control (C2) structure. Financial constraints have slowed the modernization and replacement of many aging satellites and communications links, raising the possibility that Russia might not be able to identify a potential attack or communicate with troops in the field if an attack were underway. Some fear that the misinterpretation of an ambiguous event might lead to the launch of nuclear weapons. Concerns also are focused on the safety and security of nuclear warheads in storage facilities in Russia. Reports of Russian nuclear materials for sale on the black market, when combined with evidence of weaknesses in security systems, have raised concerns about the possible theft or diversion of nuclear materials from these facilities. The USA and Russia are cooperating in many fora to improve the safety, security, and control over Russia's nuclear weapons and materials. Through the Nunn-Lugar Cooperative Threat Reduction Program, the U.S. Department of Defense has provided assistance worth nearly \$2 billion to help Russia, Ukraine, Kazakhstan, and Belarus safely transport and store weapons and eliminate launchers under the START Treaties. Also, the Department of Energy's Materials Protection, Control and Accounting Program is helping Russia and other former Soviet republics secure nuclear materials at research and other facilities in the former Soviet Union.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security; United States*

**20080021864** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Wolf, Amy F; Sep 13, 2002; 21 pp.; In English

Report No.(s): AD-A477726; CRS-IB98038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477726>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, which were deployed on the territories of several of the former Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and as many as 12,000 warheads for nonstrategic nuclear weapons. Many analysts in the USA and Russia have expressed concerns about the safety, security, and control over these weapons. Some of these concerns focus on Russia's nuclear command and control (C2) structure. Financial constraints have slowed the modernization and replacement of many aging satellites and communications links, raising the possibility that Russia might not be able to identify a potential attack or communicate with troops in the field if an attack were underway.

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DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security; United States*

**20080021893** Library of Congress, Washington, DC USA

**SEAFARER: Extremely Low Frequency Naval Communications System**

Gannon, Edmund J; Jun 20, 1978; 12 pp.; In English

Report No.(s): AD-A477804; CRS-IB78015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477804>

Ballistic missile submarines (SSBNs) and nuclear attack submarines (SSNs) cannot perform all of their missions effectively under current communications limitations. Existing communications systems require these submarines to approach the surface and deploy a submerged antenna in order to receive messages from land-based stations. This reduces their operational efficiency and increases their detectability. Modern nuclear-powered submarines are capable of operating at such greater depths and for much longer periods than in the past. Despite these capabilities, they are required to approach the surface at least every 12 hours to receive messages and instructions. SEAFARER (Surface ELF transmitting system For Addressing Remotely deployed Receivers), an extremely low frequency communications system designed for worldwide communications with submerged submarines, has been proposed as a supplement to current systems. SEAFARER can penetrate seawater to great depths, allowing communications with ballistic missile submarines while they remain at optimal operating depths and speeds. Critics of SEAFARER claim that the system is too vulnerable to nuclear attack, has too low a data transmission rate, and is too limited in capacity, and that its installation might present radiation hazards to onsite residents. For these and other reasons, system development of SEAFARER has been slow and no actual construction of the system has begun.

DTIC

*Extremely Low Frequencies; Submarines; Telecommunication*

**20080021898** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Wolf, Army F; Aug 15, 2003; 20 pp.; In English

Report No.(s): AD-A477824; CRS-IB98038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477824>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, and these weapons were deployed on the territories of several of the former Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and perhaps as many as 12,000 warheads for nonstrategic nuclear weapons. Many analysts in the USA and Russia have expressed concerns about the safety, security, and control over these weapons. Some of these concerns focus on Russia's nuclear command and control structure. Financial constraints have slowed the modernization and replacement of many aging satellites and communications links, raising the possibility that Russia might not be able to identify a potential attack or communicate with troops in the field if an attack were underway. Some fear that the misinterpretation of an ambiguous event might lead to the launch of nuclear weapons. Some also expressed concern that the year 2000 computer bug could affect Russia's command and control system, but it did not. Some concerns are also focused on the safety and security of nuclear warheads in storage facilities in Russia. Press reports and statements by Russian officials about possible missing warheads have added to these concerns. However, General Eugene Habiger, former Commander-in-Chief of the U.S. Strategic Command, stated that he had no major concerns about security at Russian nuclear storage facilities after he visited several. Reports of Russian nuclear materials for sale on the black market, when combined with evidence of weaknesses in the security systems have raised concerns about the possible theft or diversion



of nuclear materials from these facilities. The USA and Russia are cooperating in many fora to improve the safety, security, and control over Russia's nuclear weapons and materials.

DTIC

*Command and Control; Communication Networks; Nuclear Power Plants; Nuclear Warheads; Nuclear Weapons; Russian Federation; Safety; Security*

**20080021902** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Woolf, Amy F; Dec 5, 2001; 21 pp.; In English

Report No.(s): AD-A477830; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477830>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, and these weapons were deployed on the territories of several of the longer Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and perhaps as many as 12,000 warheads for nonstrategic nuclear weapons.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security*

**20080021903** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Woolf, Amy F; Jun 25, 2003; 21 pp.; In English

Report No.(s): AD-A477831; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477831>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, and these weapons were deployed on the territories of several of the longer Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and perhaps as many as 12,000 warheads for nonstrategic nuclear weapons.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security*

**20080021904** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Woolf, Amy F; Feb 5, 2003; 20 pp.; In English

Report No.(s): AD-A477832; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477832>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, and these weapons were deployed on the territories of several of the longer Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and perhaps as many as 12,000 warheads for nonstrategic nuclear weapons.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security*

**20080021905** Library of Congress, Washington, DC USA

**Nuclear Weapons in Russia: Safety, Security, and Control Issues**

Woolf, Amy F; Nov 25, 2002; 20 pp.; In English

Report No.(s): AD-A477833; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477833>

When the Soviet Union collapsed in late 1991, it reportedly possessed more than 27,000 nuclear weapons, and these weapons were deployed on the territories of several of the longer Soviet republics. All of the nuclear warheads have now been moved to Russia, but Russia still has around 6,000 strategic nuclear weapons and perhaps as many as 12,000 warheads for nonstrategic nuclear weapons.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security*



**20080022166** National Inst. of Information and Communications Technology, Tokyo, Japan

**Review of the National Institute of Information and Communications Technology, Volume 53, No. 4**

December 2007; 127 pp.; In English; See also 20080022167 - 20080022182; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Overview of the Wideband Internet Engineering Test and Demonstration Satellite Project; Overview of WINDS Satellite; Communications System; On-board Baseband Switch; Multibeam Antenna System; Ka band High Power Multi-port Amplifier (MPA); Ka-band Active Phased Array Antenna; Overview of Earth Stations for WINDS Experiments; Earth Stations for WINDS High-Speed Network; High-Speed Burst Modem for Bent Pipe Relay Mode; WINDS Network Data Gathering System; Development of Network Management Center for WINDS; Earth Stations for WINDS Regenerative Communication Mode; WINDS Satellite Networking Protocol for Regenerative Mode; WINDS Satellite Networking Protocol for Bent-pipe Mode; and Plan of Experiments.

Derived from text

*Antenna Arrays; Power Amplifiers; Phased Arrays; Multibeam Antennas; Microwave Antennas; Information Systems; Extremely High Frequencies; Ground Stations; Data Systems*

**20080022167** National Inst. of Information and Communications Technology, Japan

**Earth Stations for WINDS High-Speed Network**

Hashimoto, Yukio; Takahashi, Takashi; Yoshimura, Naoko; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 61-65; In English; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

A high-speed network is developed for the high-speed communication of user data rate over 622 Mbps using WINDS bent pipe relay mode. We are developing a super high-data rate-VSAT with 2.4 m diameter antenna and a large earth terminal with 4.8 m diameter antenna. SDR-VSAT is used for high-speed communication of 622 Mbps and installed in the vehicle. LET is used for high-speed communication of 1244 Mbps and set up at the NICT Kashima space technology center. The earth station for the high-speed network requires the 1.1 GHz wideband transmitter and receiver to be the same as the on-board transponder of WINDS.

Author

*Satellite Networks; Communication Satellites; High Speed; Earth Terminals; Broadband; Engineering Test Satellites; Aerospace Engineering; Systems Engineering*

**20080022168** Japan Aerospace Exploration Agency, Japan

**Ka band High Power Multi-port Amplifier (MPA)**

Kuroda, Tomonori; Shimada, Masaaki; Ogawa, Yasuo; Hosoda, Ikuo; Katakami, Kanji; Motohashi, Yasuo; Makazawa, Minoru; Kitahara, Masaki; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 41-48; In Japanese; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

A Ka-band High Power Multi-port Amplifier (MPA) has been developed and will be demonstrated through the communication experiments for the future satellite communication systems by multi-beams in the Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) program. The conventional satellite communication systems by multibeams, has been designed so that the transponder configuration set for each power amplifier is connected to its exclusive antenna beam, so if a port's power condition for communication has some margin, its surplus power can't be distributed to other ports. On the other hand, WINDS has an MPA and its control system is by ground terminal; the total output power of the MPA is shared among all communication ports, and it is possible to assign required output power in several antenna beams efficiently within total output power. MPA for WINDS have 8 input-output ports, the frequency band is 17.7-18.8 GHz, and total output power is more than 280 W.

Author

*Extremely High Frequencies; Amplifiers; Broadband; Engineering Test Satellites; Satellite Communication; Communication Satellites; Satellite Networks; Aerospace Engineering*

**20080022169** National Inst. of Information and Communications Technology, Japan

**WINDS Satellite Networking Protocol for Regenerative Mode**

Yoshimura, Naoko; Hashimoto, Yukio; Takahashi, Takashi; Kuroda, Tomonori; Ogawa, Yasuo; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 99-103; In Japanese; See also [20080022166](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The Wideband InterNetworking engineering test and Demonstration Satellite (WINDS), which is an experimental satellite

and development by Japan Aerospace Exploration Agency (JAXA) and NICT, has two operating modes: a regenerative mode and a bent-pipe mode. The regenerative mode is realized using an on-board ATM switch subsystem (ABS) which was developed by the National Institute of Information and Communications Technology (NICT). In the regenerative mode, ABS demodulates, switches, and modulates the receiving data. In this section, we introduce the networking protocol for the regenerative mode.

Author

*Broadband; Engineering Test Satellites; Satellite Communication; Satellite Networks*

**20080022170** National Inst. of Information and Communications Technology, Japan

#### **WINDS Satellite Networking Protocol for Bent-pipe Mode**

Takahashi, Takashi; Yoshimura, Naoko; Hashimoto, Yukio; Ogawa, Yasuo; Kuroda, Tomonori; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 105-108; In Japanese; See also [20080022166](#); Original contains color illustrations; Copyright; Avail.: Other Sources

The Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) has two types of transponders; regenerative mode and bent-pipe mode. In this section, the networking protocol for using the bent-pipe mode is described. There are two types of communication modes in the bent-pipe mode. One is the bent-pipe continuous wave mode, which is used with traditional communication satellites. Another is the bent-pipe time division multiple access (TDMA) mode, which can communicate at the same time with the regenerative mode.

Author

*Broadband; Engineering Test Satellites; Satellite Networks; Communication Satellites; Transponders; Satellite Communication*

**20080022171** National Inst. of Information and Communications Technology, Japan

#### **Overview of Earth Stations for WINDS Experiments**

Takahashi, Takashi; Hashimoto, Yukio; Ogawa, Yasuo; Kuroda, Tomonori; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 57-59; In Japanese; See also [20080022166](#); Copyright; Avail.: Other Sources

The Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) has been developed assuming the four types of user earth stations. Those earth stations have been developed by the Japan Aerospace Exploration Agency (JAXA) and National Institute of Information and Communications Technology (NICT). The WINDS satellite communication system is very complex, requiring a satellite network control station, the WINDS network management station, which was developed by JAXA. Overviews of those Earth stations for WINDS experiments are described.

Author

*Broadband; Engineering Test Satellites; Ground Stations; Network Control; Satellite Communication; Satellite Networks; Communication Networks*

**20080022172** Japan Aerospace Exploration Agency, Japan

#### **Overview of WINDS Satellite**

Sato, Tetsuo; Nakamura, Yasuo; Araki, Tsunehiko; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 9-16; In Japanese; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

JAXA, Japan Aerospace Exploration Agency, and NICT, National Institute of Information and Communications Technology, are jointly proceeding with development of WINDS, Wideband InterNetworking engineering test and Demonstration Satellite, as part of the e-Japan Priority Policy Program of the Japanese government's IT strategy headquarters. WINDS will be launched by H-IIA launch vehicle in the Japanese fiscal year 2007 to establish the world's most advanced information and telecommunications network.

Author

*Satellite Networks; Aerospace Engineering; Broadband; Engineering Test Satellites*

**20080022173** Japan Aerospace Exploration Agency, Japan

#### **Multibeam Antenna System**

Ozawa, Satoru; Hasegawa, Takumi; Shimasa, Masaaki; Hirayama, Katsunori; Koishi, Yoichi; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 33-40; In Japanese; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

A multibeam antenna system is being developed for mounting on the Wideband InterNetworking engineering test and

Demonstration Satellite (WINDS), the GIGA bit class communication satellite, slated for launch in 2008 by the Japan Aerospace Exploration Agency (JAXA). This paper describes the radio frequency (RF) characteristics of this antenna system.  
Author

*Broadband; Engineering Test Satellites; Satellite Networks; Communication Satellites; Multibeam Antennas; Aerospace Engineering*

**20080022174** National Inst. of Information and Communications Technology, Koganei, Japan

#### **Plan of Experiments**

Ohkawa, Mitsugu; Takahashi, Takashi; Yoshimura, Naoko; Hashimoto, Yukio; Suzuki, Ryutaro; Tomii, Naoya; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 109-115; In Japanese; See also [20080022166](#); Original contains color illustrations; Copyright; Avail.: Other Sources

Wideband InterNetworking engineering test and Demonstration Satellite was developed by Japan Aerospace Exploration Agency (JAXA) and National Institute of Information and Communications Technology (NICT). The experimental plan has two categories. One is a fundamental experiment which will be carried out by JAXA and NICT. The other is application experiment which will be conducted by several selected organization. NICT's experiment plan includes evaluating the performances of the onboard equipment, the earth station, fundamental transmission, high speed satellite networking communication, and the network application.

Author

*Satellite Networks; Satellite Communication; Broadband; Aerospace Engineering; Technology Assessment; Engineering Test Satellites*

**20080022175** National Inst. of Information and Communications Technology, Japan

#### **On-board Baseband Switch**

Yoshimura, Naoko; Hashimoto, Yukio; Takahashi, Takashi; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 25-31; In Japanese; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The National Institute of Information and Communications Technology (NICT) and the Japan Aerospace Exploration Agency (JAXA) have developed the Wideband InterNetworking engineering test and Demonstration Satellite (WINDS). NICT is in charge of developing the ATM-based baseband switching subsystem (ABS) for the WINDS satellite. The ABS enables high-speed, highly efficient regenerative switched connections between several beams. In the ABS, the demodulator part can process multiple data rate from 1.5 Mbps to 155 Mbps. The baseband switching part can be ATM-based switching data. We aim for efficient use of wireless link resource by statistical multiplexing effect.

Author

*Broadband; Satellite Networks; Satellite Communication; Wireless Communication; Onboard Equipment; Engineering Test Satellites; Aerospace Engineering*

**20080022176** Japan Aerospace Exploration Agency, Japan

#### **Communications System**

Shimada, Masaaki; Kuroda, Tomonori; Yajima, Masanobu; Ozawa, Satoru; Ogawa, Yasuo; Yokoyama, Mikio; Takahashi, Takashi; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 17-24; In Japanese; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

WINDS (Wideband InterNetworking engineering test and Demonstration Satellite) is an experimental satellite enabling communications at significantly higher data rates. The satellite employs advanced technologies such as high G/T multi-beam antennas, high power multi-port amplifier, active phased array antenna and regenerative baseband switching, to realize both very high data rate transmissions and advanced broadband satellite networking. The satellite communication system aims at maximum rate of 155 Mbps (receiving)/6 Mbps (transmitting) for home use using a 45-centimeter aperture antenna and ultra high speed of 1.2 Gbps (receiving/transmitting) for office use using a 5 meter class aperture antenna. In this paper, communications system and function and performance of transponders of the WINDS are introduced.

Author

*Broadband; Engineering Test Satellites; Satellite Networks; Satellite Communication; Aerospace Engineering; Systems Engineering*

**20080022177** Japan Aerospace Exploration Agency, Japan

**Ka band Active Phased Array Antenna**

Yajima, Masanobu; Kuroda, Tomonori; Maeda, Tsuyoshi; Shimada, Masaaki; Hasegawa, Takumi; Kitao, Shiro; Hariu, Kenichi; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 49-55; In Japanese; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The Active Phased Array Antenna (APAA) is one piece of mission equipment on the Wideband InterNetworking engineering test and Demonstration Satellite (WINDS); with a frequency of Ka band and a maximum data rate of 1.2 Gbps communication will be realized by APAA. It consists of 128 antenna elements and many extremely miniaturized radio frequency (RF) modules. It can scan two beams of a transmitting antenna and a receiving antenna electronically and independently. The WINDS service area covers almost all of the world which is a visible region from the satellite by APAA. This paper introduces the role of APAA, its background, functions, key technologies, and major specifications, and describes development results.

Author

*Antenna Arrays; Phased Arrays; Broadband; Engineering Test Satellites; Radio Frequencies; Extremely High Frequencies; Communication Satellites; Satellite Networks*

**20080022178** National Inst. of Information and Communications Technology, Tokyo, Japan

**WINDS Network Data Gathering System**

Takahashi, Takashi; Yoshimura, Naoko; Hashimoto, Yukio; Ohkawa, Mitsugu; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 79-81; In English; See also [20080022166](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) network data gathering system has received several kinds of network data such as telemetry from the satellite, the network configuration data, and so on. Those data are sent from the WINDS network management center in Japan Aerospace Exploration Agency (JAXA) Tsukuba Space Center through the leased line. The WINDS network data gathering system has several functions, such as a display function of the trend graph, data search function, and so on.

Author

*Broadband; Engineering Test Satellites; Satellite Communication; Satellite Networks; Aerospace Engineering; Systems Engineering*

**20080022179** National Inst. of Information and Communications Technology, Japan

**Overview of the Wideband Internet Engineering Test and Demonstration Satellite Project**

Kadowaki, Naoto; Suzuki, Ryutaro; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 3-8; In English; See also [20080022166](#); Original contains color illustrations; Copyright; Avail.: Other Sources

Wideband InterNetworking engineering test and Demonstration Satellite was developed by Japan Aerospace Exploration Agency (JAXA) and National Institute of Information and Communications Technology (NICT). The experimental plan has two categories. One is a fundamental experiment which will be carried out by JAXA and NICT. The other is application experiment which will be conducted by several selected organizations. NICT's experiment plan includes evaluating the performances of the onboard equipment, the earth station, fundamental transmission, high speed satellite networking communication, and the network application.

Author

*Communication Networks; Satellite Communication; Satellite Networks; Aerospace Engineering; Technology Assessment*

**20080022180** National Inst. of Information and Communications Technology, Japan

**High-Speed Burst Modem for Bent Pipe Relay Mode**

Hashimoto, Yukio; Takahashi, Takashi; Yoshimura, Naoko; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 67-78; In English; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The 622 Mbps/1244 Mbps dual rate satellite switched-time division multiple access (SS-TDMA) terminal is developed for the high-speed network of the Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) bent-pipe mode. This terminal is consisted of a high-speed burst modem, a digital terminal that is a burst and communication controller,



a router and a transmission control protocol (TCP) accelerator. In addition at Kashima earth station, the receiver of the 155 Mbps reference burst transmitted Japan Aerospace Exploration Agency (JAXA) standard station is provided. We have developed the high-speed burst modem and digital terminal. The 155 Mbps reference receiver was supplied the same equipment using the JAXA standard station. The router and the TCP accelerator will be supplied from commercial goods. The high-speed burst modem is a digital modem of Quadrature Phase Shift Keying and the transmission rate of 1648 Mbps as the user data rate of 1244 Mbps. And the modem has another mode working a half rate clock for the transmission rate of 824 Mbps as the user data rate of 644 Mbps. In this mode, two carriers can be used for upper and lower band of the WINDS transponder. The ground tests using 622 Mbps prototype burst modem with RF equipments of the earth station and the WINDS transponder showed good results that the Eb/No is less than 10dB at the bit error rate (BER) of  $10(\exp-10)$ .

Author

*Modems; High Speed; Satellite Networks; Satellite Communication; Earth Terminals; Transponders; Broadband; Engineering Test Satellites; Aerospace Engineering; Systems Engineering*

**20080022181** Japan Aerospace Exploration Agency, Japan

#### **Earth Stations for WINDS Regenerative Communication Mode**

Ogawa, Yasuo; Shimada, Masaaki; Yokoyama, Mikio; Luroda, Tomonori; Fujiwara, Yuuichi; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 93-98; In Japanese; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) has two communications modes. One of them is a regenerative communication mode. Japan Aerospace Exploration Agency (JAXA) is developing Ultra Small Aperture Terminal (USAT) and Very Small Aperture Terminal (VSAT) for this mode. This paper describes the characteristics and functions of these earth stations for WINDS.

Author

*Ground Stations; Broadband; Engineering Test Satellites; Satellite Communication; Satellite Networks*

**20080022182** Japan Aerospace Exploration Agency, Japan

#### **Development of Network Management Center for WINDS**

Ogawa, Yasuo; Yokoyama, Mikio; Tomonori, Kuroda; Fujiwara, Yuuichi; Shimada, Masaaki; Review of the National Institute of Information and Communications Technology, Volume 53, No. 4; December 2007, pp. 83-91; In Japanese; See also [20080022166](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The Japan Aerospace Exploration Agency (JAXA) is developing an earth station which has communication controller and circuit-switched capabilities for the Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) communication experiment system. This station is installed in the JAXA Tsukuba Space Center, and operates as a control center for the experiment system. This paper describes the characteristics and functions of this station.

Author

*Network Control; Broadband; Engineering Test Satellites; Satellite Communication; Satellite Networks; Aerospace Engineering; Systems Engineering*

**20080022197** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

#### **Radiation Characteristics of Reflectarray Antennas: Methodology and Applications to Dual Configurations**

Khayatian, Behrouz; Rahmat-Samii, Yahya; Huang, John; November 6, 2006; 6 pp.; In English; EuCAP 2006: European Conference on Antennas and Propagation, 6-10 Nov. 2006, Nice, France; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40774>

Reflectarrays combines key features of large reflectors and phased array elements to generate a collimated beam as required in high gain antennas. In reflectarrays, a large flat reflecting surface with many resonant patch elements is illuminated by a feed (or by a feed/subreflector in dual reflector configuration). In many space applications, reflectarrays applications can be advantageous because their large surface can be folded or rolled as a part of spacecraft payload before being deployed. Consequently, a reflectarray can significantly reduce both volume and mass requirements in space deployment. To optimize reflectarray antenna performance, a phase correction mechanism must be applied to its individual array elements some of which are well documented in the literatures. In this study, we attempt to extend analytical techniques in reflector analysis to reflectarrays by introducing a number of approaches to estimate the reflectarray antenna performance independent of its phase compensation mechanism. In one approach, a Physical Optics (PO) current will be assigned to the surface of individual



reflectarray elements upon which a phase correction will be applied. In the second approach, a transmit/receive (TX/RX) radiation characteristics will be assigned to individual reflectarray elements from which coupling coefficients will be calculated and assigned as the excitation coefficient of individual elements. PO approach is modeled in the UCLA reflector code while coupling (TX/RX) method is implemented in both UCLA code as well as TICRA (GRASP) software. Results are presented for single and dual configurations with the main reflector as a reflectarray. The approach described is used to design a 3-m Cassegrain offset-fed configuration for dual X/Ka-bands application.

Author

*Antenna Arrays; Reflector Antennas; Superhigh Frequencies; Phased Arrays; Coupling Coefficients; Cassegrain Optics; Reflectors; Physical Optics; High Gain*

**20080022262** Army Research Inst., Alexandria, VA USA

### **Automated Feedback and Situation Awareness in Net-Centric C3**

Barnett, John S; Ross, Jennifer M; Feb 2008; 39 pp.; In English

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A478164; TR-1223; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of net-centric warfare (NCW) is to give soldiers an information advantage that leads to a war-fighting advantage. However, NCW systems are quite complex and dynamic, characteristics which can lead to impaired situation awareness (SA) and increased mental workload. It has been suggested that an automated alerting system would help Soldiers focus their attention on mission critical events. This series of experiments investigated how automated audio-visual alerts affect user SA and perceived workload. Two similar experiments were conducted. In each experiment, participants viewed a simulation of a net-centric system, the Force XXI Battle Command Brigade and Below (FBCB2), which included an automated alerting system. SA and workload were measured both with the alerting system enabled and disabled. In the second study, the difficulty of the monitoring task was increased and the automated alerts included a pop-up pictorial representation of the critical event. Results indicate that automated alerting systems do not improve user SA, but they also do not impair user SA. However, mental workload was significantly lower when alerts were enabled. These results can be used to aid decisions about whether or not to include automated alerts in NCW systems.

DTIC

*Command and Control; Feedback; Warning Systems*

## 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*.

**20080021261** NASA Langley Research Center, Hampton, VA, USA

### **TEM Cell Testing of Cable Noise Reduction Techniques From 2 MHz to 200 MHz - Part 1**

Bradley, Arthur T.; Evans, William C.; Reed, Joshua L.; Shimp, Samuel K.; Fitzpatrick, Fred D.; January 2008; 4 pp.; In English; 2008 Asia Pacific EMC Symposium, 19-23 May 2008, Singapore, Singapore; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 811073.02.09.02.10; Copyright; Avail.: CASI: [A01](#), Hardcopy

This paper presents empirical results of cable noise reduction techniques as demonstrated in a TEM cell operating with radiated fields from 2 - 200 MHz. It is the first part of a two-paper series. This first paper discusses cable types and shield connections. In the second paper, the effects of load and source resistances and chassis connections are examined. For each topic, well established theories are compared to data from a real-world physical system. Finally, recommendations for minimizing cable susceptibility (and thus cable emissions) are presented. There are numerous papers and textbooks that present theoretical analyses of cable noise reduction techniques. However, empirical data is often targeted to low frequencies (e.g. <50 KHz) or high frequencies (>100 MHz). Additionally, a comprehensive study showing the relative effects of various noise reduction techniques is needed. These include the use of dedicated return wires, twisted wiring, cable shielding, shield connections, changing load or source impedances, and implementing load- or source-to-chassis isolation. We have created an experimental setup that emulates a real-world electrical system, while still allowing us to independently vary a host of parameters. The goal of the experiment was to determine the relative effectiveness of various noise reduction techniques when the cable is in the presence of radiated emissions from 2 MHz to 200 MHz. The electronic system (Fig. 1) consisted of two

Hammond shielded electrical enclosures, one containing the source resistance, and the other containing the load resistance. The boxes were mounted on a large aluminium plate acting as the chassis. Cables connecting the two boxes measured 81 cm in length and were attached to the boxes using standard D38999 military-style connectors. The test setup is shown in Fig. 2. Electromagnetic fields were created using an HP8657B signal generator, MiniCircuits ZHL-42W-SMA amplifier, and an EMCO 5103 TEM cell. Measurements were taken using an Agilent E4401B spectrum analyzer and HP1141a differential probes.

Author

*Noise Reduction; Signal Generators; Spectrum Analysis; Wiring; Shielding; Low Frequencies; Connectors*

**20080021303** NASA Langley Research Center, Hampton, VA, USA

**TEM Cell Testing of Cable Noise Reduction Techniques from 2 MHz to 200 MHz -- Part 2**

Bradley, Arthur T.; Evans, William C.; Reed, Joshua L.; Shimp, Samuel K., III; Fitzpatrick, Fred D.; January 2008; 4 pp.; In English; Asia-Pacific Symposium on Electromagnetic Compatibility, 19-22 May 2008, Singapore, Singapore; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

This paper presents empirical results of cable noise reduction techniques as demonstrated in a TEM cell operating with radiated fields from 2 - 200 MHz. It is the second part of a two-paper series. The first paper discussed cable types and shield connections. In this second paper, the effects of load and source resistances and chassis connections are examined. For each topic, well established theories are compared to data from a real-world physical system. Finally, recommendations for minimizing cable susceptibility (and thus cable emissions) are presented. There are numerous papers and textbooks that present theoretical analyses of cable noise reduction techniques. However, empirical data is often targeted to low frequencies (e.g. <50 KHz) or high frequencies (>100 MHz). Additionally, a comprehensive study showing the relative effects of various noise reduction techniques is needed. These include the use of dedicated return wires, twisted wiring, cable shielding, shield connections, changing load or source impedances, and implementing load- or source-to-chassis isolation. We have created an experimental setup that emulates a real-world electrical system, while still allowing us to independently vary a host of parameters. The goal of the experiment was to determine the relative effectiveness of various noise reduction techniques when the cable is in the presence of radiated emissions from 2 MHz to 200 MHz.

Author

*Wiring; Shielding; Noise Reduction; High Frequencies; Low Frequencies*

**20080021369** Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

**Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics**

Chen, Shi-Shuenn, Editor; November 2007; ISSN 0253-3839; 192 pp.; In English; See also 20080021370 - 20080021383; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: The Next-Generation Medium-Voltage Power Conversion Systems; Evaluation of Various Adaptive Voltage Positioning (AVP) Schemes for Computer Power Sources; A Versatile Three-Phase DC-DC Converter Circuit for Fuel Cell Applications; Self-Constructing Sugeno Type Adaptive Fuzzy Neural Network for Two-Axis Motion Control System; A Parallel-APF System with Current Sharing Controller and Load-Path Control Center to Improve Dynamic Response and Achieve Weighting Current Distribution; Adaptive Controller Design for a Synchronous Reluctance Drive Considering Saturation; Predictive Control of Three-Phase PWM Rectifier with Active Filtering; A 24-Pulse Diode Rectifier with Coupled Three-Phase Reactor; A Probabilistic Approach to Optimizing Power Rating of Interline Power Flow Controllers in Distributed Generation Power Systems; A Novel Single-Stage Parallel High Power Factor Correction AC/DC Flyback Converter: Dynamics and Control; FPGA Realization of Adaptive Speed Control IC for PMSM Drive; Analysis and Controller Design of a Novel Zero-Voltage-Switching PWM Push-Pull DC-DC Converter; Self-Load Bank Burn-In Test with Voltage-Controlled Regulator for Three-Phase Induction Motor Drives; and A Multiple-Input Multiple-Output Power Converter with Efficient Power Management.

Derived from text

*Adaptive Control; Field-Programmable Gate Arrays; Current Distribution; Power Converters; Voltage Converters (DC to DC); MIMO (Control Systems); Electric Potential; Dynamic Control; Voltage Regulators*

**20080021370** National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

**Adaptive Controller Design for a Synchronous Reluctance Drive Considering Saturation**

Liu, Tian-Hua; Lin, Ming-Tsan; Chang, Chin-Lung; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1177 - 1186; In English; See also [20080021369](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC-95-2221-E-011-189; Copyright; Avail.: Other Sources

This paper proposes the adaptive controller design for maximum torque control of a synchronous reluctance drive system in which the saturation effect is considered. First, the saturation effect of the d-axis and the q-axis inductances is discussed and modelled. Next, a systematic maximum torque control method is developed under the model including saturation. After that, an adaptive controller is proposed to improve the dynamic responses. Both the closed-loop adjustable speed control system and closed-loop position control system are implemented. A 32 bit Digital Signal Processing (DSP), TMS 320-C30, is used to execute the speed and position control algorithms. As a result, the hardware circuit is quite simple. Experimental results show that the system has satisfactory performance, including transient responses, load disturbance responses, and tracking responses. The measured results can validate the correctness of the theoretical analysis. This paper presents a new control method for a synchronous reluctance motor.

Author

*Adaptive Control; Feedback Control; Reluctance; Speed Control; Torque; Control Systems Design*

**20080021371** Tokyo Inst. of Tech., Tokyo, Japan

**The Next-Generation Medium-Voltage Power Conversion Systems**

Akagi, Hirofumi; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1117 - 1135; In English; See also [20080021369](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper describes the next-generation medium voltage power conversion systems based on transformerless cascade Pulse Width Modulation (PWM) converters and bidirectional isolated dc-dc converters. A 350-V, 10-kW and 20-kHz dc-dc converter is designed, constructed and tested as a core circuit for medium-voltage power conversion systems. It consists of two single-phase full-bridge converters using eight Insulated Gate Bipolar Transistors (IGBTs) and a 20-kHz transformer with a nano-crystalline soft-magnetic material core and litz wires. The transformer plays an essential role in achieving galvanic isolation between the two full-bridge converters. The overall efficiency from the dc-input to dc-output terminals is accurately measured to be as high as 97%. Loss analysis clarifies that the overall efficiency may reach 99% or higher when SiC-based power devices are used. In addition, this paper presents the 6.6-kV transformerless STATCOM (STATIC synchronous COMPensator) intended for achieving reactive-power control in industrial and distribution power systems. It is characterized by direct connection to the 6.6-kV grids, thus bringing significant reductions in cost, weight and size to the 6.6-kV STATCOM.

Author

*Electric Potential; Voltage Converters (DC to DC); Power Supply Circuits*

**20080021372** Naval University of Gdynia, Gdynia, Poland

**A 24-Pulse Diode Rectifier with Coupled Three-Phase Reactor**

Mysiak, Piotr; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1197 - 1212; In English; See also [20080021369](#); Copyright; Avail.: Other Sources

The article presents the principle of operation, design method, and results of laboratory and simulation tests of a 24-pulse power network converter system with direct-current voltage output, the concept and practical realization of which was worked out within the framework of a research project financed by the State Committee for Scientific Research. The paper concerns the up-to-date topic of power-electronic conversion of alternating current power drawn from a supply line, without any negative effect of a converter on this line. The presented converter allows significant reduction of undesirable higher harmonics in the power network current, including the elimination of harmonics of orders of 23 and 25. The 24-pulse nature of operation of the system is obtained using three sets of coupled three-phase power network reactors (CTR).

Author

*Diodes; Power Converters; Power Reactors; Rectifiers*

**20080021373** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**Analysis and Controller Design of a Novel Zero-Voltage-Switching PWM Push-Pull DC-DC Converter**

Lin, Jong-Lick; Wang, Chiou-Feng; Hsieh, Jen-Cheng; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1251 - 1265; In English; See also [20080021369](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC 95-2221-E0006-461; Copyright; Avail.: Other Sources

In this work, based on the bridge-type push-pull converter, the ZVS-PWM technology is applied to design a novel zero-voltage-switching (ZVS) PWM push-pull dc-dc converter. In the proposed converter, two auxiliary switches are used to control the resonant occurrences. The converter is constant-frequency operation. Both of the main switches of the proposed converter thereby achieve zero-voltage-switching and the maximum efficiency of the converter is close to 92%. The small-signal model of the proposed converter based on the averaging method is then derived. Notably, the dynamic behavior of the ZVS-PWM push-pull converter is better than that of the conventional push-pull converter. The accuracy of theoretical analysis is verified by simulation and experimental results. Finally, a phase-lead-plus-integral controller and a minor-loop controller are designed for output voltage regulation. The proposed converter with minor-loop controller has better performances than with phase-lead-plus-integral controller under various input voltage and load variations.

Author

*Controllers; Dynamic Characteristics; Electric Potential; Voltage Converters (DC to DC); Control Systems Design; Direct Current; Push-Pull Amplifiers*

**20080021374** Da-Yeh Univ., Chang-Hua, Taiwan, Province of China

**A Multiple-Input Multiple-Output Power Converter with Efficient Power Management**

Chung, Yi-Nung; Lin, Deng-Chung; Tseng, Kuo-Ching; Wang, Cheng-Wei; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1277 - 1286; In English; See also [20080021369](#)

Contract(s)/Grant(s): NSC 93-2622-E-212-018-CC3; Copyright; Avail.: Other Sources

In order to use renewable energy effectively, a multiple-input multiple-output power converter using the Flyback structure is developed in this paper. In this design, line power, solar energy, and a battery are used as input power sources. The output provides power to different loads and to charge a battery also. In the usual situation, the solar energy is used as the primary source. If the solar energy is insufficient, then the reserved energy in the battery is used to supply the loads. When both the battery and solar energy are insufficient, the system model switches to the power grid for supplying loads. This development uses a transformer together with a single chip controller to control the input activation and output feedback control. With the single chip controller, one transformer can achieved multiple-input to multiple-output functions which significantly reduce the volume and weight of the entire system, thereby achieving the goal of its being light, thin, short and small.

Author

*Controllers; MIMO (Control Systems); Solar Energy; Control Systems Design; Automatic Control; Electric Control*

**20080021375** Naval University of Gdynia, Gdynia, Poland

**Predictive Control of Three-Phase PWM Rectifier with Active Filtering**

Wojciechowski, Daniel; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1187-1195; In English; See also [20080021369](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The paper discusses an AC voltages sensorless predictive control system of Three-phase Pulse-Width Modulator (PWM) rectifier with active filtering. The proposed control system was designed to maximize active filtering effectiveness in a steady state. Grid currents are controlled by using a model based predictive controller. Set grid currents are calculated by using a predictive algorithm based on instantaneous powers theory. In both algorithms the grid voltage is required, which is in general distorted and unbalanced. For this purpose, a novel estimator and predictor of grid voltage is applied. DC voltage control is realized by the nonlinear structure of the variable gain PI controller. It assures fast control in transient states during changes of DC load as well as low gain in steady state oscillations of DC voltage related to active filtering. Simulations and experimental results that are presented in the paper confirm very precise, effective and grid voltage distortion independent parallel active filtering capabilities for the proposed control system.

Author

*Modulators; Pulse Duration; Rectifiers; Active Control; Power Efficiency*



**20080021376** Zielona Gora Univ., Zielona Gora, Poland

**A Probabilistic Approach to Optimizing Power Rating of Interline Power Flow Controllers in Distributed Generation Power Systems**

Benysek, Grzegorz; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1213 - 1221; In English; See also [20080021369](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

High-power electronic converter topologies, in such forms as Unified Power Flow Controllers (UPFC), Static Compensators (STATCOM) and Interline Power Flow Controllers (IPFC), have been used to enhance and optimize the use of transmission facilities, under the concept of a flexible ac transmission system (FACTS). In Europe, the anticipated proliferation of distributed-generation (DG) in the near future, driven by governmental initiatives and the European Commission's Framework Programs, has prompted new interests in the reliability and economy of power delivery and interconnection at the lower sub-station level of 15kV. This paper investigates the use of IPFC, which are dc/ac converters linked by common DC terminals, in a DG-power system from an economy perspective. By using a probabilistic approach, it can be shown that the power ratings of parallel active power filters used in the IPFC are considerably reduced from those of the deterministic approach, when reliability is not compromised. Analytical predications, and experimental measurements at a 15kV substation fed by a number of wind generators, confirm the validity of the proposed approach.

Author

*Alternating Current; Controllers; Inverted Converters (DC to AC); Ratings; Current Regulators*

**20080021377** National Chung-Cheng Univ., Ming-Hsiung Chin Yi, Taiwan, Province of China

**A Parallel-APF System with Current Sharing Controller and Load-Path Control Center to Improve Dynamic Response and Achieve Weighting Current Distribution**

Nien, Hung-Shou; Wu, Tsai-Fu; Tsai, Jiun-Ren; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1167 - 1176; In English; See also [20080021369](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper presents design and implementation of a paralleled active power filter (APF) system with current sharing controller (CSC) and load-path control center (LPCC). This system can filter harmonic currents, compensate reactive power and improve power factor. In the system, each APF module is directly tied to the load, source and buses, and there is no communication between modules. Through CSC and LPCC, the modules can share the total reactive and harmonic currents of the load according to their power ratings. With the proposed control scheme, power capacity of the system can be readily and flexibly expanded. Since there is no communication between modules, system expandability and flexibility will increase, and a hot-swap feature can be readily achieved. Simulation and experimental results have verified the feasibility and performance of the proposed parallel-APF system.

Author

*Controllers; Current Distribution; Dynamic Response; Active Control; Electric Switches; Electric Current*

**20080021378** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

**A Versatile Three-Phase DC-DC Converter Circuit for Fuel Cell Applications**

Lai, Jih-Sheng; Moon, Seung-Ryul; Kim, Raeyoung; Lin, Feng-Yuan; Liu, Yu-Hsuan; Lin, Ming-Hsien; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1145 - 1152; In English; See also [20080021369](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

Multiphase dc-dc converters allow current sharing among phases and high-frequency ripple cancellation and are very desirable for low-voltage high-power fuel cell applications. In this paper, a versatile three-phase dc-dc converter circuit as a building block is proposed for different output voltage levels including non-isolated 48 V for telecom and isolated 400 V for subsequent stage dc-ac inverter applications. For either type of application, the proposed three-phase converter circuit is controlled by the same complementary gating control that allows synchronous rectification for the non-isolated version and zero-voltage soft switching for the isolated version. Two sets of 5-kW converters have been built and tested with a fuel cell simulator. Experimental results are given to show the superiority of the efficiency performance in two different applications.

Author

*Electric Potential; Fuel Cells; Voltage Converters (DC to DC)*



**20080021379** Southern Taiwan Univ. of Technology, Tainan, Taiwan, Province of China

**FPGA Realization of Adaptive Speed Control IC for PMSM Drive**

Kung, Ying-Shieh; Wang, Ming-Shyan; Chuang, Chun-Ling; Huang, Chung-Chun; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1237 - 1249; In English; See also [20080021369](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper presents an adaptive speed control IC for use in a PMSM (Permanent Magnet Synchronous Motor) drive based on FPGA (Field Programmable Gate Array) technology. Firstly, PMSM is mathematically modelled and the vector control scheme is introduced in the current loop of the PMSM drive. Secondly, to increase the performance of the PMSM drive, an AFC (Adaptive Fuzzy Controller) constructed by a fuzzy basis function and a parameter adjustable mechanism is derived and applied to the speed loop of a PMSM drive to cope with the effect of the system dynamic uncertainty and external load. Thirdly, a proposed adaptive speed control IC based on the FPGA is employed to realize the aforementioned current vector controller and adaptive speed controller of PMSM drive. In addition, a FSM (Finite State Machine with a Datapath) is presented to model the overall AFC algorithm. As a result, a fully digital controller, including the AFC, the current vector scheme, SVPWM (Space Vector Pulse Width Modulation) generation, coordinate transformation and QEP (Quadrature Encoder Pulse) detection, for PMSM drive can be realized within a single FPGA chip. Finally, an experimental system is set up and some experimental results are demonstrated.

Author

*Adaptive Control; Controllers; Field-Programmable Gate Arrays; Permanent Magnets; Synchronous Motors; Control Systems Design*

**20080021380** National Central Univ., Chung-Li, Taiwan, Province of China

**Self-Constructing Sugeno Type Adaptive Fuzzy Neural Network for Two-Axis Motion Control System**

Lin, Faa-Jeng; Chou, Po-Huan; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1153 - 1166; In English; See also [20080021369](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC 95-2221-E-259-042-MY3; Copyright; Avail.: Other Sources

A self-constructing Sugeno type adaptive fuzzy neural network (SAFNN) control system is proposed in this study for the contour tracking control of a two-axis motion control system. The adopted two-axis motion control system is composed of two permanent magnet linear synchronous motors (PMLSMs). The proposed SAFNN combines the merits of a self-constructing fuzzy neural network (SCFNN) and a TSK-type fuzzy inference mechanism. Moreover, the structure and the parameter learning phases are performed concurrently and on line in the SAFNN. The structure learning is based on the partition of input space, and the parameter learning is based on the supervised gradient descent method using a delta adaptation law. Furthermore, the proposed control algorithms are implemented in a TMS320C32 DSP-based control computer. From the simulated and experimental results, the contour tracking performance of the two-axis motion control system is significantly improved and robustness can be obtained as well using the proposed SAFNN control system.

Author

*Network Control; Neural Nets; Synchronous Motors; Computer Networks; Fuzzy Systems*

**20080021381** National Taiwan Univ., Taipei, Taiwan, Province of China

**Evaluation of Various Adaptive Voltage Positioning (AVP) Schemes for Computer Power Sources**

Chen, Dan; Lee, Martin; Chen, Ching-Jan; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1137 - 1143; In English; See also [20080021369](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC 94-2213-E-002-122; Copyright; Avail.: Other Sources

The latest computer CPUs require the use of DC power converters with AVP. Three commonly-used AVP control schemes were compared using small-signal loop gain analysis. From the comparison results emerges the fourth scheme proposed recently: the Native current-mode AVP scheme (NAVP). NAVP provides inherent phase current balancing, cycle-to-cycle protection, large stability margin, good line regulation, and constant output impedance. It compares favorably against the other three schemes.

Author

*Electric Potential; Power Converters; Power Supply Circuits; Electric Power Supplies*

**20080021382** Southern Taiwan Univ. of Technology, Tainan, Taiwan, Province of China

**Self-Load Bank Burn-In Test with Voltage-Controlled Regulator for Three-Phase Induction Motor Drives**

Chu, Ching-Lung; Chan, Hsiao-Yen; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1267 - 1276; In English; See also [20080021369](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC 94-2213-E-218-031; Copyright; Avail.: Other Sources

In order to save energy and reduce the test costs for motor drives, this paper proposes a novel self-load bank that uses a circulating current method to perform the burn-in test on three-phase induction motor drives. The voltage-controlled regulator is operated in parallel with the tested unit and controls the tested output current in a manner similar to the operation characteristics of an induction motor load. The tested output current controlled by the regulator simply recycles between the input and output terminals of the tested unit, and does not feed back to the utility system. The rated capacity of the voltage-controlled regulator of this proposed burn-in test system is smaller than that of the tested unit. This proposed burn-in testing system will result in a frequency difference between the tested unit and the utility system. Experimental results show that by using a directly connected RL or motor load, the energy saved in the burn-in test is approximately 80% of that lost by the conventional method.

Author

*Burn-In; Induction Motors; Voltage Regulators; Electric Power Supplies*

**20080021383** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**A Novel Single-Stage Parallel High Power Factor Correction AC/DC Flyback Converter: Dynamics and Control**

Lin, Jong-Lick; Huang, Shuo-Kuo; Hsieh, Jen-Cheng; Journal of The Chinese Institute of Engineers, Volume 30, No. 7. Transactions of the Chinese Institute of Engineers, Series A. Special Issue: Power Electronics; November 2007, pp. 1223 - 1235; In English; See also [20080021369](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC 95-2221-E0006-461; Copyright; Avail.: Other Sources

Based on the structure of parallel power factor correction, a novel single-stage parallel high power factor correction AC/DC flyback converter is proposed in this paper. By use of a transformer with a tertiary winding, the novel converter inherently possesses a high power factor. It has low voltage stress across the bulk capacitor at light loads. In this paper, the operation principle of the proposed converter is analyzed, and then the AC small-signal mathematical model is derived by averaging method. PI and sliding mode controllers are designed to achieve output voltage regulation on the basis of the derived model. The experimental measurements are provided to verify the accuracy of the theoretical analysis. It is shown that both controllers can regulate the output voltage under line and load variations. The inherent capacity for high power factor correction of the overall system is still maintained.

Author

*Alternating Current; Control Systems Design; Dynamic Control; Current Converters (AC to DC); Power Factor Controllers; Current Regulators*

**20080021395** Army Research Lab., Adelphi, MD USA

**Thermal Simulation of Four Die-Attach Materials**

Ovrebø, Gregory K; Jan 2008; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477372; ARL-MR-0686; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We performed a time-dependent simulation of thermal transfer in a circuit board, comparing the effects of using four different die-attach materials with high-power silicon carbide diodes. This simulation attempted to reproduce the results of a laboratory experiment in which thermal measurements were made of circuit boards under a time-varying load.

DTIC

*Dies; Electrical Resistivity; Simulation; Thermal Simulation; Thermodynamic Properties*

**20080021489** Park, Vaughan and Fleming, LLP, Davis, CA, USA

**Floating Input Amplifier for Capacitively Coupled Communication**

Drost, R. J., Inventor; Ho, R., Inventor; Sutherland, I. E., Inventor; 28 Jun 04; 17 pp.; In English

Contract(s)/Grant(s): NBCH020055

Patent Info.: Filed 28 Jun 04; US-Patent-Appl-SN-10-879-606

Report No.(s): PB2007-110134; No Copyright; Avail.: CASI: [A03](#), Hardcopy

One embodiment of the present invention provides a capacitively-coupled receiver amplifier that has an input with no DC

coupling. A DC voltage is programmed on the input. During programming, a transmitter is held at a voltage at a midpoint between a voltage that represents a logical '1' and a voltage that represents a logical '0' and the input voltage of the receiver amplifier is programmed to be substantially the switching-threshold voltage for the receiver amplifier. Then, during normal data communication, the transmitter drives high and low electrical signals that are coupled to the receiver amplifier. Since the input of the receiver amplifier has been substantially set to the DC voltage, the receiver amplifier need not control the DC voltage of the input for each transition in the electrical signals.

NTIS

*Floating; Patent Applications; Amplifiers; Telecommunication*

**20080021490** Honeywell International, Inc., Morristown, NJ, USA

**Novel Conductor Geometry for Electronic Circuits Fabricated on Flexible Substrates**

Roush, J. A., Inventor; Schmidt, J. F., Inventor; Dood, S. R., Inventor; 16 Jun 04; 12 pp.; In English

Contract(s)/Grant(s): MDA972-00-C-0005

Patent Info.: Filed Filed 16 Jun 04; US-Patent-Appl-SN-10-869-404

Report No.(s): PB2007-110133; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A flexible conductor formed on a flexible substrate. In one embodiment, a semiconductor device is disclosed. The semiconductor device comprises a periodic structure of islands and at least one conductor. The at least one conductor comprises a series of repeating geometric features affixed to the periodic structure of islands. The geometric features of the conductor are adapted to stretch the conductor rather than break the conductor when the substrate is bent.

NTIS

*Circuits; Conductors; Fabrication; Patent Applications; Substrates*

**20080021491** Hall [David R.], Provo, UT, USA

**Downhole Transmission System. PAT-APPL-10-878-146**

Hall, D. R., Inventor; Hall, T., Inventor; 28 Jun 04; 19 pp.; In English

Contract(s)/Grant(s): DE-FC26-01 NT41229

Patent Info.: Filed Filed 28 Jun 04; US-Patent-Appl-SN-10-878-146

Report No.(s): PB2007-110130; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A transmission system in a downhole component comprises a data transmission element in both ends of the downhole component. Each data transmission element houses an electrically conducting coil in a MCEI circular trough. The electrically conducting coil comprises at least two generally fractional loops. In the preferred embodiment, the transmission elements are connected by an electrical conductor. Preferably, the electrical conductor is a coaxial cable. Preferably, the MCEI trough comprises ferrite. In the preferred embodiment, the fractional loops are connected by a connecting cable. In one aspect of the present invention, the connecting cable is a pair of twisted wires. In one embodiment the connecting cable is a shielded pair of twisted wires. In another aspect of the present invention, the connecting cable is a coaxial cable. The connecting cable may be disposed outside of the MCEI circular trough.

NTIS

*Data Transmission; Patent Applications*

**20080021492** Hall [David R.], Provo, UT, USA

**Downhole Transmission System. PAT-APPL-10-878-193**

Hall, D. R., Inventor; Fox, J., Inventor; 28 Jun 04; 23 pp.; In English

Contract(s)/Grant(s): DE-FC26-01 NT41229

Patent Info.: Filed Filed 28 Jun 04; US-Patent-Appl-SN-10-878-193

Report No.(s): PB2007-110129; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A transmission system in a downhole component comprises a data transmission element in both ends of the downhole component. Each data transmission element houses an electrically conducting coil in a MCEI circular trough. An electrical conductor connects both the transmission elements. The electrical conductor comprises at least three electrically conductive elements insulated from each other. In the preferred embodiment the electrical conductor comprises an electrically conducting outer shield, an electrically conducting inner shield and an electrical conducting core. In some embodiments of the present

invention, the electrical conductor comprises an electrically insulating jacket. In other embodiments, the electrical conductor comprises a pair of twisted wires. In some embodiments, the electrical conductor comprises semi-conductive material.

NTIS

*Data Transmission; Patent Applications*

**20080021574** Hall (David R.), Provo, UT, USA

**Downhole Transmission System Comprising a Coaxial Capacitor**

Hall, D. R., Inventor; Pixton, D. S., Inventor; Johnson, M. L., Inventor; Bartholomew, D. B., Inventor; Hall, T., Inventor; 28 Jun 04; 27 pp.; In English

Contract(s)/Grant(s): DE-FC26-01NT41229

Patent Info.: Filed Filed 28 Jun 04; US-Patent-Appl-SN-11-878-242

Report No.(s): PB2007-110128; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A transmission system in a downhole component comprises a plurality of data transmission elements. A coaxial cable having an inner conductor and an outer conductor is disposed within a passage in the downhole component such that at least one capacitor is disposed in the passage and having a first terminal coupled to the inner conductor and a second terminal coupled to the outer conductor. Preferably the transmission element comprises an electrically conducting coil. Preferably, within the passage a connector is adapted to electrically connect the inner conductor of the coaxial cable and the lead wire. The coaxial capacitor may be disposed between and in electrical communication with the connector and the passage. In another embodiment a connector is adapted to electrical connect a first and a second portion of the inner conductor of the coaxial cable and a coaxial capacitor is in electrical communication with the connector and the passage.

NTIS

*Capacitors; Data Transmission; Coaxial Cables; Electronic Equipment*

**20080021736** Intelliserv, Inc., Houston, TX, USA

**Loaded Transducer for Downhole Drilling Components**

Hall, D. R., Inventor; Fox, J., Inventor; Daly, J. E., Inventor; 29 Aug. 05; 14 pp.; In English

Contract(s)/Grant(s): DE-FC26-01NT41229

Patent Info.: Filed Filed 29 Aug. 05; US-Patent-Appl-SN-11-162-103

Report No.(s): PB2007-110137; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system for transmitting information between downhole components has a first downhole component with a first mating surface and a second downhole component having a second mating surface configured to substantially mate with the first mating surface. The system also has a first transmission element with a first communicating surface and is mounted within a recess in the first mating surface. The first transmission element also has an angled surface. The recess has a side with multiple slopes for interacting with the angled surface, each slope exerting a different spring force on the first transmission element. A second transmission element has a second communicating surface mounted proximate the second mating surface and adapted to communicate with the first communicating surface.

NTIS

*Drilling; Patent Applications; Transducers*

**20080021743** UT Battelle, LLC, Oak Ridge, TN, USA

**Method of Making Cascaded Die Mountings with Springs-Loaded Contact-Bond Options**

Hsu, J. S., Inventor; Adams, D. J., Inventor; Su, G. J., Inventor; Marlino, L. D., Inventor; Ayers, C. W., Inventor; 29 Apr. 05; 13 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Patent Info.: Filed Filed 29 Apr. 05; US-Patent-Appl-SN-11-119-328

Report No.(s): PB2007-111070; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A cascaded die mounting device and method using spring contacts for die attachment, with or without metallic bonds between the contacts and the dies, is disclosed. One embodiment is for the direct refrigerant cooling of an inverter/converter carrying higher power levels than most of the low power circuits previously taught, and does not require using a heat sink.

NTIS

*Dies; Integrated Circuits; Joints (Junctions); Patent Applications; Mounting*

**20080021744** Williams (Hovey), LLP, Kansas City, MO, USA

**Method of Creating Multi-Layered Monolithic Circuit Structure Containing Integral Buried and Trimmed Components**

Blazek, R. J., Inventor; Barner, G. E., Inventor; Bandler, S. W., Inventor; Eubank, E., Inventor; Uribe, F., Inventor; 17 Mar. 04; 6 pp.; In English

Contract(s)/Grant(s): DE-AC04-01AL66850

Patent Info.: Filed Filed 17 Mar. 04; US-Patent-Appl-SN-10-802-203

Report No.(s): PB2007-111069; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method of creating a multi-layered monolithic circuit structure wherein individual layers of standard alumina thick film ceramic substrate and the resistors, inductors, capacitors, and other circuit componentry printed thereon are fired, and the circuit componentry trimmed or otherwise adjusted to achieve a desired degree of precision prior to combining the layers with a thick film glass bonding agent to form the monolithic structure.

NTIS

*Integrated Circuits; Fabrication*

**20080021769** Stanford Linear Accelerator Center, CA, USA

**Gate Drive for High Speed, High Power IGBTs**

Nguyen, M. N.; Cassel, R. L.; deLamare, J. E.; Pappas, G. C.; January 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-908994; SLAC-PUB-12591; No Copyright; Avail.: National Technical Information Service (NTIS)

A new gate drive for high-voltage, high-power IGBTs has been developed for the SLAC NLC (Next Linear Collider) Solid State Induction Modulator. This paper describes the design and implementation of a driver that allows an IGBT module rated at 800A/3300V to switch up to 3000A at 2200V in 3mS with a rate of current rise of more than 10000A/mS, while still being short circuit protected. Issues regarding fast turn on, high de-saturation voltage detection, and low short circuit peak current will be presented. A novel approach is also used to counter the effect of unequal current sharing between parallel chips inside most high-power IGBT modules. It effectively reduces the collector-emitter peak current, and thus protects the IGBT from being destroyed during soft short circuit conditions at high di/dt.

NTIS

*Bipolar Transistors; Gates (Circuits); High Speed*

**20080021795** California Univ., Berkeley, CA, USA

**Disposal of Hazardous Cathode Ray Tube Waste, Using a Biopolymer Modified Concrete System**

Kim, D., Inventor; Yen, T. F., Inventor; 27 Apr 05; 14 pp.; In English

Contract(s)/Grant(s): DE-AC26-01NT41307

Patent Info.: Filed Filed 27 Apr 05; US-Patent-Appl-SN-11-117-070

Report No.(s): PB2007-109178; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A structural material formed of concrete-like substances which includes lead-including sand embedded within the structural material. One aspect bind the lead-containing sand using the biopolymer and/or a cross-linking agent. The biopolymers can be Xanthan gum, guar gum, and/or Chitosan. Different materials can be used for the cross-linking agent including boric acid. The materials cause the lead to be bound within a matrix within the structure, and prevent the lead from leaching out.

NTIS

*Biopolymers; Cathode Ray Tubes; Concretes; Hazardous Wastes*

**20080021796** National Renewable Energy Lab., Golden, CO USA

**Zn/cu(inga)se2 Solar Cells Prepared by Vapor Phase zn Doping**

Ramanathan, K., Inventor; Hasoon, F. S., Inventor; Asher, S. E., Inventor; Dolan, J., Inventor; Keane, J. C., Inventor; 3 Sep 03; 16 pp.; In English

Contract(s)/Grant(s): DE-AC3699GO10093

Patent Info.: Filed Filed 3 Sep 03; US-Patent-Appl-SN-10-534-217

Report No.(s): PB2007-109179; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A process for making a thin film ZnO/Cu(InGa)Se sub 2 solar cell without depositing a buffer layer and by Zn doping from a vapor phase, comprising: depositing Cu(InGa)Se sub 2 layer on a metal back contact deposited on a glass substrate;



heating the Cu(InGa)Se sub 2 layer on the metal back contact on the glass substrate to a temperature range between about 100 C. to about 250 C.; subjecting the heated layer of Cu(InGa)Se sub 2 to an evaporant species from a Zn compound; and sputter depositing ZnO on the Zn compound evaporant species treated layer of Cu(InGa)Se sub 2.

NTIS

*Additives; Solar Cells; Thin Films; Vapor Phases*

**20080021886** Delaware Univ., Newark, DE USA

**Optoelectronic Circuits Using 2D and 3D Self-Collimation Photonic Crystals**

Prather, Dennis W; Jul 2007; 50 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0412

Report No.(s): AD-A477786; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477786>

In our effort to develop and demonstrate the design, fabrication, and experimental characterization of self-collimation photonic crystal devices (SCPhCs) in both 2D and 3D structures, we identified various tasks and goals towards achieving the proposed applications. Two-dimensional self collimation photonic crystal structures will be used for in-plane optical signal distribution and routing while three-dimensional structures will be used for out-plane signal distribution, to provide high-density optically interconnected optoelectronic PhC circuits to distribute the optical signal between various circuits and in different angles. As previously proposed we intend to fabricate 2D structures using III-V materials and 3D structures using Silicon, and later use flip-chip bonding to construct our optoelectronic circuit. Hence, In this phase we develop and refine 111-V lithography and etching processes, including ebeam and UV interferometric lithography, ICP etching, and Oxidation followed by HF undercut. We will also develop suitable growth techniques to obtain GaAs/AlGaAs layered structures for suspended PhC Devices.

DTIC

*Circuits; Collimation; Crystals; Electro-Optics; Integrated Circuits*

**20080021890** Rutgers - The State Univ., Piscataway, NJ USA

**1677V, 5.7 mohm.cm<sup>2</sup> 4H-SiC Bipolar Junction Transistors**

Zhang, Jiahui; Alexandrov, Petre; Zhao, Jian H; Burke, Terry; Nov 10, 2004; 14 pp.; In English

Contract(s)/Grant(s): DAAE07-02-C-L050

Report No.(s): AD-A477801; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477801>

This paper reports the development of high power 4H-SiC bipolar junction transistors (BJT) with both high blocking voltage and low specific on-resistance ( $R_{sp\_on}$ ). A single BJT cell with an active area of 0.61 mm<sup>2</sup> blocks up to  $V_{ceo} = 1677$  V and conducts up to 3.2 A ( $J_c = 525$  A/cm<sup>2</sup>) at a forward voltage drop of  $V(CE) = 3.0$ V, corresponding to a  $R_{sp\_on}$  of 5.7 m $\Omega$ .cm<sup>2</sup>. In 4H-SiC BJT research, this BJT set a record high value of  $V(BR)_2 / R(SP)_ON$  of 500 MW/cm<sup>2</sup>.

DTIC

*Bipolar Transistors; Junction Transistors; Silicon Carbides*

**20080022041** Colorado State Univ., Fort Collins, CO USA

**Electronically Induced Redox Barriers for Treatment of Groundwater: Cost & Performance Report**

Sale, Tom; Gilbert, David; Oct 2006; 44 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478033; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Given success with a demonstration, there is an opportunity for a full-scale e-barrier that could replace an existing high-cost pump-and-treat system. In summary, data presented in this report describes substantive progress in demonstrating a new technology for managing contaminated groundwater at DoD facilities. At present, it is not clear that either cost or efficacy results will drive near-term widespread use of the technology for chlorinated ethenes. On the other hand, the technology holds promise for energetic compounds in groundwater. Our hope is that success with energetic compounds will lead to further refinement and broad use of the technology. The concept of an e-barrier is that a panel of closely spaced permeable electrodes is installed in a trench that intercepts a plume of contaminated groundwater. Application of an electrical potential to the electrodes imposes oxidizing conditions at the positive electrode and reducing conditions at the negative electrode. Using electrodes to deliver and recover electrons, thermodynamic conditions are shifted to drive transformation of target compounds to nontoxic products.

DTIC

*Costs; Decontamination; Ground Water; Oxidation-Reduction Reactions; Technology Transfer*

**20080022060** Army Research Development and Engineering Command, Warren, MI USA

**A Fuzzy System for Fault Diagnostics in Power Electronics Based Brake-by-Wire System**

Murphey, Yi L; Masrur, Abul; Chen, ZhiHang; Zhang, BaiFang; May 31, 2005; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478113; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper presents a structured fuzzy system for fault diagnostics in a brake-by-wire system. Our focus is on the power electronics switches within a electrical motor. We have developed a simulated model of brake-by-wire system to generate current and voltage signals under the normal condition and six faulty conditions in the power electronics circuit. Our experiments show that the proposed fuzzy diagnostic system is effective in accurately predicting faults as well as the location of faults.

DTIC

*Diagnosis; Electric Switches; Electronic Equipment; Fuzzy Systems; Wire*

**20080022067** Duke Univ., Durham, NC USA

**Experimental Control of a Fast Chaotic Time-Delay Opto-Electronic Device**

Blakely, Jonathan N; Jan 2003; 148 pp.; In English

Report No.(s): AD-A478153; DAAD19-02-1-0223; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The focus of this thesis is the experimental investigation of the dynamics and control of a new type of fast chaotic opto-electronic device: an active interferometer with electronic bandpass filtered delayed feedback displaying chaotic oscillations with a fundamental frequency as high as 100 MHz. To stabilize the system, I introduce a delayed feedback control suitable for fast time-delay systems. The new opto-electronic device consists of a semiconductor laser, a Mach-Zehnder interferometer, and an electronic feedback loop. Both the nonlinearity and the timescale of the oscillations are easily manipulated experimentally. The system displays a route to chaos that begins with a Hopf bifurcation from a steady state to a periodic oscillation at the so-called fundamental frequency. Further bifurcations give rise to a chaotic regime with a broad, flattened power spectrum. I develop a mathematical model of the device that shows very good agreement with the observed dynamics. To control chaos, I introduced modification of a well known control approach called time-delay autosynchronization (TDAS) in which the control perturbation is formed by comparing the current value of a system variable to its value at a time in the past equal to the period of the orbit to be stabilized. The current state of a time-delay dynamical system retains a memory of the state of the system one feedback delay time in the past. As a result, the past state of the system can be used to predict the current state. In order to take advantage of this effect, the new control method forms a perturbation according to the TDAS scheme but delays actuation of the control perturbation by a time equal to the feedback delay time of the system to be controlled. This effectively sets the control-loop latency equal to the feedback delay time of the uncontrolled system.

DTIC

*Chaos; Control; Electro-Optics; Feedback; Time Lag*

**20080022196** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Quasi Real Time Data Analysis for Air Quality Monitoring with an Electronic Nose**

Zhou, Hanying; Shevade, Abhijit V.; Pelletier, Christine C.; Homer, Margie L.; Ryan, M. Amy; May 24, 2006; 69 pp.; In English; Interface 2006, 24-27 May 2006, Pasadena, CA, USA; Original contains color and black and white illustrations;

Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40799>

Cabin Air Quality Monitoring: A) Functions; 1) Incident monitor for targeted contaminants exceeding targeted concentrations. Identify and quantify. 2) Monitor for presence of compounds associated with fires or overheating electronics. 3) Monitor clean-up process. B) Characteristics; 1) Low mass, low power device. 2) Requires little crew time for maintenance and calibration. 3) Detects, identifies and quantifies selected chemical species at or below 24 hour SMAC.

Derived from text

*Air Quality; Contaminants; Maintenance; Real Time Operation; Calibrating*

**20080022260** Duke Univ., Durham, NC USA

**Time-Delay Systems with Band-Limited Feedback**

Illing, Lucas; Blakely, J N; Gauthier, Daniel J; Aug 2005; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Fast nonlinear devices with time-delayed feedback, developed for applications such as communications and ranging,

typically include components that are AC-coupled, i.e. components that block zero frequencies. As an example of such a system, we describe a new opto-electronic device with band-limited feedback that uses a Mach-Zehnder interferometer as passive nonlinearity and a semiconductor laser as a current-to-optical-frequency converter. Our implementation of the device produces oscillations in the frequency range of tens to hundreds of MHz. We observe periodic oscillations created through a Hopf bifurcation as well as quasiperiodic and high dimensional chaotic oscillations. Motivated by the experimental results, we investigate the steady-state solution and its bifurcations in time-delay systems with band-limited feedback and arbitrary nonlinearity. We show that the steady state loses stability, generically, through a Hopf bifurcation, which can be either supercritical or subcritical. As a result of this investigation, we find that band-limited feedback introduces practical advantages, such as the ability to control the characteristic time-scale of the dynamics, and that it introduces differences to Ikeda-type systems already at the level of steady-state bifurcations, e.g. bifurcations exist in which limit cycles are created with periods other than the fundamental 'period-2' mode found in Ikeda-type systems.

DTIC

*Electro-Optics; Feedback; Time Lag*

### 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*.

**20080021798** State Univ. of New York, Stony Brook, NY, USA; Brookhaven National Lab., Upton, NY USA  
**Modeling and Simulation of Fluid Mixing for Laser Experiments and Supernova (May 1, 2006-April 30, 2007)**

Glimm, J.; Li, X.; Zhang, Y.; May 23, 2007; 7 pp.; In English

Contract(s)/Grant(s): DEFGS206NA26208

Report No.(s): DE2007-907765; No Copyright; Avail.: Department of Energy Information Bridge

The three year plan for this project is to develop novel theories and advanced simulation methods leading to a systematic understanding of turbulent mixing. A primary focus is the comparison of simulation models (both Direct Numerical Simulation and subgrid averaged models) to experiments. The comprehension and reduction of experimental and simulation data are central goals of this proposal. We will model 2D and 3D perturbations of planar interfaces. We will compare these tests with models derived from averaged equations (our own and those of others). As a second focus, we will develop physics based subgrid simulation models of diffusion across an interface, with physical but no numerical mass diffusion. We will conduct analytic studies of mix, in support of these objectives. Advanced issues, including multiple layers and reshock, will be considered.

NTIS

*High Energy Interactions; Lasers; Simulation; Supernovae; Turbulent Mixing*

**20080022027** Science Applications International Corp., Abingdon, MD USA

**Evaporation into Couette Flow**

Danberg, James E; Jan 2008; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD13-03-D-0017

Report No.(s): AD-A477975; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The equation governing the evaporation from a microliter droplet of a chemical warfare agent into Couette flow is derived using an integral method. It is assumed that the evaporation from a small drop is controlled by the linear velocity distribution in the near wall region of a laminar or turbulent atmospheric boundary layer. The result is presented in terms of nondimensional parameters: Sherwood (Sh) number as a function of Reynolds (Re) number to the 2/3 power, and Schmidt (Sc) number to the 1/3 power with a 0.852 constant of proportionality. These results are confirmed using a Crank-Nicolson implicit solution of the diffusion equation. In addition to agreement between the integral and numerical results for the diffusion rate, good agreement is also obtained in the computed concentration distributions with the profiles assumed in the integral analysis. Evaporation rate predictions are compared to evaporation rate measurements of HD droplets on a glass surface obtained in the U.S. Army Edgewood Chemical Biological Center 5-cm wind tunnels. The average slope of the Sh number data versus the Re number Sc number parameter is 0.98, which exceeds the theoretical results by 13%, but the prediction falls within two standard deviations of + or -17%.

DTIC

*Couette Flow; Evaporation; Integral Equations*

**20080022257** Army Engineer Research and Development Center, Vicksburg, MS USA

**Physical Model Study of Wave Action in New Thomsen Harbor, Sitka, Alaska**

Hughes, Steven A; Cohen, Julie; Acuff, Hugh F; Feb 2008; 127 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A477897; ERDC/CHL-TR-08-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A 1-to-75 scale physical model of Sitka, Alaska, encompassing portions of the Western Channel, the region protected by the three breakwaters, New Thomsen Harbor, and the Sitka and Japonski Island shorelines, was constructed at the modeling facilities of the U.S. Army Engineer Research and Development Center's Coastal and Hydraulics Laboratory. The primary objectives of the physical model study were to (1) establish the cause for wave action within the harbor causing vertical motion of the floating docks and (2) investigate potential engineering alternatives to reduce wave action within the harbor to acceptable levels. A total of 179 tests were conducted in the Sitka physical model during four time periods between the completion of the model in September 2005 and February 2007. Several hypotheses explaining increased wave action in New Thomsen Harbor were tested. Of these hypotheses, wave focusing by local bathymetry near New Thomsen Harbor appeared to be the most plausible; incident waves interacting with waves reflected by the shoreline at high water were a possible contributor for longer period waves. Large, short-period waves from the northwest could cause high waves in the harbor, but only when the wind blows hard from that direction. Distance between the rubble-mound breakwaters and harbor is also adequate to generate sizable short-period waves within the harbor. The short-wave energy could excite a harmonic frequency of the dock system resulting in adverse motions. At present the floating dock harmonics are unknown. Closing one or more gaps between adjacent breakwaters and/or breakwaters and the shoreline reduced wave heights in New Thomsen Harbor. Leaving only one gap open when waves came from the southwest reduced wave heights by about half. Closing only one gap while leaving the rest open did not create an appreciable wave height reduction when waves came from the southwest.

DTIC

*Harbors; Wave Propagation*

## 35

### INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

**20080021249** NASA Dryden Flight Research Center, Edwards, CA, USA

**Application of High-Temperature Extrinsic Fabry-Perot Interferometer Strain Sensor**

Piazza, Anthony; May 2008; 21 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021249>

In this presentation to the NASA Aeronautics Sensor Working Group the application of a strain sensor is outlined. The high-temperature extrinsic Fabry-Perot interferometer (EFPI) strain sensor was developed due to a need for robust strain sensors that operate accurately and reliably beyond 1800 F. Specifically, the new strain sensor would provide data for validating finite element models and thermal-structural analyses. Sensor attachment techniques were also developed to improve methods of handling and protecting the fragile sensors during the harsh installation process. It was determined that thermal sprayed attachments are preferable even though cements are simpler to apply as cements are more prone to bond failure and are often corrosive. Previous thermal/mechanical cantilever beam testing of EFPI yielded very little change to 1200 F, with excellent correlation with SG to 550 F. Current combined thermal/mechanical loading for sensitivity testing is accomplished by a furnace/cantilever beam loading system. Dilatometer testing has can also be used in sensor characterization to evaluate bond integrity, evaluate sensitivity and accuracy and to evaluate sensor-to-sensor scatter, repeatability, hysteresis and drift. Future fiber optic testing will examine single-mode silica EFPIs in a combined thermal/mechanical load fixture on C-C and C-SiC substrates, develop a multi-mode Sapphire strain-sensor, test and evaluate high-temperature fiber Bragg Gratings for use as strain and temperature sensors and attach and evaluate a high-temperature heat flux gauge.

Derived from text

*Fabry-Perot Interferometers; High Temperature; Strain Gages; Temperature Sensors; Fiber Optics*



**20080021364** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Low-Complexity Adaptive Lossless Compression of Hyperspectral Imagery**

Klimesh, Matthew; August 13, 2006; 9 pp.; In English; SPIE Optics and Photonics 2006, 13-17 Aug. 2006, San Diego, CA, USA; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40772>

A low-complexity, adaptive predictive technique for lossless compression of hyperspectral imagery is described. This technique is designed to be suitable for implementation in hardware such as a field programmable gate array (FPGA); such an implementation could be used for high-speed compression of hyperspectral imagery onboard a spacecraft. The predictive step of the technique makes use of the sign algorithm, which is a relative of the least mean square (LMS) algorithm from the field of low-complexity adaptive filtering. The compressed data stream consists of prediction residuals encoded using a method similar to that of the JPEG-LS lossless image compression standard. Compression results are presented for several datasets including some raw Airborne Visible/ Infrared Imaging Spectrometer (AVIRIS) datasets and raw Atmospheric Infrared Sounder (AIRS) datasets. The compression effectiveness obtained with the technique is competitive with that of the best of previously described techniques with similar complexity.

Author

*Image Processing; Field-Programmable Gate Arrays; Adaptive Filters; Infrared Imagery; Infrared Instruments; Predictions; Data Compression; Data Flow Analysis*

**20080021575** Cochran Freund and Yong, LLC, Fort Collins, CO, USA

**Cooperative Optical-Imaging Sensor Array**

Barrett, S. F., Inventor; Wilcox, M. J., Inventor; Thelen, D. C., Inventor; Cox, D. F., Inventor; 11 Jun 05; 12 pp.; In English Contract(s)/Grant(s): NAWC-N68936-01-2-2002; NAWC-N68936-00-R-0095

Patent Info.: Filed Filed 11 Jun 05; US-Patent-Appl-SN-11-150-478

Report No.(s): PB2007-110127; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus and method for providing image primitives, such as edge polarity, edge magnitude, edge orientation, and edge displacement, and derivatives thereof, for an object are described. The data are obtained substantially simultaneously and processed in parallel such that multiple objects can be distinguished from one another in real time.

NTIS

*Imaging Techniques; Optical Equipment; Optical Measuring Instruments; Image Processing*

**20080021597** NASA Stennis Space Center, Stennis Space Center, MS, USA

**Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop**

January 30, 2006; In English; 2004 High Spatial Resolution Commercial Imagery Workshop, 8-10 Nov, 2004, Reston, VA, USA; See also 20080021598 - 20080021657; CD-ROM contains full text document in Microsoft Word format

Contract(s)/Grant(s): Task Order NNS04AB54T

Report No.(s): SSTI-2220-0039; Copyright; Avail.: CASI: [C01](#), CD-ROM

Topics covered include: NASA Applied Sciences Program; USGS Land Remote Sensing: Overview; QuickBird System Status and Product Overview; ORBIMAGE Overview; IKONOS 2004 Calibration and Validation Status; OrbView-3 Spatial Characterization; On-Orbit Modulation Transfer Function (MTF) Measurement of QuickBird; Spatial Resolution Characterization for QuickBird Image Products 2003-2004 Season; Image Quality Evaluation of QuickBird Super Resolution and Revisit of IKONOS: Civil and Commercial Application Project (CCAP); On-Orbit System MTF Measurement; QuickBird Post Launch Geopositional Characterization Update; OrbView-3 Geometric Calibration and Geopositional Accuracy; Geopositional Statistical Methods; QuickBird and OrbView-3 Geopositional Accuracy Assessment; Initial On-Orbit Spatial Resolution Characterization of OrbView-3 Panchromatic Images; Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps; Stennis Space Center Verification and Validation Capabilities; Joint Agency Commercial Imagery Evaluation (JACIE) Team; Adjacency Effects in High Resolution Imagery; Effect of Pulse Width vs. GSD on MTF Estimation; Camera and Sensor Calibration at the USGS; QuickBird Geometric Verification; Comparison of MODTRAN to Heritage-based Results in Vicarious Calibration at University of Arizona; Using Remotely Sensed Imagery to Determine Impervious Surface in Sioux Falls, South Dakota; Estimating Sub-Pixel Proportions of Sagebrush with a Regression Tree; How Do YOU Use the National Land Cover Dataset?; The National Map Hazards Data Distribution System; Recording a Troubled World; What Does This-Have to Do with This?; When Can a Picture Save a Thousand Homes?; InSAR Studies of Alaska Volcanoes; Earth Observing-1 (EO-1) Data Products; Improving Access to the USGS Aerial Film Collections: High Resolution Scanners; Improving Access to the USGS Aerial Film Collections: Phoenix Digitizing System Product Distribution; System and Product Characterization: Issues Approach; Innovative Approaches to Analysis of Lidar Data for the National Map; Changes in



Imperviousness near Military Installations; Geopositional Accuracy Evaluations of QuickBird and OrbView-3: Civil and Commercial Applications Project (CCAP); Geometric Accuracy Assessment: OrbView ORTHO Products; QuickBird Radiometric Calibration Update; OrbView-3 Radiometric Calibration; QuickBird Radiometric Characterization; NASA Radiometric Characterization; Establishing and Verifying the Traceability of Remote-Sensing Measurements to International Standards; QuickBird Applications; Airport Mapping and Perpetual Monitoring Using IKONOS; OrbView-3 Relative Accuracy Results and Impacts on Exploitation and Accuracy Improvement; Using Remotely Sensed Imagery to Determine Impervious Surface in Sioux Falls, South Dakota; Applying High-Resolution Satellite Imagery and Remotely Sensed Data to Local Government Applications: Sioux Falls, South Dakota; Automatic Co-Registration of QuickBird Data for Change Detection Applications; Developing Coastal Surface Roughness Maps Using ASTER and QuickBird Data Sources; Automated, Near-Real Time Cloud and Cloud Shadow Detection in High Resolution VNIR Imagery; Science Applications of High Resolution Imagery at the USGS EROS Data Center; Draft Plan for Characterizing Commercial Data Products in Support of Earth Science Research; Atmospheric Correction Prototype Algorithm for High Spatial Resolution Multispectral Earth Observing Imaging Systems; Determining Regional Arctic Tundra Carbon Exchange: A Bottom-Up Approach; Using IKONOS Imagery to Assess Impervious Surface Area, Riparian Buffers and Stream Health in the Mid-Atlantic Region; Commercial Remote Sensing Space Policy Civil Implementation Update; USGS Commercial Remote Sensing Data Contracts (CRSDC); and Commercial Remote Sensing Space Policy (CRSSP): Civil Near-Term Requirements Collection Update.

Derived from text

*Accuracy; Imaging Techniques; Data Systems; Earth Sciences; Calibrating; Change Detection; Bidirectional Reflectance; Statistical Analysis; Real Time Operation; Remote Sensing; Optical Radar; Satellite Imagery*

**20080021598** Science Applications International Corp., Sioux Falls, SD, USA

#### **Changes in Imperviousness near Military Installations**

Xian, George; McMahon, Cory; Crane, Mike; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The population and rate of land development in and around many U.S. cities has grown significantly in the past twenty years. Urbanization and sprawl in proximity to military installations has influenced the military community's ability to maintain their mission focus. This study uses satellite remote sensing data to identify spatial changes over time for communities neighboring two military installations- Fort Benning, GA, and Fort Bragg, NC. Established in 1918, Fort Benning is located in the lower Piedmont Region of West Central Georgia and spreads over 182,000 acres. Fort Benning's immediate neighbor is Columbus, Georgia. Fort Bragg, also created in 1918, is the world's largest airborne training facility with over 45,000 military personnel. It is located just west of Fayetteville, North Carolina, and covers approximately 160,700 acres. Both installations are experiencing pressure from urban expansion associated with the surrounding communities. To detect and map urban growth over time, a subpixel impervious surface (IS) change detection method (Fig. 1) was applied. This procedure uses high-resolution DOQQs (1m) to classify urban land cover and estimate IS at 1m resolution (Fig. 2) for training data sets. Landsat 5 TM and Landsat 7 ETM+ images acquired in 1993 and 2001 for Fort Benning, and 1992 and 2002 for Fort Bragg (Fig. 3), were used as the primary data sources for mapping IS changes from the training datasets. A regression tree algorithm was used to model percent imperviousness for two dates in a 30 Meter spatial resolution. Changes in urban land cover were identified through quantifying percent impervious surface as an indicator of urban sprawl.

Derived from text

*Change Detection; Satellite Observation; Military Personnel; Landsat 5; High Resolution; Urban Development; Land Use*

**20080021599** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

#### **Initial On-Orbit Spatial Resolution Characterization of OrbView-3 Panchromatic Images**

Blonski, Slawomir; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Characterization was conducted under the Memorandum of Understanding among Orbital Sciences Corp., ORBIMAGE, Inc., and NASA Applied Sciences Directorate. Acquired five OrbView-3 panchromatic images of the permanent Stennis Space Center edge targets painted on a concrete surface. Each image is available at two processing levels: Georaw and Basic. Georaw is an intermediate image in which individual pixels are aligned by a nominal shift in the along-scan direction to adjust for the staggered layout of the panchromatic detectors along the focal plane array. Georaw images are engineering data and are not delivered to customers. The Basic product includes a cubic interpolation to align the pixels better along the focal plane and

to correct for sensor artifacts, such as smile and attitude smoothing. This product retains satellite geometry - no rectification is performed. Processing of the characterized images did not include image sharpening, which is applied by default to OrbView-3 image products delivered by ORBIMAGE to customers. Edge responses were extracted from images of tilted edges in two directions: along-scan and cross-scan. Each edge response was approximated with a superposition of three sigmoidal functions through a nonlinear least-squares curve-fitting. Line Spread Functions (LSF) were derived by differentiation of the analytical approximation. Modulation Transfer Functions (MTF) were obtained after applying the discrete Fourier transform to the LSF.

Derived from text

*Modulation Transfer Function; Spatial Resolution; Discrete Functions; Focal Plane Devices; Fourier Transformation; Pixels; Characterization; Curve Fitting*

**20080021603** South Dakota State Univ., Brookings, SD, USA

**QuickBird Geometric Verification (Brookings, SD Test Site)**

Darbha, Ravikanth; Helder, Dennis; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single viewgraph presentation reviews the verification of QuickBird geometric images. Using Quickbird images from Brookings, South Dakota, it was determined that the geometric accuracy of the QuickBird standard and orthorectified products met NASA scientific data purchase specifications.

CASI

*Geometric Accuracy; Satellite Imagery; Satellite Observation; Imaging Techniques; Image Analysis; Remote Sensing*

**20080021604** Woods Hole Research Center, MA, USA

**Using IKONOS Imagery to Assess Impervious Surface Area, Riparian Buffers and Stream Health in the Mid-Atlantic Region**

Goetz, Schott J.; Jantz, Claire; Wright, Robb K.; Snyder, Marcia; Melchior, Brian; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 23 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the use of IKONOS satellite imagery to assess impervious surface areas and the land cover, specifically trees, effects the health of streams. The area in this study is Montgomery County, Maryland.

CASI

*Satellite Imagery; Land Use; Water; Pollution; Drainage; Water Runoff; Rivers*

**20080021605** South Dakota State Univ., Brookings, SD, USA

**QuickBird and OrbView-3 Geopositional Accuracy Assessment**

Helder, Dennis; Ross, Kenton; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 40 pp.; In English; See also [20080021597](#); Original contains color illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Objective: Compare vendor-provided image coordinates with known references visible in the imagery. Approach: Use multiple, well-characterized sites with >40 ground control points (GCPs); sites that are a) Well distributed; b) Accurately surveyed; and c) Easily found in imagery. Perform independent assessments with independent teams. Each team has slightly different measurement techniques and data processing methods. NASA Stennis Space Center. South Dakota State University.

Derived from text  
*Computer Programs; Accuracy; Imagery; Ground Based Control*

**20080021606** GIS/Trans, Ltd, Austin, TX, USA

**Using Remotely Sensed Imagery to Determine Impervious Surface in Sioux Falls, South Dakota**

Sohl, Lauri B.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 23 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the use of satellite imagery in determining impervious surfaces (i.e., those surfaces

that are impermeable in the urban landscape.) in Sioux Falls, South Dakota. An impervious surface such as parking lots, sidewalks, rooftops, and roadways is an indicator of more intensive land use.

CASI

*Land Use; Remote Sensing; Satellite Imagery; Urban Research; Cities; Urban Development*

**20080021608** Geological Survey, Washington, DC, USA

**Improving Access to the USGS Aerial Film Collections: High Resolution Scanners**

Miller, Wayne; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This is a single slide presentation that shows the scanners, the available spot sizes and the distribution products that the USGS is using to improve access to its aerial film collection.

CASI

*Aerial Reconnaissance; High Resolution*

**20080021609** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

**Joint Agency Commercial Imagery Evaluation (JACIE) Team**

Pagnutti, Mary; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single viewgraph presents the activities, purpose and results of the Joint Agency Commercial Imagery Evaluation (JACIE) team. Included are several images of various locales from various satellites.

CASI

*Satellite-Borne Photography; Satellite Imagery; Satellite Observation*

**20080021610** Arizona Univ., Tucson, AZ, USA

**QuickBird Radiometric Characterization**

Thome, K.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 18 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the use of reflectance based calibration of the Quickbird satellite. The reflectance based approach uses surface reflectance combined with atmospheric transmittance data to predict at-sensor radiance. The results are shown in charts and graphs.

CASI

*Radiance; Radiometers; Spectral Reflectance; Calibrating; Satellite Observation*

**20080021611** GDA Corp., State College, PA, USA

**Automated, Near-Real Time Cloud and Cloud Shadow Detection in High Resolution VNIR Imagery**

Hulina, Stephanie; Varylguin, Dmitry; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 12 pp.; In English; High Spatial Resolution Commercial Imagery Workshop sponsored by the Joint Agency Commercial Imagery Evaluation (JACIE) Team, 8-10 Nov. 2004, Reston, Virginia, USA; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation provides an overview of cloud and cloud shadow detection using high resolution, visible near-infrared (VNIR) imagery. The challenge to detect clouds and cloud shadows using fully automated, per pixel, medium and high-resolution data without the use of thermal data was answered by the development of the Cloud and Shadow Assessment (CASA) system. CASA uses algorithms based on spectral, spatial and contextual information and hierarchical self-learning logic, while near-real time, fully automated, per pixel detection is gathered by VNIR data. One year into the 2-year project, the CASA prototype has been fully automated. Future steps and actionable events in the project include algorithm revision and optimization, looking for commercial validation datasets as well as validation partners, and meeting goals of having an accurate, real- to near-real runtime, commercial-grade system. In the future it is hoped that this technology may be extended

to other applications including the enhancement of features located under shadows and automated updates of road and hydrology networks and building footprints.

CASI

*Clouds; Shadows; Detection; Infrared Imagery; High Resolution; Automation; Real Time Operation*

**20080021614** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA; NASA Stennis Space Center, Stennis Space Center, MS, USA

**Developing Coastal Surface Roughness Maps Using ASTER and QuickBird Data Sources**

Spruce, Joe; Berglund, Judith; Davis, Bruce; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 39 pp.; In English; See also [20080021597](#); Original contains color illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation regards one element of a larger project on the integration of NASA science models and data into the Hazards U.S. Multi-Hazard (HAZUS-MH) Hurricane module for hurricane damage and loss risk assessment. HAZUS-MH is a decision support tool being developed by the National Institute of Building Sciences for the Federal Emergency Management Agency (FEMA). It includes the Hurricane Module, which employs surface roughness maps made from National Land Cover Data (NLCD) maps to estimate coastal hurricane wind damage and loss. NLCD maps are produced and distributed by the U.S. Geological Survey. This presentation discusses an effort to improve upon current HAZUS surface roughness maps by employing ASTER multispectral classifications with QuickBird 'ground reference' imagery.

Derived from text

*Coasts; Hazards; Hurricanes; Satellite-Borne Photography; Satellite Imagery; Satellite Observation; Maps*

**20080021615** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

**Geopositional Statistical Methods**

Ross, Kenton; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 29 pp.; In English; See also [20080021597](#); Original contains color illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

RMSE based methods distort circular error estimates (up to 50% overestimation). The empirical approach is the only statistically unbiased estimator offered. Ager modification to Shultz approach is nearly unbiased, but cumbersome. All methods hover around 20% uncertainty (@ 95% confidence) for low geopositional bias error estimates. This requires careful consideration in assessment of higher accuracy products.

Derived from text

*Accuracy; Statistical Analysis; Error Analysis; Bias; Distortion*

**20080021616** Interior Dept., Washington, DC, USA; Geological Survey, Washington, DC, USA

**Recording a Troubled World**

Beck, Ron; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent events required the best possible information about land surface conditions in sensitive regions. Landsat proved useful for studying the extent and direction of the smoke and debris cloud the morning after the attack on the World Trade Center. Later, Landsat imagery were used to provide information about land features in Afghanistan and Iraq.

Derived from text

*Landsat Satellites; Earth Surface; Satellite Imagery; Surface Properties*

**20080021617** Geological Survey, Washington, DC, USA

**What Does This... Have to Do with This?**

Beck, Ron; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Human exposure to agricultural chemicals has long been associated with cancer, birth defects, and neurological disorders. Today the USGS collaborates with the National Cancer Institute and Colorado State University to evaluate the potential use



of remotely sensed satellite imagery to study agricultural chemical exposure in Iowa, Nebraska, and Colorado.

Derived from text

*Exposure; Agriculture; Satellite Imagery; Remote Sensing; Cancer; Defects*

**20080021618** Geological Survey, Washington, DC, USA; Interior Dept., Washington, DC, USA

#### **When Can a Picture Save a Thousand Homes?**

Beck, Ron; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As the wildland-urban interface expands, more people than ever are at risk from wildland fire. Landsat is a crucial tool in the Government's fight to protect lives, property, and natural resources from this growing threat.

Derived from text

*Landsat Satellites; Earth Resources; Fires*

**20080021619** Arizona Univ., Tucson, AZ, USA

#### **Adjacency Effects in High Resolution Imagery**

Cattrall, C.; Thome, K. J.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Landsat 7 has been radiometrically stable since launch from multiple onboard approaches. With a large set of surface measurements to work with, it is an ideal test bed for observing the adjacency effect over small test sites. We believe we can see an adjacency effect in Landsat images of small, dark test sites with relatively bright surroundings. In this poster, we explore the possible adjacency effects which may be observed in Quickbird image of Pima County Fairgrounds near Tucson, where surroundings have higher reflectance than the dark target. Correction for the adjacency effect improves agreement with vicarious calibration coefficients from large test sites (right). Errors in aerosol optical depth have little effect & upon the results. Increased reflectance from surrounding pixels (i.e., specific surroundings areas such as bright sand to NW of test site) increases the adjacency effect. Adjacency effects may explain discrepancies in vicarious calibration results from small test sites. This effect strongly depends on wavelength. Knowledge of appropriate reflectance of surroundings is crucial.

Derived from text

*Reflectance; High Resolution; Imagery; Calibrating; Landsat Satellites; Optical Thickness; Pixels*

**20080021620** Geological Survey, Washington, DC, USA

#### **Camera and Sensor Calibration at the USGS**

Christopherson, Jon; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This brief presentation highlights the camera and sensor calibration efforts of the U.S. Geological Survey (USGS). The USGS has been responsible for the characterization and calibration of aerial film cameras since the early 1970s. The USGS is now actively researching the capabilities and potential calibration methods for the wider variety of digital airborne cameras through contracts and cooperative efforts between industry, academia and other government agencies. To this end, the USGS has established a laboratory capability for characterizing the geometric performance and stability of small- and medium-format digital cameras. The USGS is also testing a potential method of calibrating aerial cameras while over a surveyed test range. This method may hold promise for digital cameras and potentially even film cameras. Additionally, the USGS is working loosely with other Federal agencies to establish standards and policies for the procurement and use of digital aerial products.

Derived from text

*Cameras; Sensors; Calibrating; Geological Surveys; Aerial Photography*

**20080021623** DigitalGlobe, Bay Saint Louis, MS, USA

#### **QuickBird Applications**

Kudola, Robert; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 42 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews some of the civilian applications of satellite images. It shows many images of



hurricane damaged coastlines and cities, and images for other usages, such as assessing the imperviousness of various land usage patterns in urban areas and right-of-way management.

CASI

*Satellite Imagery; Satellite Observation; Satellite-Borne Photography; Damage; Damage Assessment*

**20080021624** Geological Survey, Washington, DC, USA

**System and Product Characterization: Issues Approach**

Rufe, Phil; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single viewgraph reviews the approach of the USA Geologic Survey (USGS) to systems and products. Examples given are the USGS failure to be prepared for digital cameras, the Geometric Approach, the BIAS Zone, Spatial Parameters, and the Relative Edge Response (RER).

CASI

*Geology; Satellite Imagery; Imaging Techniques; Satellite Observation*

**20080021625** City of Sioux Falls, SD, USA

**Using Remotely Sensed Imagery to Determine Impervious Surface in Sioux Falls, South Dakota**

Sohl, Lauri; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The city of Sioux Falls, South Dakota has been acquiring hard copy aerial photography of the city and its growth areas since the 1930's and digital high resolution orthophotography and digital elevation models since 1998. Early Geographic Information System (GIS) uses of the digital orthophotography was limited. For mapping purposes, the imagery was displayed as a background. There was little analysis performed other than utilizing the imagery to fine tune vector layers. Over time, the uses of orthophotography have evolved. No longer are the images used solely as an attractive background for non-scientific purposes. Instead, the orthophotography is distributed enterprise wide through various means and is used for high-end spatial analysis. High resolution commercially available satellite imagery is also available for the city of Sioux Falls. The imagery provides information from the infrared portion of the spectrum, a wavelength not covered by aerial photography. A resolution merge between the satellite imagery and the aerial photography was performed, resulting in a data set with the higher resolution of the ortho photography but with the spectral coverage of the satellite imagery. This merged data set was used to analyze impervious surface areas within the city, which was in turn utilized by city engineering staff as a additional tool to determine the amount of storm water runoff. This poster focuses on the use of high resolution orthophotography, enhanced by infrared data derived from satellite imagery, and its feasibility and usefulness in determining the location and quantities of pervious vs impervious areas in the city of Sioux Falls. Methodology and results are discussed.

Derived from text

*Aerial Photography; High Resolution; Infrared Spectra; Orthophotography; Satellite Imagery; Satellite Observation; Water Runoff; Image Analysis*

**20080021628** NASA Stennis Space Center, Stennis Space Center, MS, USA

**NASA Radiometric Characterization**

Holekamp, Kara; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 27 pp.; In English; See also [20080021597](#); Original contains color illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the characterization of radiometric data by NASA. The objective was to perform radiometric vicarious calibrations of imagery and compare with vendor-provided calibration coefficients. The approach was to use multiple, well-characterized sites. These sites are widely used by the NASA science community for radiometric characterization of airborne and space borne sensors. Using the data from these sites, the investigators performed independent characterizations with independent teams. Each team has slightly different measurement techniques and data processing methods.

CASI

*Calibrating; Data Processing; Radiometers*

**20080021629** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Establishing and Verifying the Traceability of Remote-Sensing Measurements to International Standards**

Fraser, Gerald T.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 29 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the principles of establishing and verifying the traceability of remote sensing measurements to national and international scales. Doing this allows comparisons to be made independent of time or locale, and improves understanding of instrument performance, provides confidence in the accuracy of the measurements, improves measurement accuracy and helps contractors understand and meet agency requirements, protecting contractor and customer.

CASI

*Accuracy; Remote Sensing; Standardization; Radiometric Correction; Radiometers*

**20080021632** Global Imaging, Inc., Solana Beach, CA, USA

**OrbView-3 Radiometric Calibration**

Kohm, Kevin; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 17 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation's objective is to review the OrbView-3 (OV-3) radiometric calibration approach, characterize relative radiometric performance and characterize the Signal-to-Noise Ratio from the OrbView-3 instrumentation. Included in the presentation are slides detailing the OV-3 orbit characteristics, the OV-3 sensor characteristics, the focal plane, the spectral plane, the absolute and relative calibration, streaking and banding, Signal-to-Noise Ratio (SNR), and charts that review the panchromatic streaking and banding, and multispectral banding.

CASI

*Calibrating; Radiometers; Image Enhancement; Radiometric Correction; Satellite Observation*

**20080021633** Arizona Univ., Tucson, AZ, USA

**Comparison of MODTRAN to Heritage-based Results in Vicarious Calibration at University of Arizona**

Leisso, Nathan; Thome, Kurt; Catrall, Chris; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single view presentation reviews work done by the Remote Sensing Group (RSG) with vicarious reflectance-based satellite calibration since early work on the Landsat program in the mid 1980's. This work has been based on a radiative transfer code (UA-Flat) that incorporates a flat atmosphere profile assuming a plane parallel, horizontally homogenous atmosphere. Recently the RSG has switched to using MODTRAN-4 as a basis of a code to profile atmospheric and reflectance data and transfer the computed reflected radiance to the sensor. Calibration of the Quickbird-2 sensor using UA-Flat and MODTRAN-4 allows a comparison between the two codes.

Derived from text

*Calibrating; Reflectance; Remote Sensing; Computer Programs; Comparison*

**20080021635** South Dakota State Univ., Brookings, SD, USA

**Effect of Pulse Width vs. GSD on MTF Estimation**

Choi, Jason; Helder, Dennis; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single viewgraph examines the effect of pulse width as opposed to Ground Sample Distance (GSD) in estimating the Modulation Transfer Function (MTF). The MTF at Nyquist frequency is a standard measure of spatial quality of a imaging system. The procedure to arrive at the Pulse MTF Estimator is reviewed, and the results are discussed.

CASI

*Imaging Techniques; Modulation Transfer Function; Pulse Duration; Figure of Merit; Optical Measurement*

**20080021637** Geological Survey, Washington, DC, USA

**Geometric Accuracy Assessment: OrbView ORTHO Products**

Coan, Michael; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 9 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the use of Image Assessment Software (IAS) with base image of high geometric confidence to assess geometric characteristics of unknown products. The original software written in 1980's for Landsat geo-assessment. It uses normalized cross-correlation of grey levels in variable sized chips for image matching. The possibility of using this software for high-resolution imagery was first investigated by comparison of software generated results with manual interpretation results in 2003. Three examples are reviewed,

CASI

*Geometric Accuracy; High Resolution; Image Analysis; Imagery; Computer Programs*

**20080021638** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Automatic Co-Registration of QuickBird Data for Change Detection Applications**

Bryant, Nevin A.; Logan, Thomas L.; Zobrist, Albert L.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 25 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the use Automatic Fusion of Image Data System (AFIDS) for Automatic Co-Registration of QuickBird Data to ascertain if changes have occurred in images. The process is outlined, and views from Iraq and Los Angeles are shown to illustrate the process.

CASI

*Change Detection; Data Systems; Satellite Imagery; Image Analysis; Imaging Techniques; Satellite Observation; Imagery; Remote Sensing*

**20080021639** Geological Survey, Sioux Falls, SD, USA

**Earth Observing-1 (EO-1) Data Products**

Miller, Wayne; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single slide shows views from the Hyperion, and Advanced Land Imager (ALI) instrument on the Earth Observing-1 satellite.

CASI

*Satellite Observation; Images*

**20080021640** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

**Atmospheric Correction Prototype Algorithm for High Spatial Resolution Multispectral Earth Observing Imaging Systems**

Pagnutti, Mary; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 33 pp.; In English; See also [20080021597](#); Original contains color illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the creation of a prototype algorithm for atmospheric correction using high spatial resolution earth observing imaging systems. The objective of the work was to evaluate accuracy of a prototype algorithm that uses satellite-derived atmospheric products to generate scene reflectance maps for high spatial resolution (HSR) systems. This presentation focused on preliminary results of only the satellite-based atmospheric correction algorithm.

CASI

*Algorithms; Atmospheric Correction; High Resolution; Imaging Techniques; Spatial Resolution; Remote Sensing*

**20080021641** Geological Survey, Washington, DC, USA

**InSAR Studies of Alaska Volcanoes**

Zhong, Lu; Wicks, C.; Power, J.; Dzurisin, D.; Masterlark, T.; Kwoun, O.; Rykhus, R.; Thatcher, W.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single viewgraph presents Interferometric Synthetic Aperture Radar (InSAR) images and details information about several Alaskan Volcanoes and changes to their formation over a several years time frame.

CASI

*Interferometry; Synthetic Aperture Radar; Volcanoes; Satellite Imagery*

**20080021642** Geological Survey, Washington, DC, USA

**Improving Access to the USGS Aerial Film Collections: Phoenix Digitizing System Product Distribution**

Miller, Wayne; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single slide shows the Phoenix Digitizing system, that is being used to improve access to the USGS Aerial Film Collections. It includes views of the auto-focus camera, the system setup, and list the available product distribution media.

CASI

*Cameras; Aerial Photography*

**20080021643** Science Applications International Corp., Reston, VA, USA

**Innovative Approaches to Analysis of Lidar Data for the National Map**

Stoker, Jason M.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This one page overview of LIDAR (Light Detection and Ranging) discusses what LIDAR is and what its uses are in terms of 'The National Map'

CASI

*Optical Radar; Radar Data*

**20080021644** National Geospatial-Intelligence Agency, Saint Louis, MO, USA

**Geopositional Accuracy Evaluations of QuickBird and OrbView-3: Civil and Commercial Applications Project (CCAP)**

Bresnahan, Paul; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 27 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the evaluation of the geopositional accuracy of the images from QuickBird and OrbView-3. The goal of this project is to determine whether a sample of panchromatic commercial imagery products met the vendor-stated absolute geopositional accuracy specifications.

CASI

*Accuracy; Imagery; Position (Location); Image Analysis; Comparison*

**20080021645** DigitalGlobe, Bay Saint Louis, MS, USA

**QuickBird Radiometric Calibration Update**

Kudola, Robert; Krause, Keith; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 9 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation discusses the reasons for performing radiometric correction, and includes charts showing Red Band DCA 5-4 Difference, Red Band DCA 5-4 Percent Banding, and Streaking Results. Views of a pre-corrected and corrected images are given in examples of streaking correction.

CASI

*Calibrating; Radiometric Correction; Image Enhancement*

**20080021646** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

**Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps**

Knowlton, Kelly; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Objectives: a) To determine the magnitude of radiometric tarp BRDF; b) To determine whether an ASD FieldSpec Pro spectroradiometer can be used to perform the experiment. Radiometric tarps with nominal reflectance values of 52%, 35%, and 3.5%, deployed for IKONOS, QuickBird, and OrbView-3 overpasses Ground-based spectroradiometric measurements of tarp and Spectralon® panel taken during overpass using ASD FieldSpec Pro spectroradiometer, and tarp reflectance calculated. Reflectance data used in atmospheric radiative transfer model (MODTRAN) to predict satellite at-sensor radiance for radiometric calibration. Reflectance data also used to validate atmospheric correction of high-spatial-resolution multispectral image products

Derived from text

*Radiometers; Spectroradiometers; Bidirectional Reflectance; Atmospheric Correction; Atmospheric Models; Calibrating; High Resolution; Spatial Resolution; Reflectance*

**20080021647** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

**Stennis Space Center Verification and Validation Capabilities**

O'Neal, Duane; Daehler, Erik; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Topics covered include: Spatial Response; Reflectance Radiometry; Positional Accuracy; Stationary Atmospheric Monitoring; Laboratory Calibration; Thermal Radiometry; Hyperspectral Radiometry; and Portable Atmospheric Monitoring. Derived from text

*Calibrating; Environmental Monitoring; Radiometers; Bidirectional Reflectance; Global Positioning System*

**20080021648** City of Sioux Falls, SD, USA

**Applying High-Resolution Satellite Imagery and Remotely Sensed Data to Local Government Applications: Sioux Falls, South Dakota**

VanAartsen, Steven J.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 55 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The purpose of this study, reviewed in this viewgraph: is to analyze the usefulness of high-resolution satellite imagery applied to local government applications; to speculate on potential applications using the unique qualities of the satellite imagery, to compare high resolution satellite imagery to traditional aerial photography, and to apply the satellite imagery to a few specific applications.

Derived from text

*Aerial Photography; Satellite Imagery; Satellite Observation; Cities; Urban Research*

**20080021649** Interior Dept., Washington, DC, USA; Geological Survey, Washington, DC, USA

**How Do YOU Use the National Land Cover Dataset?**

Beck, Ron; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single view presentation lists many of the uses for which the National Land Cover Dataset (NLCD) has been used, the percents are shown in a graph of the organization types of the users, and maps of the NLCD, of the USA, Virginia, and Richmond, VA (the last is shown with a completing view from Landsat 7.)

CASI

*Landsat 7; Land Use; Maps; Data Products*



**20080021650** Geological Survey, Washington, DC, USA

**The National Map Hazards Data Distribution System**

Benson, Michael; Granneman, Brian; Jones, Brenda; Risty, Ron; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This single viewgraph document reviews the USA Geologic Survey (USGS) map Hazards distribution system. Using views from various Earth observing satellites. the service researches the development of non-standard digital and graphic products in support of emergency response activities.

CASI

*Data Systems; Emergencies; Hazards; Maps; Remote Sensing; Satellite Observation; Satellite Imagery; Spaceborne Photography*

**20080021655** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Determining Regional Arctic Tundra Carbon Exchange: A Bottom-Up Approach**

Huemrich, Fred; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 39 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the carbon atmospheric exchange with Arctic tundra. In the Arctic the ecosystem has been a net carbon sink. The project investigates the question of how might climate warming effect high latitude ecosystems and the Earth ecosystems and how to measure the changes.

CASI

*Arctic Regions; Carbon; Ecosystems; Carbon Dioxide Concentration*

**20080021657** DigitalGlobe, Bay Saint Louis, MS, USA

**QuickBird System Status and Product Overview**

Kudola, Robert; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 31 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the status of the QuickBird systems. Included in this are satellite views of the World War II Memorial, Washington D.C.; and Athens, Greece. Also the use of Oblique satellite images are reviewed, and the compatibility of these images with Commercial Off the Shelf (COTS) software is discussed.

Author

*Satellite Imagery; Imaging Techniques; Satellite Observation; Data Products*

**20080021811** Army Engineer Research and Development Center, Vicksburg, MS USA

**Multi-Sensor Systems Development for UXO Detection and Discrimination: Man-Portable Dual Magnetic/Electromagnetic Induction Sensor**

Wright, David; Bennett, Jr , Hollis H; Dove, Linda P; Ballard, John H; Fields, Morris P; Demoss, Tere A; Butler, Dwain K; Feb 2008; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477585; ERDC/EL-TR-08-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477585>

An unexploded ordnance (UXO) survey instrument that simultaneously collects total field magnetic data and frequency domain electromagnetic (FDEM) data was developed and tested for the detection and characterization of buried UXO objects. The system comprised an FDEM sensor operating at a single frequency of 9.8 kHz and a cesium vapor magnetometer. The system was tested in dynamic survey (detection) and cued analysis (characterization) modes at the Naval Research Laboratory Blossom Point UXO test facility in Maryland and the U.S. Army Engineer Research and Development Center (ERDC) UXO test site in Mississippi. During these tests, electromagnetic (EM)-induced bias in the magnetic data was mitigated by physically offsetting the magnetometer from the EM transmitter coils. In both detection surveys, the aggregate detection rate exceeded the detection rates for the individual component sensor technologies. The cued analysis tests performed at Blossom Point showed that features can be estimated using physics-based analyses. The location estimate errors provided by these

analyses were consistently less than 0.3 m. The cued analysis data collected at the ERDC UXO test site have been used to provide position estimates for most of the emplaced targets at this site.

DTIC

*Ammunition; Detectors; Magnetic Induction; Magnetometers; Multisensor Applications; Systems Engineering*

**20080021850** Texas Univ., Arlington, TX USA

**MARSnet: Mission-aware Autonomous Radar Sensor Network for Future Combat Systems**

May 3, 2007; 86 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0395

Report No.(s): AD-A477686; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477686>

During the period of 7/1/2007-12/31/2007, we performed the following studies on radar sensor network: 1) Network-enabled Electronic Warfare (NEW) for Collaborative Automatic Target Recognition (CATR); 2) Foliage clutter modeling using narrowband and UWB radars; 3) A propagation Environment Modeling in Foliage using UWB radars; 4) Target detection in foliage using short-time Fourier transform and UWB radar sensor networks; 5) Some experimental studies on path loss models for wireless sensor networks based on Xbow motes, 6) Theoretical studies on distributed connected dominating set construction in random geometric k-Disk graphs for potential application to real sensor networks.

DTIC

*Autonomy; Combat; Electronic Warfare; Radar; Radar Detection; Target Recognition*

**20080022033** Geophex Ltd., Raleigh, NC USA

**Handheld, Broadband Electromagnetic UXO Sensor: Cost & Performance Report**

Won, I J; SanFilipo, Bill; Oren, Alex; Dec 1, 2006; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-MM-0036

Report No.(s): AD-A478002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The broadband electromagnetic sensor improvement and demonstration undertaken in this project took the prototype GEM-3 and evolved it into an operational sensor with increased bandwidth and dynamic range, and enough memory and processing power to allow efficient data acquisition while decreasing the weight for ease of operation. Through this program, the GEM-3 has evolved from prototype into a fully operational, full-scale instrument, and the objective of this demonstration was to verify its capability to perform under realistic conditions of buried UXO contamination. The goal was to combine multi-frequency inphase and quadrature data in an optimal way to identify local anomalies that are potentially UXO. The technology demonstration scope was all-encompassing, including blind-grid testing of three configurations handheld 40cm sensor, pushcart mounted 96cm sensor, and ATV towed 96cm sensor challenge scenarios with woods and moguls using the handheld sensor and large open fields using the large coil with pushcart and towed configurations. The moguls area was covered with snow, the woods and parts of the open area were covered with several inches of water.

DTIC

*Ammunition; Broadband; Costs; Magnetic Induction; Ordnance*

**20080022081** Washington Univ., Seattle, WA USA

**Measurement of Non-Linear Internal Waves and Their Interaction with Surface Waves Using Coherent Real Aperture Radars**

Plant, William J; Sep 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0274

Report No.(s): AD-A478242; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objectives of the grant were to use a coherent real aperture radar to 1) study the interaction of surface waves with internal wave, the process that is responsible for the synthetic aperture radar (SAR) imagery of internal waves; 2) Determine the extent to which Doppler velocity modulations observed by coherent radars, including along-track interferometric SARs, are faithful representations of surface currents generated by internal waves; and 3) track the temporal and spatial development of internal waves as they are generated, propagate and dissipate.

DTIC

*Apertures; Coherent Radar; Internal Waves; Nonlinearity; Ocean Surface; Surface Waves; Water Waves*

**20080022263** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Cassini Camera Contamination Anomaly: Experiences and Lessons Learned**

Haemmerle, Vance R.; Gerhard, James H.; June 19, 2006; 15 pp.; In English; SpaceOps Earth, Moon, Mars and Beyond, 19-23 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources  
ONLINE: <http://hdl.handle.net/2014/40797>

We discuss the contamination 'Haze' anomaly for the Cassini Narrow Angle Camera (NAC), one of two optical telescopes that comprise the Imaging Science Subsystem (ISS). Cassini is a Saturn Orbiter with a 4-year nominal mission. The incident occurred in 2001, five months after Jupiter encounter during the Cruise phase and ironically at the resumption of planned maintenance decontamination cycles. The degraded optical performance was first identified by the Instrument Operations Team with the first ISS Saturn imaging six weeks later. A distinct haze of varying size from image to image marred the images of Saturn. A photometric star calibration of the Pleiades, 4 days after the incident, showed stars with halos. Analysis showed that while the halo's intensity was only 1 - 2% of the intensity of the central peak of a star, the halo contained 30 - 70% of its integrated flux. This condition would impact science return. In a review of our experiences, we examine the contamination control plan, discuss the analysis of the limited data available and describe the one-year campaign to remove the haze from the camera. After several long conservative heating activities and interim analysis of their results, the contamination problem as measured by the camera's point spread function was essentially back to preanomaly size and at a point where there would be more risk to continue. We stress the importance of the flexibility of operations and instrument design, the need to do early in-flight instrument calibration and continual monitoring of instrument performance.

Author

*Cassini Mission; Cameras; Contamination; Imaging Techniques; Lessons Learned*

**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*.

**20080021393** Fort Hays State Univ., Hays, KS USA

**BTEC Thermal Model**

Irvin, Lance J; Maseberg, P D; Buffington, Gavin D; Clark, III, Clifton D; Thomas, Robert J; Edwards, Michael L; Stolarski, Jacob; Oct 2007; 99 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F41624-02-D-7003; Proj-7757

Report No.(s): AD-A477371; No Copyright; Avail.: Defense Technical Information Center (DTIC)

AFRL/RHDO has developed a configurable, laser-tissue interaction model that includes components from various areas of Biophysics. The model predicts heat transfer in biological tissue, in either one-dimension or two-dimensional cylindrical coordinates, and is coupled to an Arrhenius damage model. A simulation can be configured as a single run, or a damage-threshold search. Multiple models for describing the laser-tissue interaction are available, including linear absorption (1D, 2D), Monte Carlo scattering (2D) and Beam Propagation Methods using Finite Difference approximations or Hankel Transform methods (2D).

DTIC

*Biophysics; Coherent Light; Heat Transfer*

**20080022023** Naval Research Lab., Washington, DC USA

**Incoherent Combining of High-Power Fiber Lasers for Directed-Energy Applications**

Sprangle, Phillip; Ting, Antonio; Penano, Joseph; Fischer, Richard; Hafizi, Bahman; Jan 16, 2008; 25 pp.; In English

Contract(s)/Grant(s): Proj-67-9466-08

Report No.(s): AD-A477956; NRL/MR/6790-08-9096; No Copyright; Avail.: Defense Technical Information Center (DTIC)

High-power fiber lasers can be incoherently combined to form the basis of a directed high-energy laser system. This approach has a number of advantages over other beam combining methods and can result in compact, robust, low maintenance and long-lifetime high-energy laser systems. The first field demonstration of incoherent beam combining using kilowatt-class,

single-mode fiber lasers over a kilometer propagation range is discussed. The experiment employed four fiber lasers and a beam director consisting of individually controlled steering mirrors. Propagation efficiencies greater than 90% at power levels of 3 kilowatts were demonstrated at a range greater than 1 kilometer.

DTIC

*Fiber Lasers; High Power Lasers; Lasers*

**20080022066** Duke Univ., Durham, NC USA

**Two-Photon Raman Gain in a Laser Driven Potassium Vapor**

Concannon, Hope M; Feb 1, 1996; 289 pp.; In English

Contract(s)/Grant(s): DAAL03-92-G-0286; DAAH04-94-G-0174

Report No.(s): AD-A478150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Atomic systems that display a linear or weakly nonlinear interaction with light are well known and well understood. However, when the interaction between light and matter becomes highly nonlinear and the light and matter strongly couple, the systems become much more difficult to understand both theoretically and experimentally. One example of a strongly coupled, highly nonlinear system is the two-photon laser that is based on the two-photon stimulated emission process. This laser has intrigued theorists and experimentalists alike. Research has been hindered, however, by the difficulties in constructing such a laser. Most two-photon gain media prove unsuitable due to small gain and the occurrence of destructive competing nonlinear effects. I have developed a new two-photon gain medium that overcomes these difficulties. It consists of a laser-driven potassium vapor in which the origin of the gain is due to the two-photon Raman scattering process. The two-photon gain feature is identified by performing spectroscopy of the laser-driven potassium vapor. To complement the experimental observations, I have developed a theoretical model of the two-photon Raman gain medium using the semi-classical density-matrix formalism. The predictions of the model are in qualitative agreement with the experimentally observed frequency- and intensity-dependence of the two-photon gain. I also describe a simplified rate-equation model of two-photon lasers through which I explore their steady-state and transient behavior. The model highlights the novel threshold behavior of two-photon lasers and the need to inject an external field to initiate lasing. This work, both theoretical and experimental, provides the first step toward a robust experimental realization of a two-photon laser.

DTIC

*Metal Vapor Lasers; Metal Vapors; Photons; Potassium; Raman Lasers*

## 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*.

**20080021200** NASA Glenn Research Center, Cleveland, OH, USA

**Interference Fit Life Factors for Roller Bearings**

Oswald, Fred B.; Zaretsky, Erwin V.; Poplawski, Joseph V.; [2008]; 38 pp.; In English

Contract(s)/Grant(s): WBS 877868.02.07.03.04.01; Copyright; Avail.: Other Sources

The effect of hoop stresses in reducing cylindrical roller bearing fatigue life was determined for various classes of inner ring interference fit. Calculations were performed for up to seven interference fit classes for each of ten bearing sizes. Each fit was taken at tightest, average and loosest values within the fit class for RBEC-5 tolerance, thus requiring 486 separate analyses. The hoop stresses were superimposed on the Hertzian principal stresses created by the applied radial load to calculate roller bearing fatigue life. The method was developed through a series of equations to calculate the life reduction for cylindrical roller bearings based on interference fit. All calculated lives are for zero initial bearing internal clearance. Any reduction in bearing clearance due to interference fit was compensated by increasing the initial (unmounted) clearance. Results are presented as tables and charts of life factors for bearings with light, moderate and heavy loads and interference fits ranging from extremely light to extremely heavy and for bearing accuracy class RBEC 5 (ISO class 5). Interference fits on the inner bearing ring of a cylindrical roller bearing can significantly reduce bearing fatigue life. In general, life factors are smaller (lower life) for bearings running under light load where the unfactored life is highest. The various bearing series within a particular bore size had almost identical interference fit life factors for a particular fit. The tightest fit at the high end of the

RBEC-5 tolerance band defined in ANSI/ABMA shaft fit tables produces a life factor of approximately 0.40 for an inner-race maximum Hertz stress of 1200 MPa (175 ksi) and a life factor of 0.60 for an inner-race maximum Hertz stress of 2200 MPa (320 ksi). Interference fits also impact the maximum Hertz stress-life relation.

Author

*Roller Bearings; Interference Fit; Cylindrical Bodies; Accuracy; Cavities; Shafts (Machine Elements)*

**20080021212** NASA Glenn Research Center, Cleveland, OH, USA

**Compliant Foil Journal Bearing Performance at Alternate Pressures and Temperatures**

Bruckner, Robert J.; Puleo, Bernadette J.; June 09, 2008; 7 pp.; In English; ASME Turbo Expo, 9-13 Jun. 2008, Berlin, Germany; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.03.01.01

Report No.(s): GT2008-50174; Copyright; Avail.: Other Sources

An experimental test program has been conducted to determine the highly loaded performance of current generation gas foil bearings at alternate pressures and temperatures. Typically foil bearing performance has been reported at temperatures relevant to turbomachinery applications but only at an ambient pressure of one atmosphere. This dearth of data at alternate pressures has motivated the current test program. Two facilities were used in the test program, the ambient pressure rig and the high pressure rig. The test program utilized a 35 mm diameter by 27 mm long foil journal bearing having an uncoated Inconel X-750 top foil running against a shaft with a PS304 coated journal. Load capacity tests were conducted at 3, 6, 9, 12, 15, 18, and 21 krpm at temperatures from 25 to 500 C and at pressures from 0.1 to 2.5 atmospheres. Results show an increase in load capacity with increased ambient pressure and a reduction in load capacity with increased ambient temperature. Below one-half atmosphere of ambient pressure a dramatic loss of load capacity is experienced. Additional lightly loaded foil bearing performance in nitrogen at 25 C and up to 48 atmospheres of ambient pressure has also been reported. In the lightly loaded region of operation the power loss increases for increasing pressure at a fixed load. Knowledge of foil bearing performance at operating conditions found within potential machine applications will reduce program development risk of future foil bearing supported turbomachines.

Author

*Foil Bearings; Journal Bearings; Load Tests; Performance Tests; Shafts (Machine Elements); Turbomachinery; Pressure Distribution; Ambient Temperature; Coatings; Elastic Properties*

**20080021785** Southwest Research Inst., San Antonio, TX USA

**Diesel Particulate Measurement Research, 2007. Phase 2, Final Report**

Mar. 01, 2007; 68 pp.; In English

Contract(s)/Grant(s): CRC-E-66

Report No.(s): PB2007-112631; SWRI-03.10415; CRC-E-66-2; No Copyright; Avail.: National Technical Information Service (NTIS)

This report covers work under Phase 2 of Project E-66. The objectives of Phase 2 were to: (1) Investigate the effect of filter face velocity and sampling time on solid and volatile particle collection by a Teflon membrane filter, namely the Pall Teflo filter; (2) Examine the effect of dilution conditions on particle measurement, including CVS primary dilution ratio, residence time and temperature, and secondary dilution ratio and residence time; and (3) Study the effect of exhaust and dilution system conditioning on particle measurement.

NTIS

*Diesel Engines; Exhaust Emission; Particulates*

**20080021799** General Electric Co., Lynn, MA, USA

**21st Century Locomotive Technology: Quarterly Technical Status Report 17 DOE/AL68284-TSR17 (January 2007-April 2007)**

January 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-FC04-2002AL68284

Report No.(s): DE2007-907726; No Copyright; Avail.: Department of Energy Information Bridge

Studies of nozzle optimization for a new piston bowl design were performed.

NTIS

*Fuel Injection; Locomotives; Rail Transportation; Optimization; Exhaust Nozzles; Technologies*



**20080021800**

**Seabasing Innovation Cell 'Transfer of Goods at Sea'**

Selfridge, Mark; Mar 2004; 216 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N0002401-WX-20594

Report No.(s): AD-A476465; NSWCCD-20-TR-2004/04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA476465>

The Center for Innovation in Ship Design (CISD) at the Naval Surface Warfare Center - Carderock Division (NSWC-CD) was tasked by the Chief of Naval Research to investigate Seabasing as it relates to Seapower 21 and the USA Navy Transformation. At Carderock, a multi-disciplinary team formed in late February 2003 and reported on 30 May 2003; a period of 14 weeks. The team was led by Mark Selfridge, a Naval Architect from the UK Ministry of Defense (MoD) currently on a 2-year exchange at NSWC-CD. Specifically, the CISD team was tasked to investigate the naval architectural implications of transferring cargo and personnel in a seabase environment. Emphasis was placed on rough water operations. The team developed four advanced concepts to enhance transfer of goods at sea and completed preliminary assessments of their performance within a seabase. The four concepts are an Intermediate Transfer Station (ITS), a Deep Water Stable Craneship, a Seabase Hub, and an Advanced Logistics Delivery System (ALDS). In addition, a number of seabase enabling technologies (i.e., selective offload, reconfigurable spaces, seakeeping, materiel management systems, a cargo dispenser concept, an air pallet cargo stowage concept, and spiral ramp concepts) were investigated to enhance the understanding of key design drivers and to highlight naval architectural issues.

DTIC

*Cargo; Cargo Ships; Dynamic Structural Analysis; Logistics; Marine Technology; Materials Handling; Military Operations; Seas; Unloading*

**39**

**STRUCTURAL MECHANICS**

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

**20080021447** Georgia School of Technology, Atlanta, GA, USA; Weidlinger Associates, New York, NY, USA

**Best Practices for Reducing the Potential for Progressive Collapse in Buildings**

Ellingwood, B. R.; Smilowitz, R.; Dusenberry, D. O.; Duthinh, D.; Lew, H. S.; Feb. 2007; 216 pp.; In English

Report No.(s): PB2007-112598; NISTIR-7396; No Copyright; Avail.: CASI: [A10](#), Hardcopy

This document is intended to provide owners and practicing engineers with current best practices to reduce the likelihood of progressive collapse of buildings in the event of abnormal loading. The report includes a discussion of an acceptable risk approach to progressive collapse, which involves defining the threat, event control, and structural design to resist postulated event. Practical means for reducing risk for new and existing buildings are presented. An extensive review is provided of the design methods used to enhance a building's resistance to progressive collapse. These include the indirect method (providing sufficient tie forces), the specific local resistance method (designing key elements to withstand abnormal loads), and the alternate load path method (allowing for redistribution of load in the event of the loss of a key member). Design considerations for different structural materials are summarized. The methodology for evaluating and mitigating progressive collapse potential in existing buildings is also discussed. Three appendices provide supporting information. Appendix A presents a worldwide review of progressive collapse provisions in various national design standards. Appendix B identifies knowledge gaps related to progressive collapse that require research. Appendix C provides case studies of progressive collapses. This document is not intended to provide step-by-step design guidance for practicing engineers; however, applicable design standards are referenced and summarized in Appendix A.

NTIS

*Blast Loads; Buildings; Collapse; Loads (Forces); Procedures*

**20080021453** Utah Dept. of Transportation, Salt Lake City, UT, USA; Utah Univ., Salt Lake City, UT, USA

**Time-Dependent Effects and Validation from Monitoring of Post-Tensioned Spliced Girders and Deck Joints**

Pantelides, C. P.; Saxey, B. W.; Emerson, J.; Reaveley, L. D.; Dec. 2006; 70 pp.; In English

Report No.(s): PB2007-112586; UT-07-02; No Copyright; Avail.: National Technical Information Service (NTIS)

This project report summarizes the results of monitoring a post-tensioned spliced girder bridge in Salt Lake City. This

report describes the monitoring of the 4500 South Bridge on Interstate 15. The north-bound bridge consists of eight post-tensioned, spliced, precast concrete girders, having three segments each, for a single clear span of 61.443 m (201 ft - 7 in.). Four girders and portions of the bridge deck and parapet wall have been instrumented and monitored for approximately four years. Data recorded from the bridge included concrete strain at selected girder locations, as well as post-tensioned girder losses through eight load cells, and girder deflections for one of the girders through surveys. The actual losses at midspan in the girder being monitored, including time-dependent losses and anchorage seating and friction losses, were on average 14.5% of the initial post-tensioning forces; the absolute upward midspan deflection was 0.15% of the clear span, and the two splice points were deflecting in an almost identical manner indicating excellent girder/splice performance. Analytical procedures are compared to experimental measurements of the losses of the post-tensioned spliced precast concrete girder being monitored. The assumed losses in design were very close to those observed and the design methodology for incorporating losses is found to be adequate. Shrinkage and creep tests, performed on concrete used in constructing the post-tensioned spliced, precast concrete girders, were used to obtain the ultimate creep coefficient and ultimate shrinkage strain. LVDT measurements at the cold joints show that the cold joints are in good health. The abutment movements and rotations were found to be small. The vertical deflections of the post-tensioned girders were measured due to thermal gradients and were compared to AASHTO predicted deflections. General recommendations for using spliced-girder post-tensioned bridges in future projects are provided.

NTIS

*Concretes; Girders; Highways; Time Dependence*

**20080021750** Connecticut Transportation Inst., Storrs, CT, USA

**Bridge Monitoring Network: Installation and Operation**

DeWolf, J. T.; D'Attilio, P. F.; Feldblum, E. G.; Lauzon, R. G.; Dec. 2006; 45 pp.; In English  
Report No.(s): PB2007-112577; CT-2217-F-06-10; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report discusses the planning, design and installation of monitoring systems on a network of bridges in the State of Connecticut. The project began with the development of a generic set of guidelines for using currently available monitoring equipment to serve as a basis for designing long-term systems for each of the different bridges. These were then used to design individual monitoring systems that were tailored to each bridge, using sensors for strain, temperature, tilt and vibration. Monitoring has been conducted on a continuous basis, with excitation provided by normal traffic loading. Results from the four fully operational monitored bridges are presented. The goal has been to use long-term monitoring to learn how bridges behave over many years and to use data from the monitoring systems to establish a basis for long-term structural health monitoring. Systems for five additional bridges are planned or under construction.

NTIS

*Bridges (Structures); Concretes; Installing; Steels; Structural Engineering*

**20080022039** Library of Congress, Washington, DC USA

**'Bunker Busters': Sources of Confusion in the Robust Nuclear Earth Penetrator Debate**

Medalia, Jonathan; Sep 22, 2004; 15 pp.; In English  
Report No.(s): AD-A478027; CRS-RL32599; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Robust Nuclear Earth Penetrator (RNEP), often called a 'bunker buster,' is at present the subject of a cost and feasibility study to determine if either of two nuclear bombs, the B61 and the B83, could be modified, mainly by adding a heavy, pointed case, so as to be able to penetrate perhaps 10 meters into earth or rock. This penetration would increase the weapon's ability, by a factor of 20 to 50, to destroy hardened and deeply buried facilities. The Department of Defense has expressed concern that potential U.S. adversaries are using such facilities because the 1991 and 2003 wars in Iraq demonstrated that U.S. precision conventional weapons can readily destroy facilities that are above the surface or buried at shallow depth. If the study shows RNEP to be feasible and affordable, and if the President and Congress approve, RNEP could move from a study to development and, perhaps, deployment. The RNEP debate has received much attention and spawned much confusion. This report examines sources of confusion in this debate. Part of the difficulty in analyzing this debate is that the RNEP study raises large and complex issues. Should the USA improve its ability to destroy buried targets, or are there offsetting reasons not to? What would be the targets for RNEP, and by what measures should its military effectiveness be judged? How reliable are estimates of collateral damage resulting from RNEP? Protagonists debate whether RNEP will lower the nuclear threshold and make nuclear use more likely. The threshold may be seen as criteria that must be met for the President to order nuclear weapon use. RNEP would arguably not lower this threshold because it would not change these criteria. It could make nuclear use less likely if it deters actions that meet this threshold; if it does not, it could make such use

more likely because RNEP, like other nuclear weapons, would expand the circumstances in which these weapons might be used. This report will not be updated.

DTIC

*Depth; Feasibility; Nuclear Weapons; Penetration*

## 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*.

**20080021602** Geological Survey, Washington, DC, USA; ITT Industries, Inc., Reston, VA, USA; Interior Dept., Washington, DC, USA

#### **On-Orbit System MTF Measurement**

Servoss, Thomas G.; Vogler, Scott G.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 18 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation focuses an assessment of on-orbit system modulation transfer function (MTF) measurement techniques. The objective of the study was to survey, characterize, and recommend the most accurate, repeatable, practical, and robust technique(s) suitable for on-orbit image-based MTF validation. Simulation images were used to generate metrics of accuracy and confidence bounds, among other variables. The findings conclude that the ICA and ISO techniques yield comparable results. It is recommended that the ICA slanted edge technique should be used for on-orbit MTF measurement analysis and characterization. Additionally, the genAutoCedge measurement technique is discussed as being routine for robust automated MTF measurement.

Derived from text

*Modulation Transfer Function; Orbits; Space Surveillance (Spaceborne); Imaging Techniques*

**20080021607** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

#### **Draft Plan for Characterizing Commercial Data Products in Support of Earth Science Research**

Ryan, Robert E.; Terrie, Greg; Berglund, Judith; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 33 pp.; In English; See also [20080021597](#); Original contains color illustrations  
Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation introduces a draft plan for characterizing commercial data products for Earth science research. The general approach to the commercial product verification and validation includes focused selection of a readily available commercial remote sensing products that support Earth science research. Ongoing product verification and characterization will question whether the product meets specifications and will examine its fundamental properties, potential and limitations. Validation will encourage product evaluation for specific science research and applications. Specific commercial products included in the characterization plan include high-spatial-resolution multispectral (HSMS) imagery and LIDAR data products. Future efforts in this process will include briefing NASA headquarters and modifying plans based on feedback, increased engagement with the science community and refinement of details, coordination with commercial vendors and The Joint Agency Commercial Imagery Evaluation (JACIE) for HSMS satellite acquisitions, acquiring waveform LIDAR data and performing verification and validation.

Derived from text

*Earth Sciences; Research; Remote Sensing; Products; Data Systems; Commercialization; Characterization; Proving*

**20080021612** Science Applications International Corp., Washington, DC, USA

#### **Science Applications of High Resolution Imagery at the USGS EROS Data Center**

Coan, Michael; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 17 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation from the U.S. Geological Survey Earth Resources Observation and Science (USGS EROS) Data Center provides an overview science applications of high resolution imagery at the USGS EROS Data Center. There are several high

resolution projects at the Center's Science Directorate including the Native American Project which uses aerial photo products for forest inventory, new road and structure locations, range management and prairie dog town delineations; and, the LandFire Project which uses high resolution methods for computing shrub coverage and structure in the Western U.S. Using the sagebrush research example, it is demonstrated that high resolution imagery enables improved identification and classification. Segmented OrbView multispectral imagery at 4m, in comparison to Landsat imagery at 30m, displays potential for riparian zone delineation, wildlife habitat characterization, soil type differentiation, cropland quality assessment, environmental monitoring and more. Additionally, the OrbView 4m Multispectral image contributed to visual verification of a stream density modeling procedure in a Topographic Program which attempts to predict where perennial and intermittent streams will occur.

Derived from text

*Geological Surveys; Earth Resources; EROS (Satellites); High Resolution; Imagery*

**20080021613** Geological Survey, Washington, DC, USA

**USGS Commercial Remote Sensing Data Contracts (CRSDC)**

Duncan, Mike; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 13 pp.; In English; See also [20080021597](#); Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This briefing provides information about a vehicle contract available to U. S. Geological Survey (USGS) and other federal agency partners for the procurement of commercially available remotely sensed data. These contracts are tools for meeting the geospatial data needs of the USGS, and other federal, state and local government entities. The contracts allow access to commercially available data from both airborne and satellite platforms.

Derived from text

*Geological Surveys; Earth Resources; Remote Sensing; Data Acquisition; Government Procurement; Contracts*

**20080021626** Geological Survey, Washington, DC, USA

**Commercial Remote Sensing Space Policy Civil Implementation Update**

Snyder, Greg; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 15 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation focuses on space policy for commercial remote sensing and implementing this policy in the civil sector. The goal is to use commercial remote sensing satellite and data services to the maximum practical extent in civil missions. To this extent, remote sensing data requirements must be characterized and quantified to meet both short- and long-term objectives. Most recently, there were 257 data requests collected, which included 14 requests for extensive or full U.S. coverage, while the remaining requests were for high resolution data with broad distribution needs. While the intention is to highlight commercial satellite data and provide it to the broadest possible civil customer base, this will require infrastructure enhancements such as adding commercial satellite data to several U. S. Geological Survey (USGS) holdings, as well as the need for ongoing support from customer staff in the areas of project planning, consultation, search and order and data distribution. Currently, the USGS administers satellite data contracts tailored to civil needs, receiving multi-year imagery requirements from across the civil community. USGS analyzes these requirements for commonality with other agencies. Future steps include increasing the quality and quantity of the requirements database, developing case studies demonstrating the utility of satellite data for major national needs, exposing more users to satellite data by populating a highly visible civil archive and educating agencies on the full potential of commercial satellites to meet civil mission needs.

Derived from text

*Remote Sensing; Data Acquisition; Data Management; Procurement Policy; Government/Industry Relations; Space Law*

**20080021627** Geological Survey, Reston, VA, USA

**USGS Land Remote Sensing: Overview**

Feuquay, Jay; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 24 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph document reviews the remote sensing operations via satellite at the USA Geologic Survey (USGS). The components of the operations include the Satellite Operations, (i.e., Landsat 5 and Landsat 7), the long term data preservation



and access to the Landsat archive, and the National Satellite Land Remote Sensing Data Archive (NSLRSDA) and the utilization of remote sensing research and data.

CASI

*Landsat Satellites; Remote Sensing; Satellite Imagery; Satellite Observation*

**20080021630** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

**Spatial Resolution Characterization for QuickBird Image Products 2003-2004 Season**

Blonski, Slawomir; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 18 pp.; In English; See also [20080021597](#); Original contains color illustrations

Contract(s)/Grant(s): NAS13-650; NNS04AB54T; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation focuses on spatial resolution characterization for QuickBird panchromatic images in 2003-2004 and presents data measurements and analysis of SSC edge target deployment and edge response extraction and modeling. The results of the characterization are shown as values of the Modulation Transfer Function (MTF) at the Nyquist spatial frequency and as the Relative Edge Response (RER) components. The results show that RER is much less sensitive to accuracy of the curve fitting than the value of MTF at Nyquist frequency. Therefore, the RER/edge response slope is a more robust estimator of the digital image spatial resolution than the MTF. For the QuickBird panchromatic images, the RER is consistently equal to 0.5 for images processed with the Cubic Convolution resampling and to 0.8 for the MTF resampling.

Derived from text

*Satellites; Satellite Imagery; Spatial Resolution; Characterization; High Resolution; Earth Observations (From Space)*

**20080021631** National Geospatial-Intelligence Agency, Bethesda, MD, USA

**Image Quality Evaluation of QuickBird Super Resolution and Revisit of IKONOS: Civil and Commercial Application Project (CCAP)**

Jones, Edward C.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 13 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation used the National Imagery Interpretability Rating Scale (NIIRS) to evaluate the image quality of DigitalGlobe QuickBird super resolution imagery and to revisit IKONOS space imaging. IKONOS pan imagery was assessed in the fall of 2000. The data was re-analyzed because new outlier procedures had been established and it needed to be determined if there had been a change in image quality over time. Findings reveal that while the average NIIRS rating was smaller than in the previous evaluation, the difference was not statistically significant. It is concluded that IKONOS panchromatic image quality has not changed between 2001 and 2003.

Derived from text

*Satellite Imagery; Quality Control; Image Resolution; High Resolution*

**20080021634** Geological Survey, Washington, DC, USA

**Estimating Sub-Pixel Proportions of Sagebrush with a Regression Tree**

Homer, Collin; McKinley, Randy; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 1 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This brief presentation highlighting QuickBird imagery introduces a new method of sagebrush characterization using a Regression Tree to predict the pixel quantity of sagebrush in each pixel. This effort is designed to facilitate an ecosystem-wide effort to map, quantify and predict sagebrush steppe habitat in the Wyoming Basin for sage grouse.

Derived from text

*Satellites; Satellite Imagery; Pixels; Image Resolution; High Resolution; Vegetation*

**20080021636** Orbital Sciences Corp., Dulles, VA, USA

**Turning Imagery into Intelligence**

Adkins, Gary G.; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 42 pp.; In English; See also [20080021597](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation provides an overview of ORBIMAGE, as well as an OrbView-3 update and products overview.



ORBIMAGE collects, processes and distributes digital imagery of the Earth's land, oceans and atmosphere and supplies imagery and value-added geospatial information products and services worldwide. The ORBIMAGE system consists of satellite constellations, a worldwide network of ground stations, two advanced image processing facilities and one satellite control facility terminal with remote terminals. The launch profile, baseline, specifications, coverage and operations of OrbView-3 are highlighted. OrbView-3 products include imagery products such as basic, geo and ortho data sets; as well as derived products including digital elevation and thematic map products and feature maps. Overall, Orbview-3 continues to function well, offers a broad product portfolio, offers products commercially through its catalog, maintains global distributorships and has garnered key federal contracts.

Derived from text

*Satellites; Satellite Imagery; Earth Observations (From Space); Geographic Information Systems*

**20080021651** Geological Survey, Washington, DC, USA

**Commercial Remote Sensing Space Policy (CRSSP): Civil Near-Term Requirements Collection Update**

Cecere, Tom; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 29 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation focuses on commercial remote sensing space policy. The policy specifically requires civil agencies to determine which civil needs can be met by commercial remote sensing capabilities and to communicate current and projected needs to the remote sensing space industry. Short-term goals and objectives include increasing inter/intra-agency awareness of remote sensing applications and data needs, providing a basis for budget sub-team recommendations, identifying commonality between agency needs, helping guide infrastructure development and conveying requirements to the industry. Communicating requirements has the benefits of informing the industry regarding civil remote sensing needs, identifying and facilitating partnerships, encouraging the sharing of government data resources and increasing the awareness of peer users, techniques and applicable sensors for similar missions. Improved communication of results, from a data needs perspective, helps to identify civil agencies with similar missions, while from a data provider perspective, communication of results helps to identify geographical 'hot areas' to focus future capture plans. In the future it is expected that a 'living' requirements database will be introduced to test a new requirements collection system and agencies will be assisted with their requirements submissions. More immediately, steps will be taken to increase both the quality and quantity of the the requirements database, case studies will be developed to demonstrate the utility of satellite data for major national and agency-specific needs and more users will be exposed to satellite data by populating a highly visible civil archive.

Derived from text

*Remote Sensing; Procurement Policy; Government/Industry Relations; Data Management; Data Retrieval*

**20080021652** South Dakota State Univ., Brookings, SD, USA

**On-Orbit Modulation Transfer Function (MTF) Measurement of QuickBird**

Helder, Dennis; Choi, Jason; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 35 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation described the on-orbit modulation transfer function measurement (MTF) of QuickBird. The Point Spread Function (PSF) is a method of evaluating the spatial resolution of an imaging system that also measures the spread of a single point of light. The MTF is a measure of the spatial frequency response that is often calculated from the PSF. System response at the Nyquist frequency is often used as a figure of merit. NASA science data purchase (SDP) specifications indicate that the edge quality associated with the panchromatic band will provide a MTF of 0.09 or greater at the Nyquist frequency, while edge quality associated with each multispectral band will provide a MTF of 0.20 or greater at the Nyquist frequency. An edge method description is described using a combination of Fermi function fit, modified Savitzky-Golay filtering and the line spread function (LSF) with the MTF calculated by applying the Fourier transformation to LSF. Additionally, a pulse method and parametric edge detection method are described. Findings reveal that QuickBird has consistently met SDP specifications with significant margins.

Derived from text

*Satellite Imagery; Modulation Transfer Function; Spatial Resolution; Frequency Response; Edge Detection; Image Analysis*

**20080021654** Space Imaging EOSAT, Thornton, CO, USA

**Airport Mapping and Perpetual Monitoring Using IKONOS**

Damjanovic, Dejan; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 32 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation focuses on the use of IKONOS imagery in airport mapping and perpetual monitoring. This task was in answer to the problem of building cost-effective airport mapping databases for potential civil and military airports worldwide in order to enhance operational and all-weather safety. An additional challenge was how to keep those databases up-to-date with changes due to construction or unplanned events such as wars, floods, and other natural or political events, as well as alerting the user community of such updates. A life cycle for airport monitoring is highlighted which includes the construction of a geospatial information system (GIS) database, airport monitoring, updating of the GIS database and alerting all users to data changes. Leveraging the extensive archive of IKONOS images, notification of newly acquired imagery can be provided with automation allowing the ability to filter the imagery for significant changes as images are received.

Derived from text

*Earth Observations (From Space); Satellites; Satellite Imagery; Airports; Geographic Information Systems; Data Bases*

**20080021656** National Geospatial-Intelligence Agency, Saint Louis, MO, USA

**OrbView-3 Relative Accuracy Results and Impacts on Exploitation and Accuracy Improvement**

Badgall, Paul; Grohman, Greg; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 14 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In order to better exploit OrbView-3 its internal dynamics (or relative accuracy) needs to be understood to standardize production procedures. The National Geospatial Intelligence Agency therefore undertook a relative evaluation on Orbview-3 data to investigate possible errors that may not have been visible or obvious during the traditional CCAP geometric evaluation performed in Summer 2004. Different tests, performed on much larger datasets, were undertaken to seek out any systematic issues that could be looked into deeper as timer permits. This presentation is an early look at those relative accuracy results, impacts on exploitation and accuracy improvement data. Overall, the absolute accuracy of Orbview-3 is very good, however absolute, relative and interior orientation errors should be considered when controlling or triangulating sensor data. These errors are relatively small in comparison to those generated by the per-pixel repositioning that occurs from elevation errors within the orthorectification process.

Derived from text

*Satellites; Satellite Imagery; Accuracy; Geometric Rectification (Imagery); Image Analysis*

**20080021804** Library of Congress, Washington, DC USA

**North American Oil Sands: History of Development, Prospects for the Future**

Humphries, Marc; Jan 17, 2008; 31 pp.; In English

Report No.(s): AD-A477532; CRS-RL34258; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477532>

When it comes to future reliable oil supplies, Canada's oil sands will likely account for a greater share of U.S. oil imports. Oil sands account for about 46% of Canada's total oil production and oil sands production is increasing as conventional oil production declines. Since 2004, when a substantial portion of Canada's oil sands were deemed economic, Canada, with about 175 billion barrels of proved oil sands reserves, has ranked second behind Saudi Arabia in oil reserves. Canadian crude oil exports were about 1.82 million barrels per day (mbd) in 2006, of which 1.8 mbd or 99% went to the USA. Canadian crude oil accounts for about 18% of U.S. net imports and 12% of all U.S. crude oil supply. Oil sands, a mixture of sand, bitumen (a heavy crude that does not flow naturally), and water, can be mined or the oil can be extracted in-situ using thermal recovery techniques. Typically, oil sands contain about 75% inorganic matter, 10% bitumen, 10% silt and clay, and 5% water. Oil sand is sold in two forms: (1) as a raw bitumen that must be blended with a diluent for transport, and (2) as a synthetic crude oil (SCO) after being upgraded to constitute a light crude. Bitumen is a thick tar-like substance that must be upgraded by adding hydrogen or removing some of the carbon. Exploitation of oil sands in Canada began in 1967, after decades of research and development that began in the early 1900s. The Alberta Research Council (ARC), established by the provincial government in 1921, supported early research on separating bitumen from the sand and other materials. Demonstration projects continued through the 1940s and 1950s. The Great Canadian Oil Sands company, established by U.S.-based Sunoco, later renamed

Suncor, began commercial production in 1967 at 12,000 barrels per day. In the USA, a number of obstacles, including the remote and difficult topography, scattered deposits, and lack of water, have resulted in an uneconomic oil sands resource base.  
DTIC

*Canada; Crude Oil; Extraction; International Trade; Oils; Sands*

#### 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*.

**20080021183** NASA Glenn Research Center, Cleveland, OH, USA

#### **Closed-Cycle Hydrogen-Oxygen Regenerative Fuel Cell at the NASA Glenn Research Center-An Update**

Bents, David J.; Chang, Bei-Jiann; Johnson, Donald W.; Garcia, Christopher P.; April 2008; 15 pp.; In English; 2007 Fuel Cell Seminar, 15-22 Oct. 2007, San Antonio, TX, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.03

Report No.(s): NASA/TM-2008-215055; E-16268; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021183>

The closed cycle hydrogen-oxygen proton exchange membrane (PEM) regenerative fuel cell (RFC) at the NASA Glenn Research Center has demonstrated multiple back-to-back contiguous cycles at rated power and round-trip efficiencies up to 52 percent. It is the first fully closed cycle RFC ever demonstrated. (The entire system is sealed; nothing enters or escapes the system other than electrical power and heat.) During fiscal year fiscal year (FY) FY06 to FY07, the system s numerous modifications and internal improvements focused on reducing parasitic power, heat loss, and noise signature; increasing its functionality as an unattended automated energy storage device; and in-service reliability.

Author

*Regenerative Fuel Cells; Closed Cycles; Power Efficiency; Energy Storage; Cooling*

**20080021385** Schadow (Klaus), San Clemente, CA, USA

#### **Energetics and Power Generation**

Schadow, Klaus; Mar 1, 2007; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A476826; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA476826>

No abstract available

*Electric Generators; Electric Power Plants*

**20080021764** Townsend and Townsend and Crew, LLP, San Francisco, CA, USA

#### **Direct Alcohol Fuel Cells Using Solid Acid Electrolytes**

Haile, S. M., Inventor; Uda, T., Inventor; 30 Mar 05; 9 pp.; In English

Contract(s)/Grant(s): NSF-DMR-9902882; ONR-N00014-02-1-0192

Patent Info.: Filed Filed 30 Mar 05; US-Patent-Appl-SN-11-095-464

Report No.(s): PB2007-109292; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Direct alcohol fuel cells using solid acid electrolytes and internal reforming catalysts are disclosed. The fuel cell generally comprises an anode, a cathode, a solid acid electrolyte and an internal reforming catalyst. The internal reforming catalyst may comprise any suitable reformer and is positioned adjacent the anode. In this configuration the heat generated by the exothermic fuel cell catalyst reactions and ohmic heating of the fuel cell electrolyte drives the endothermic fuel reforming reaction, reforming the alcohol fuel into hydrogen. Any alcohol fuel may be used, e.g. methanol or ethanol. The fuel cells according to this invention show increased power density and cell voltage relative to direct alcohol fuel cells not using an internal reformer.

NTIS

*Alcohols; Catalysts; Electrolytes; Fuel Cells; Patent Applications; Solid Electrolytes*

**20080021837** Oak Ridge National Lab., TN USA

**Magnetohydrodynamic Electromagnetic Pulse (MHD-EMP) Interaction with Power Transmission and Distribution Systems**

Tesche, F M; Barnes, P R; Meliopoulos, A P; Feb 1992; 113 pp.; In English

Contract(s)/Grant(s): DNA-IACRO-90-822; IA-0046-C156-A1

Report No.(s): AD-A477653; ORNL/SUB/90-SG828/1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477653>

This report discusses the effects of the late-time high-altitude electromagnetic electrical transmission and distribution (T&D) systems. This environment, known as the magnetohydrodynamic electromagnetic pulse (MHD-EMP), is a very slowly varying electric field induced in the earth's surface, similar to the field induced by a geomagnetic storm. It can result in the flow of a quasi-dc current in grounded power lines and in the subsequent magnetic saturation of transformers. This saturation, in turn, causes 60-Hz harmonic distortion and an increase in the reactive power required by generation facilities. This report analyzes and discusses these phenomena. The MHD-EMP environment is briefly discussed, and a simplified form of the earth-induced electric field is developed for use in a parametric study of transmission line responses. Various field coupling models are described, and calculated results for the responses of both transmission and distribution-class power lines are presented. These calculated responses are compared with measurements of transformer operation under dc excitation to infer the MHD-EMP response of these power system components. It is found that the MHD-EMP environment would have a marked effect on a power system by inducing up to several hundreds of amperes of quasi-dc current on power lines. These currents will cause transformers to saturate which could result in excessive harmonic generation, voltage swings, and voltage suppression. The design of critical facilities which are required to operate during and after MHD-EMP events will have to be modified in order to mitigate the effects of these abnormal power system conditions.

DTIC

*Electric Fields; Electromagnetic Pulses; Magnetic Fields; Magnetohydrodynamics*

**20080021896** Library of Congress, Washington, DC USA

**Electric-Drive Propulsion for U.S. Navy Ships: Background and Issues for Congress**

O'Rourke, Ronald; Jul 31, 2000; 69 pp.; In English

Report No.(s): AD-A477822; CRS-RL30622; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477822>

The Navy in January 2000 selected electric-drive propulsion technology for use on its planned next-generation DD-21 land-attack destroyer and is considering it for use on other kinds of Navy ships as well. Electric drive poses issues for Congress concerning its costs, benefits and risks, and how the technology should be integrated into the DD-21 program or other ship-acquisition programs. Several foreign countries are developing or using electric drive in commercial or naval ships. The U.S. Navy's electric-drive development effort centers on the Integrated Power System (IPS) program. Several private-sector firms in the USA are now pursuing electric drive for the U.S. Navy market. Electric drive offers significant anticipated benefits for U.S. Navy ships in terms of reducing ship life-cycle cost, increasing ship stealthiness, payload, survivability, and power available for non-propulsion uses, and taking advantage of a strong electrical power technological and industrial base. Potential disadvantages include higher near term costs, increased technical risk, increased system complexity, and less efficiency in full-power operations. The current scarcity of precise and systematic estimates of the costs and benefits of electric drive makes it difficult for policymakers to assess the relative cost-effectiveness of differing technical approaches to achieving electric drive. Some of the risks involved in developing electric-drive technology have been mitigated by the successful development of electric-drive technology for commercial ships; estimates of the amount of remaining risk vary. The Navy has stated that developing common electric-drive components is feasible for several kinds of Navy ships and that pursuing electric drive technology in the form of a common family of components could have advantages for the Navy. The potential savings associated with a common system are difficult to estimate, but could be substantial.

DTIC

*Electric Generators; Electric Motors; Electric Propulsion; Navy; Propulsion System Configurations; Propulsion System Performance; Ships*

**20080021900** Aerospace Corp., El Segundo, CA USA

**Pico Satellite Solar Cell Testbed (PSSC Testbed) Design**

Simburger, E J; Liu, S; Halpine, J S; Hinkley, D A; Rumsey, D L; Swenson, J; Granata, J E; Yoo, H; Sep 30, 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A477827; TR-2007(1210)-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477827>

The PSSC Testbed flight experiment is designed to obtain accelerated space environment degradation data for advanced solar cells. The acceleration factor, with respect to total dose radiation for operational missions, will be obtained by flying the PSSC Testbed in a Geosynchronous Transfer Orbit (GTO). The resulting data will provide DOD and commercial users of advanced solar cells insight into the actual performance of these solar cells before they are flown as the power supply of a multimillion dollar satellite.

DTIC

*Solar Cells; Test Stands*

**45**

**ENVIRONMENT POLLUTION**

Includes atmospheric, water, soil, noise, and thermal pollution.

**20080021363** Government Accountability Office, Washington, DC, USA

**Aviation and the Environment: NextGen and Research and Development Are Keys to Reducing Emissions and their Impact on Health and Climate**

Dillingham, Gerald L.; May 06, 2008; 41 pp.; In English; Original contains black and white illustrations

Report No.(s): GAO-08-706T; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This testimony addresses (1) the scope and nature of aviation emissions, (2) the status of selected key federal efforts to reduce aviation emissions, and (3) next steps and challenges in reducing aviation emissions. The testimony updates prior GAO work with FAA data, literature reviews, and interviews with agency officials, industry and environmental stakeholders, and selected experts.

Author

*Exhaust Emission; Aircraft Engines; Air Pollution; Exhaust Gases; Airports*

**20080021427** Forest Service, Portland, OR USA

**Ozone Injury in West Coast Forests: 6 Years of Monitoring**

Campbell, S. J.; Wanek, R.; Coulston, J. W.; Jun. 2007; 60 pp.; In English

Report No.(s): PB2007-112110; FSGTR-PNW-722; No Copyright; Avail.: National Technical Information Service (NTIS)

Six years of monitoring for ozone injury by the Pacific Northwest Research Station Forest Inventory and Analysis Program are reported. The methods used to evaluate injury, compute an injury index, and estimate risk are described. Extensive injury was detected on ozone biomonitoring sites for all years in California, with ponderosa and Jeffrey pines, mugwort, skunkbush, and blue elderberry showing injury. Little or no injury was detected in Oregon and Washington. The relation of observed injury to ambient ozone levels is discussed. The areas with the highest modeled risk of ozone injury are the areas east of Los Angeles, the southern Sierra Nevada, and portions of the central coast.

NTIS

*Coasts; Forests; Ozone; Forest Management*

**20080021445** Denver Univ., Denver, CO, USA

**On-Road Remote Sensing of Automobile Emissions in the Phoenix Area: Year 6, November 2006**

Bishop, G. A.; Stadtmuller, R.; Stedman, D. H.; Jul. 2007; 48 pp.; In English

Contract(s)/Grant(s): E-23-9

Report No.(s): PB2007-112623; CRC-E-23-9; No Copyright; Avail.: National Technical Information Service (NTIS)

The University of Denver conducted a five-day remote sensing study in the Phoenix, AZ area in the fall of 2006. The remote sensor used in this study is capable of measuring the ratios of CO, HC, and NO to CO<sub>2</sub> in motor vehicle exhaust. From these ratios, we calculate mass emissions per kg (or gallon) of fuel and the percent concentrations of CO, CO<sub>2</sub>, HC and NO in motor vehicle exhaust which would be observed by a tailpipe probe, corrected for water and any excess oxygen not involved



in combustion. The system used in this study was also configured to determine the speed and acceleration of the vehicle, and was accompanied by a video system to record the license plate of the vehicle. This was the sixth year of a multi-year continuing study to characterize motor vehicle emissions and deterioration in the Phoenix area. However, because of the non-ideal driving mode at the site in the first year (1998), a new ramp similar to the Denver, Chicago and L.A. Basin sites had been used in 1999, 2000, 2002, 2004 and was again used this year.

NTIS

*Air Pollution; Automobiles; Exhaust Emission; Pollution Control; Remote Sensing; Roads*

**20080021449** Environmental Protection Agency, Washington, DC, USA; Department of Energy, Washington, DC, USA  
**Coal Combustion Waste Management at Landfills and Surface Impoundments, 1994-2004**

January 2006; 268 pp.; In English

Report No.(s): PB2007-112594; EPA-530-R-06-012; No Copyright; Avail.: CASI: [A12](#), Hardcopy

Fossil fuel combustion (FFC) wastes are the wastes produced from the burning of fossil fuels (i.e., coal, oil, natural gas). This includes all ash, slag, and particulates removed from flue gas. FFC wastes are categorized by EPA as a 'special waste' and have been exempted from federal hazardous waste regulations under Subtitle C of the Resource Conservation and Recovery Act (RCRA).

NTIS

*Coal; Combustion; Landfills; Waste Management*

**20080021450** Environmental Protection Agency, Washington, DC, USA  
**Solid Waste Management and Greenhouse Gases. A Life-Cycle Assessment of Emissions and Sinks. Third Edition**

Sep. 2006; 172 pp.; In English

Report No.(s): PB2007-112587; EPA-530-R-06-004; No Copyright; Avail.: CASI: [A08](#), Hardcopy

In the 21st century, management of municipal solid waste continues to be an important environmental challenge. Climate change is also a serious issue, and the USA is embarking on a number of voluntary actions to reduce the emissions of greenhouse gases that can intensify climate change. This report examines how municipal solid waste management and climate change are related. Management of municipal solid waste presents many opportunities for greenhouse gas emission reductions. Source reduction and recycling can reduce emissions at the manufacturing stage, increase forest carbon storage, and avoid landfill methane emissions. Combustion of waste allows energy recovery to displace fossil fuel-generated electricity from utilities, thus reducing greenhouse gas emissions from the utility sector and landfill methane emissions. Diverting organic materials from landfills also reduces methane emissions.

NTIS

*Air Pollution; Climate Change; Greenhouse Effect; Pollution Control; Sinks; Solid Wastes; Waste Management*

**20080021451** Environmental Protection Agency, Washington, DC, USA  
**SmartWay SIP and Transportation Conformity Guidance: Accounting for NO<sub>x</sub> Reductions from Trailer Aerodynamic Kits and Low Rolling Resistance Tires. Guidance for State and Local Air and Transportation Agencies**

Jun. 2007; 35 pp.; In English

Report No.(s): PB2007-112582; EPA-420-B-07-004; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The purpose of this guidance is to describe how to quantify and use reductions in nitrogen oxides (NO<sub>x</sub>) that result when trucks are outfitted with two specific SmartWay fuel efficient technologies: low rolling resistance tires and trailer aerodynamic kits. This guidance describes how to apply these NO<sub>x</sub> reductions in state implementation plans (SIPs) and in transportation conformity determinations. Therefore, this guidance could be of interest primarily to ozone and particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>) nonattainment and maintenance areas that are considering additional ways to reduce NO<sub>x</sub> for reasonable further progress (RFP) SIPs, attainment demonstrations, or maintenance plans, or in transportation conformity determinations. EPA's intent in producing this guidance is to facilitate the adoption of SmartWay projects as a cost-effective way to achieve needed NO<sub>x</sub> emission reductions while ensuring that these projects meet SIP and conformity requirements.

NTIS

*Air Pollution; Kits; Nitrogen Oxides; Pollution Control; Tires; Trailers; Transportation; Trucks*

**20080021452** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA  
**Meteorological and Air Quality Impacts of Heat Island Mitigation Measures in Three U.S. Cities**

Taha, H.; Chang, S. C.; Akbari, H.; Apr. 2000; 61 pp.; In English

Report No.(s): PB2007-112581; LBNL-44222; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This report investigates the air pollution reduction benefits associated with mitigating urban heat islands in three U.S.

cities. The effects of these measures in Salt Lake City, Baton Rouge, and Sacramento were evaluated through mesoscale meteorological and air quality modeling. The simulations indicate that for these three U.S. cities, adopting heat island reduction measures can result in various meteorological and air quality changes. The meteorological simulations suggest that each of the three pilot cities benefits from reduced ambient air temperatures. Decreases typically range from 1 to 2K (1.8 - 3.6oF) over modified areas. In Salt Lake City, reductions in ambient air temperatures reach up to 2K (3.6oF) at 1600 LST. The city achieves reductions in ozone concentrations of up to 3 or 4 ppb, the equivalent of about 3.5% if it were compared to an urban peak of 95 ppb. In Baton Rouge, reductions in ambient air temperatures of 0.75K (1.4oF) are possible and ozone reductions reach up to 4 or 5 ppb, the equivalent of about 4% if compared to an urban peak of 113 ppb. Finally, Sacramento enjoys reductions of 1.2K (2.2oF) as a result of heat island mitigation measures. Although these temperature reductions are not as large as those experienced in Salt Lake City, for example, their impacts on ozone are relatively larger, with reductions of up to 10 ppb from peak ozone concentrations (about 7% of the peak of 139 ppb).

NTIS

*Air Pollution; Air Quality; Cities; Heat Islands; Pollution Control*

**20080021454** Environmental Protection Agency, Washington, DC, USA

**Global Mitigation of Non-CO2 Greenhouse Gases**

Jun. 2006; 430 pp.; In English

Report No.(s): PB2007-112584; EPA-430-R-06-005; No Copyright; Avail.: CASI: [A19](#), Hardcopy

This report will provide mitigation abatement costs for reductions of non-CO2 greenhouse gases, by source category and region. The principal technologies for reducing emissions will be thoroughly described and technical and economic assumptions documented.

NTIS

*Air Pollution; Carbon Dioxide; Costs; Greenhouse Effect; Pollution Control*

**20080021502** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Database Tools for Modeling Emissions and Control of Air Pollutants from Consumer Products, Cooking, and Combustion**

Howard-Reed, C.; Polidoro, B.; Nov. 2006; 69 pp.; In English

Report No.(s): PB2007-112597; NISTIR-7364; No Copyright; Avail.: CASI: [A04](#), Hardcopy

In order to estimate building contaminant concentrations and associated occupant exposures, indoor air quality (IAQ) model users require data related to source strengths and other contaminant transport mechanisms (e.g. sinks, filters). Much of this information exists in the literature; however, it is not readily accessible, thereby requiring users to expend significant efforts in searching for this information. To support the modeling process, the National Institute of Standards and Technology (NIST) has created a series of model input databases for use in its multizone IAQ and ventilation model CONTAM. As part of this effort, a standard data entry format was developed, as well as a computer program to search the database for specific records and build a CONTAM input library. These databases and tools can serve as a basis for building an extensive collection of model input parameters, assessing the quality and completeness of existing data sets, and allow for identification of significant data gaps.

NTIS

*Air Pollution; Air Quality; Combustion; Consumers; Data Bases; Indoor Air Pollution; Pollution Control*

**20080021733** San Diego State Univ., San Diego, CA USA

**Research into the Development of Biological Methods of Dust Suppression in the Antelope Valley**

Unger, J.; Zink, T.; Feb. 2007; 42 pp.; In English

Report No.(s): PB2007-109585; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Antelope Valley, located fifty miles north of Los Angeles in the Mojave Desert, has been experiencing air quality problems caused by frequent dust storms. Bordered to the south by the San Gabriel Mountains, to the west by Coastal Mountain Ranges and to the northwest by the Tehachapi Mountains, Antelope Valley was intensely farmed until 10 to 20 years ago. Increased water costs caused many farmers to abandon farming, leaving vast tracts of bare, disturbed land. The air pollution problem caused by the abandonment of farms, miles of dirt roads, increased construction, summer brushfires and other human disturbances, combined with high winds, has led to high levels of PM(sub 10) in and around Lancaster and Palmdale. A resurgence of farming in Antelope Valley has been seen over the last few years. Most of the land used during the farming season is left fallow for up to three years because of pathogens in the soil from root crops. This practice introduces additional

airborne dust into an already existing air problem. The Dustbusters, comprised of a coalition of local farmers, the Antelope Valley Resources Conservation District, the California Air Resources Board, South Coast Air Quality Management, the USA Department of Agriculture, the Natural Resource Conservation Service, the City of Los Angeles Department of World Airports, and Southern California Edison, invited the Soil Ecology and Restoration Group (SERG) of San Diego State University to join them in addressing issues of dust mitigation in Antelope Valley.

NTIS

*Air Pollution; Dust; Dust Collectors; Pollution Control; Valleys*

**20080021738** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

**Technical Support Document for the Prevention of Significant Deterioration and Nonattainment Area New Source Review: Emissions Increase Test for Electric Generating Units**

Apr. 2007; 99 pp.; In English

Report No.(s): PB2007-112083; EPA/457/R-07/001; No Copyright; Avail.: National Technical Information Service (NTIS)

This Technical Support Document contains information and analyses supporting the proposed rule Prevention of Significant Deterioration, Nonattainment New Source Review, and New Source Performance Standards: Electric Generating Units (70 FR 61081). Our supplemental proposal contains additional regulatory and policy background for the proposed rule, as well as the specific regulatory language. This TSD contains specific information about three separate analyses conducted in support of the proposed regulatory approach, as included in the proposal and the supplemental proposal.

NTIS

*Air Pollution; Deterioration; Pollution Control; Prevention*

**20080021751** ICF International, Inc., Fairfax, VA, USA

**Lead Human Exposure and Health Risk Assessments for Selected Case Studies (Draft Report). Volume 2. Appendices**

Jul. 2007; 774 pp.; In English

Contract(s)/Grant(s): EP-D-06-115

Report No.(s): PB2007-112259; EPA/452/D-07/001B; No Copyright; Avail.: CASI: [A99](#), Hardcopy

Due to its physical and chemical properties, lead (Pb) exists in the environment predominantly in solid form. Consequently upon emission into the air, Pb deposits onto surfaces or exists in the atmosphere as a component of atmospheric aerosol, and usually in the form of various Pb compounds. The National Ambient Air Quality Standard (NAAQS) for Pb pertains to the Pb content of all Pb compounds that may be emitted to air. The major environmental transport pathway for anthropogenic Pb is the atmosphere, in which it can also undergo secondary dispersal via the deposition and resuspension of particles containing Pb. Airborne Pb particles generally have a bimodal distribution with the greater mass of Pb found in the fine fraction, for which deposition is slower and less efficient than for larger particles. Accordingly Pb may be widely dispersed. Wet and dry deposition are the ultimate paths by which Pb particles are removed from the atmosphere. This appendix describes information on sources and emissions of Pb to the atmosphere, and Pb air monitoring data.

NTIS

*Exposure; Health; Lead (Metal); Risk Assessment; Public Health*

**20080021752** ICF International, Inc., Fairfax, VA, USA

**Lead Human Exposure and Health Risk Assessments for Selected Case Studies (Draft Report). Volume 1. Human Exposure and Health Risk Assessments: Full-Scale**

Jul. 2007; 158 pp.; In English

Contract(s)/Grant(s): EP-D-06-115

Report No.(s): PB2007-112258; EPA/452/D-07/001A; No Copyright; Avail.: CASI: [A08](#), Hardcopy

This document is the first volume of the draft report Lead Human Exposure and Health Risk Assessments for Selected Areas. This volume describes the quantitative human exposure and health risk assessments being conducted to inform the U.S. Environmental Protection Agency's (EPA's) current review of the National Ambient Air Quality Standards (NAAQS) for lead (Pb). The draft risk assessment report is being provided to the Clean Air Science Advisory Committee (CASAC) and the public for review in advance of a public meeting of the CASAC Pb panel planned for August 28-29, 2007. Following that meeting, we will take CASAC and public comments into account in preparing the final document. We plan to complete the final risk assessment report in October, 2007.

NTIS

*Exposure; Health; Lead (Metal); Risk Assessment; Public Health; Air Pollution; Air Quality*

**20080021761**; National Council of the Paper Industry for Air and Stream Improvement, Inc., Gainesville, FL, USA  
**Innovative Titania-Activated Carbon System for Removal of VOC's and HAP's from Pulp, Paper, Paperboard Mills, and Wood Products Facilities with In-Situ Regeneration Capabilities**

Apr. 30, 2007; 101 pp.; In English

Contract(s)/Grant(s): DE-FC36-03ID14437

Report No.(s): DE2007-909185; No Copyright; Avail.: National Technical Information Service (NTIS)

Forest products provide essential resources for human civilization, including energy and materials. In processing forest products, however, unwanted byproducts, such as volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) are generated. The goal of this study was to develop a cost effective and reliable air pollution control system to reduce VOC and HAP emissions from pulp, paper and paperboard mills and solid wood product facilities. Specifically, this work focused on the removal of VOCs and HAPs from high volume low concentration (HVLC) gases, particularly methanol since it is the largest HAP constituent in these gases. Three technologies were developed and tested at the bench-scale: (1) A novel composite material of activated carbon coated with a photocatalyst titanium dioxide (TiO<sub>2</sub>) (referred to as TiO<sub>2</sub>-coated activated carbon or TiO<sub>2</sub>/AC), (2) a novel silica gel impregnated with nanosized TiO<sub>2</sub> (referred to as silica-titania composites or STC), and (3) biofiltration. A pilot-scale reactor was also fabricated and tested for methanol removal using the TiO<sub>2</sub>/AC and STC. The technical feasibility of removing methanol with TiO<sub>2</sub>/AC was studied using a composite synthesized via a spray desiccation method. The removal of methanol consists of two consecutive operation steps: removal of methanol using fixed-bed activated carbon adsorption and regeneration of spent activated carbon using in-situ photocatalytic oxidation. Regeneration using photocatalytic oxidation employed irradiation of the TiO<sub>2</sub> catalyst with low-energy ultraviolet (UV) light. NTIS

*Activated Carbon; Air Pollution; Boards (Paper); Industries; Organic Compounds; Pollution Control; Titania; Wood*

**20080021847** National Inst. for Occupational Safety and Health, Cincinnati, OH USA; Environmental Protection Agency, Washington, DC USA

**Preventing Worker Injuries and Deaths from Explosions in Industrial Ethylene Oxide Sterilization Facilities. Revised Edition. NIOSH-EPA-EOSA Alert**

January 2007; 40 pp.; In English

Report No.(s): PB2007-112909; DHHS/PUB/NIOSH-2007-164; EPA/550/F-99/018; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The National Institute for Occupational Safety and Health (NIOSH), the U.S. Environmental Protection Agency (EPA), and the Ethylene Oxide Sterilization Association (EOSA) request assistance in preventing explosions at industrial ethylene oxide (EtO) sterilization facilities and EtO repackaging plants. EtO is a flammable gas. During sterilization procedures, EtO can easily form explosive mixtures when it is vented to certain types of emission control devices such as catalytic oxidizers. Between 1994 and 1998, EtO was involved in 10 explosions at industrial EtO sterilization facilities and EtO repackaging plants. One of these explosions caused 1 death and 59 injuries among workers. All of these incidents caused damage to the plants, most of which used catalytic oxidizers to control EtO emissions. This Alert informs owners, managers, supervisors, engineers, safety professionals, and workers about the explosions, injuries, and deaths that may occur at industrial EtO sterilization facilities and repackaging plants. Steps are recommended for preventing these explosions.

NTIS

*Ethylene Oxide; Health; Hygiene; Industrial Safety; Safety; Sterilization*

**20080022246** Southern States Energy Board, Norcross, GA, USA

**Southeast Regional Carbon Sequestration Partnership: Phase I. Final Report**

Nemeth, K. J.; Nov. 01, 2006; 107 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT41980

Report No.(s): DE2007-909272; No Copyright; Avail.: National Technical Information Service (NTIS)

The Southeast Regional Carbon Sequestration Partnership's (SECARB) Phase I program focused on promoting the development of a framework and infrastructure necessary for the validation and commercial deployment of carbon sequestration technologies. The SECARB program, and its subsequent phases, directly support the Global Climate Change Initiative's goal of reducing greenhouse gas intensity by 18 percent by the year 2012. Work during the project's two-year

period was conducted within a Task Responsibility Matrix. The SECARB team was successful in accomplishing its tasks to define the geographic boundaries of the region; characterize the region; identify and address issues for technology deployment; develop public involvement and education mechanisms; identify the most promising capture, sequestration, and transport options; and prepare action plans for implementation and technology validation activity.

NTIS

*Carbon; Climate Change; Carbon Dioxide; Climatology*

## 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*.

**20080020586** USA Climate Change Technology Program, Washington, DC USA

#### **U.S. Climate Change Technology Program: Strategic Plan**

Sep 2006; 245 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477362; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In February 2002, President George W. Bush reorganized the overarching management structure that coordinates and directs U.S. climate change research and development activities. Under this new structure, climate change science and climate-related technology research programs are integrated to an extent not seen previously. The Climate Change Science Program (CCSP) was established to reduce the uncertainties in climate science and develop science-based resources to support decision makers. The Climate Change Technology Program (CCTP) was formed to coordinate the Federal Government's portfolio of climate-related technology research and development activities, including technology deployment and adoption activities. The Strategic Plan expands on the themes presented in CCTP's Vision and Framework for Strategy and Planning. The technologies outlined in this Plan hydrogen, biorefining, clean coal, carbon sequestration, nuclear fission and fusion, advanced concepts in buildings, industry, transportation and electric energy storage and distribution, and others have the potential to transform our economy in fundamental ways that can address not just climate change, but energy security, air quality, and other pressing needs. The Plan articulates a vision of the role for advanced technologies, defines a supporting mission for the CCTP, establishes guiding principles for Federal R&D agencies to use in formulating R&D portfolios, outlines approaches to attain CCTP's strategic goals, and identifies a series of next steps toward implementation.

DTIC

*Climate Change; Greenhouse Effect; Research Management; Technology Assessment*

**20080021232** Alaska Univ., Fairbanks, AK, USA

#### **Investigating the Auroral Thermosphere with N<sub>2</sub><sup>+</sup> Lidar**

Collins, Richard L.; Su, Liguu; Lummerzheim, Dirk; Doe, Richard A.; Characterising the Ionosphere; June 2006, pp. 2-1 - 2-14; In English; See also [20080021218](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): ATM-05-14103

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

We present a new lidar method for investigation of the aurorally-modified ionosphere. Resonance nitrogen-ion (N<sub>2</sub><sup>(+)</sup> XB) lidar system is capable of making measurements of aurorally-ionized nitrogen in the polar ionosphere up to altitudes of approx.300 km. We present a description of the prototype resonance lidar system that is currently being developed at Poker Flat Research Range. We compare the technical features and capabilities of this lidar system to conventional resonance lidar systems that measure atomic metals. Unlike incoherent scatter radar, the lidar measures a specific ionic species as opposed to a total ion profile. We describe how assimilative observational-modelling studies of the auroral E-region that combine measurements made with the lidar system, a radar system (i.e., the Advanced Modular Incoherent Scatter Radar), and a meridian scanning photometer with a multi-species ionospheric chemistry model will be conducted. We discuss how these observational-modelling studies will yield more accurate estimates of the ionic populations. We discuss how these studies can



yield estimates of nitric oxide production while it is being created in the aurora, estimates of the auroral particle energy spectrum, and allow insights into the structure of pulsating aurora.

Author

*Nitrogen; Ionized Gases; Particle Energy; Atmospheric Chemistry; Auroral Zones; Electrophotometers; Optical Radar; Auroras*

**20080021239** Universidad de Concepcion, Concepcion, Chile

**Morphology of Southern Hemisphere Riometer Auroral Absorption**

Foppiano, A. J.; Characterising the Ionosphere; June 2006, pp. 4-1 - 4-26; In English; See also [20080021218](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): INT-8815373; DPP-9119753; 1940934

Report No.(s): Paper 4; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A morphology of riometer auroral absorption is derived from hourly values, determined at several Southern Hemisphere stations, located both near the centre of the auroral absorption zone and at higher and lower latitude fringes of the zone. Since spatial coverage of the data precludes a detailed morphology determination, use was made as guideline at all stages of an auroral absorption model derived for the Northern Hemisphere (NH). The day-to-day variability was first determined from cumulative amplitude-probability distributions calculated for a given hour at a given location for a range of geophysical conditions. These distributions are found to be well represented by log-normal distributions for most locations, times-of-day and solar and geomagnetic activity levels, over the range of absorption for which values are more accurate (typically 0.3 dB or above). Furthermore, parameters of log-normal distributions are found to be related following a known simple expression, so as to permit full specification of any distribution by a single parameter. Both these results are found to be consistent with the NH counterparts. Then time-of-day dependencies were determined for several distribution parameters. These were also found to show the same features than in the NH except for locations near the so-called South Atlantic Anomaly of the geomagnetic field. Determination of latitude and longitude dependencies are only possible when due account is taken of the widening and equator ward movement of the auroral absorption zone with increasing geomagnetic activity level. Assuming Gaussian latitude dependencies apply for all hours, longitude factors are determined so as to be consistent with observed geomagnetic activity level dependencies of absorption distribution parameters for the different longitudes. These factors lead to longitude dependence, which is consistent with theoretical and empirical evidence from other phenomena. This result seems to be different from that that holds for the NH.

Author

*Riometers; Southern Hemisphere; Morphology; Normal Density Functions; Auroral Absorption; Geomagnetism; Latitude; Longitude; Geophysics*

**20080021265** Nagoya Univ., Toyokawa, Japan; NASA Langley Research Center, Hampton, VA, USA

**A Multi-Instrument Measurement of a Mesospheric Bore at the Equator**

Shiokawa, K.; Suzuki, S.; Otsuka, Y.; Ogawa, T.; Nakamura, T.; Mlynczak, M. G.; Russell, J. M., III; January 2005; 26 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): 13573006; Copyright; Avail.: CASI: [A03](#), Hardcopy

We have made a comprehensive measurement of mesospheric bore phenomenon at the equator at Kototabang, Indonesia (0.2 deg S, 100.3 deg E), using an airglow imager, an airglow temperature photometer, a meteor radar, and the SABER instrument on board the TIMED satellite. The bore was detected in airglow images of both OH-band (peak emission altitude: 87 km) and 557.7-nm (96 km) emissions, as east-west front-like structure propagating northward with a velocity of 52-58 m/s. Wave trains with a horizontal wavelength of 30-70 km are observed behind the bore front. The airglow intensity decreases for all the mesospheric emissions of OI (557.7 nm), OH-band, O2-band (altitude: 94 km), and Na (589.3 nm) (90 km) after the bore passage. The rotational temperatures of both OH-band and O2-band also decrease approximately 10 K after the bore passage. An intense shear in northward wind velocity of 80m/s was observed at altitudes of 84-90 km by the meteor radar. Kinetic temperature profile at altitudes of 20-120 km was observed near Kototabang by TIMED/SABER. On the basis of these observations, we discuss generation and ducting of the observed mesospheric bore.

Author

*Mesosphere; Tidal Waves; Wave Fronts; Equators; Measuring Instruments*

**20080021409** Air Force Research Lab., Hanscom AFB, MA USA

**Satellite and Ground-Based Observations of Auroral Energy Deposition and the Effects on Thermospheric Composition During Large Geomagnetic Storms: 1. Great Geomagnetic Storm of 20 November 2003**

Hecht, J H; Mulligan, T; Strickland, D J; Kochenash, A J; Murayama, Y; Tanaka, Y -M; Evans, D S; Conde, M G; Donovan, E F; Rich, F J; Morrison, D; Jan 2008; 30 pp.; In English

Contract(s)/Grant(s): Proj-2301

Report No.(s): AD-A477037; AFRL-RV-HA-TR-2008-1002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477037>

The great geomagnetic storm of 20-21 November 2003 was associated with the passage of magnetic cloud past the earth. The changes in thermospheric composition and particle precipitation are compared to those observed during geomagnetic activity on 17 November 2003, and during the intervening quieter period. We used data from (1) ground-based magnetometers, an imaging riometer, a scanning Doppler imaging Fabry-Perot, and photometers from stations in Alaska (2) photometers from Canadian sites, (3) NOAA POES and DMSP particle sensors, and (4) the TIMED Global Ultraviolet Imager far UV sensor. Composition changes associated with the input of auroral particle and Joule energy showed larger depletions in atomic oxygen on 20 Nov than on the other nights and greater changes than are seen in the Naval Research Laboratory Mass Spectrometer and Incoherent Scatter (NRLMSIS) model atmosphere. NRLMSIS does better in reproducing the changes during the great magnetic storm with long duration auroral energy input than during the shorter time duration that occurred on 17 Nov. During the nights with the largest changes in composition the input of Joule energy dominates over auroral particle energy. It is shown that the particle energy distributions associated with the 20-21 Nov. storm in the period around and after the passage of the magnetic cloud had lower average energies than on preceding days

DTIC

*Auroras; Deposition; Energy Transfer; Geomagnetism; Incoherent Scattering; Magnetic Storms; Photometers; Riometers; Satellite Observation; Thermosphere*

**20080022186** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Subcritical Water Extraction of Amino Acids from Atacama Desert Soils**

Amashukeli, Xenia; Pelletier, Christine C.; Kirby, James P.; Grunthner, Frank J.; Journal of Geophysical Research; September 7, 2007; Volume 112; 10 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40822>; <http://dx.doi.org/10.1029/2006JG000308>

Amino acids are considered organic molecular indicators in the search for extant and extinct life in the Solar System. Extraction of these molecules from a particulate solid matrix, such as Martian regolith, will be critical to their in situ detection and analysis. The goals of this study were to optimize a laboratory amino acid extraction protocol by quantitatively measuring the yields of extracted amino acids as a function of liquid water temperature and sample extraction time and to compare the results to the standard HCl vapor-phase hydrolysis yields for the same soil samples. Soil samples from the Yungay region of the Atacama Desert (Martian regolith analog) were collected during a field study in the summer of 2005. The amino acids (alanine, aspartic acid, glutamic acid, glycine, serine, and valine) chosen for analysis were present in the samples at concentrations of 1 - 70 parts-per-billion. Subcritical water extraction efficiency was examined over the temperature range of 30 - 325 degrees C, at pressures of 17.2 or 20.0 MPa, and for water-sample contact equilibration times of 0 - 30 min. None of the amino acids were extracted in detectable amounts at 30 degrees C (at 17.2 MPa), suggesting that amino acids are too strongly bound by the soil matrix to be extracted at such a low temperature. Between 150 degrees C and 250 degrees C (at 17.2 MPa), the extraction efficiencies of glycine, alanine, and valine were observed to increase with increasing water temperature, consistent with higher solubility at higher temperatures, perhaps due to the decreasing dielectric constant of water. Amino acids were not detected in extracts collected at 325 degrees C (at 20.0 MPa), probably due to amino acid decomposition at this temperature. The optimal subcritical water extraction conditions for these amino acids from Atacama Desert soils were achieved at 200 degrees C, 17.2 MPa, and a water-sample contact equilibration time of 10 min.

Author

*Amino Acids; Extraction; Soil Sampling; Deserts; Mars Surface; Regolith; Water Temperature; Vapor Phases; Planetary Geology; Extinction*

Includes weather observation forecasting and modification.

**20080021218** NATO Research and Technology Organization, Neuilly-sur-Seine, France

**Characterising the Ionosphere**

June 2006; In English; Specialists' Meeting organized by the Information Systems Technology Panel, in conjunction with U.R.S.I., 12-16 Jun. 2006, Fairbanks, Alaska, USA; See also 20080021219 - 20080021248; Original contains color and black and white illustrations

Report No.(s): RTO-MP-IST-056; AC/323(IST-056)TP/40; Copyright; Avail.: CASI: **C01**, CD-ROM

Topics covered include: Studies of Ionospheric Processes in the Atmosphere and the Laboratory; Investigating the Auroral Thermosphere with N<sub>2</sub><sup>+</sup> Lidar; Polar Ionospheric Imaging at Storm Time; Morphology of Southern Hemisphere Riometer Auroral Absorption; An Investigation into the Relationship between Ionospheric Scintillation and Loss of Lock in GNSS Receivers; Morphological Characteristics of L-Band Scintillations and Their Impact on GPS Signals - A Quantitative Study on the Precursors for the Occurrence of Scintillations; Observations of the Tongue of Ionization with GPS TEC and SuperDARN; VLF Phase Perturbations Produced by the Variability in Large (V/m) Mesospheric Electric Fields in the 60-70 km Altitude Range; Ionospheric F-Region Storms: Unsolved Problems; Space Weather Applications of the UAF Eulerian Parallel Polar Ionosphere Model (EPPIM); Theoretical and Observational Studies of Meteor Interactions with the Ionosphere; European Space Weather Activities; High Latitude Ionospheric Structures; Large-Scale Plasma Structure in the Polar and Auroral Ionosphere: Experimental Observations and Modelling; Direction Finding Errors Induced by Plasmawaves of the Ionosphere; Characterisation of Narrowband HF Channels in the Mid and Low Latitude Ionosphere; Quasi-Analytic Models for Density Bubbles and Plasma Clouds in the Equatorial Ionosphere; Modeling of Ionospheric Refraction of UHF Radar Signals at High Latitudes; Mitigation of Ionospheric Effects on High Frequency Surface Wave Radar; Ground-based Radar Detection of the Inner Boundary of the Ion Plasma Sheet and its Response to the Changes in the Interplanetary Magnetic Field; The European Server for Ionospheric Specification and Forecasting: Final Results from DIAS Project; A Digital Radio Receiver for Ionospheric Research; What Can We Learn About the Ionosphere Using the EISCAT Heating Facility?; GPS Sounding of the Ionosphere Onboard CHAMP; Real-Time Imaging of the Ionosphere over the UK - Preliminary Results; Characterization of the Ionosphere over the South Atlantic Ocean by Means of Ionospheric Tomography Using Dual Frequency GPS Signals Received On Board a Research Ship; GPS Users Positioning Errors during Disturbed Near-Earth Space Conditions; Review of the Current Status of Four-Dimensional Ionospheric Imaging; The International Reference Ionosphere - Climatological Standard for the Ionosphere; and Modeling of Sporadic-E Structures from Wind-Driven Kelvin-Helmholtz Turbulence.

Derived from text

*Thermosphere; Plasmas (Physics); Optical Radar; Space Weather; Mesosphere; Ionospheric Storms; Interplanetary Magnetic Fields; Climatology; Auroral Absorption; Plasma Clouds*

**20080021219** University of Western Ontario, London, Ontario, Canada

**High Latitude Ionospheric Structures**

MacDougall, John; Characterising the Ionosphere; June 2006, pp. 14-1 - 14-10; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 14; Copyright; Avail.: CASI: **A03**, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The high latitude ionosphere has much more structuring than at lower latitudes. The digital ionosonde is a very suitable instrument for studying these structures. Examples of digital ionosonde observations for 3 types of structures are shown. These are Polar Patches, polar auroras, and Poleward Moving Auroral Forms. The properties and mechanisms involved in much of this structuring is unknown.

Author

*Ionosondes; Dynamic Characteristics; Auroras; Polar Regions; Polar Caps; Imaging Techniques*

**20080021220** Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany

**Direction Finding Errors Induced by Plasmawaves of the Ionosphere**

Hawlitshka, Stefan; Characterising the Ionosphere; June 2006, pp. 16-1 - 16-14; In English; See also [20080021218](#); Original contains color illustrations

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A super-resolution high frequency (HF) direction finding (DF) system has been used to measure the temporal characteristics of mid-latitude ionospheric irregularities. By analysis of the log power spectrum of the temporal profiles they are classified into six classes: (1) traveling wave packets (TWPs), (2) wave trains (WTs), (3) large-scale traveling disturbances at the terminator (TLSTIDs), (4) interference of different waves (IDW), (5) chaos and (6) quiet state. Their occurrence is correlated to the time of day, the ionospheric layer of reflection and the geomagnetic conditions which are expressed by the local K index. In total 192.25 hours of observation have been processed with a newly developed super-resolution DF algorithm which is suited for direction finding of moving incidence angles.

Author

*Ionospheric Disturbances; Ionospheric Propagation; Direction Finding; Temperate Regions; High Frequencies; Geomagnetism; Deuterium Fluorides*

**20080021222** Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Neustrelitz, Germany

**GPS Sounding of the Ionosphere Onboard CHAMP**

Jakowski, N.; Mayer, C.; Wilken, V.; Characterising the Ionosphere; June 2006, pp. 26-1 - 26-16; In English; See also [20080021218](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): V230-630-08-TIFA-334

Report No.(s): Paper 26; Copyright; Avail.: CASI: [A04](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Space based GPS measurements onboard Low Earth Orbiting (LEO) satellites provide a unique possibility for exploring the ionosphere on a global scale. Both the radio occultation measurements in the limb sounding mode and the navigation measurements using a zenith viewing GPS antenna provide the Total Electron Content (TEC) along numerous ray paths. TEC may effectively be used for reconstructing the spatial and temporal distribution of the electron density in the ionosphere and plasmasphere. Reported are results obtained from radio occultation measurements on CHALLENGING Mini satellite Payload (CHAMP) which have provided more than 200,000 vertical electron density profiles so far. These observations contribute to a better understanding of the regular behaviour of the global ionosphere. Furthermore, the radio occultation measurements indicate irregular and/or wavelike structures in the ionosphere which may have severe impact on the functionality of radio systems. A three-dimensional imaging of the electron density distribution near the CHAMP orbit plane between CHAMP and GPS orbit height is performed by using link related TEC data derived from dual frequency navigation measurements (zenith antenna) onboard CHAMP. This type of measurements provides a good measure of the interaction of the solar wind with the global Earth's atmosphere, thus providing a good opportunity for studying this interaction via the magnetosphere.

Author

*Electron Density (Concentration); Plasmasphere; Earth Ionosphere; Ionospheric Sounding; Radio Occultation*

**20080021223** Bonn Univ., Germany

**Ionospheric F-Region Storms: Unsolved Problems**

Prolss, Gerd W.; Characterising the Ionosphere; June 2006, pp. 10-1 - 10-20; In English; See also [20080021218](#); Original contains black and white illustrations

Report No.(s): Paper 10; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Befitting the venue of this meeting, we first investigate the polar ionosphere. The most pressing problem here is that no reliable description of this region is available, not even for undisturbed conditions. To improve on this situation we have investigated the properties of some of the more prominent anomalies observed in this region, including the heating effect below the magnetospheric cusp, the subauroral electron temperature enhancement and the main ionospheric trough. Using DE-2 satellite data, we find, for example, that all these features move towards lower latitudes with increasing geomagnetic activity in a systematic way. We also show that the subauroral electron temperature enhancement and the main ionospheric trough are co-located, on average. With regard to the mid-latitude region, the positive phase of ionospheric storms remains the most challenging problem. Different mechanisms have been proposed to explain this phenomenon, including neutral gas composition changes, equatorward directed winds, and east- and northward directed electric fields. Up to now, the

measurements available are not sufficient to single out the correct explanation(s). Ionospheric holes are one of the most spectacular disturbance effects observed at equatorial latitudes. These holes are marked by a steep drop in the electron density to very low values. Also their bottom is rather flat and almost without any structure. Different explanations of this phenomenon have been offered, none of which is generally accepted.

Author

*Ionospheric Storms; Temperature Effects; Geomagnetism; Electron Energy; Neutral Gases; Electron Density (Concentration); Temperate Regions*

**20080021224** New Brunswick Univ., Fredericton, New Brunswick, Canada

**Ground-based Radar Detection of the Inner Boundary of the Ion Plasma Sheet and its Response to the Changes in the Interplanetary Magnetic Field**

Jayachandran, P. T.; MacDougall, J. W.; Moorcroft, D. R.; Donovan, E. F.; Characterising the Ionosphere; June 2006, pp. 21-1 - 21-12; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 21; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

SuperDARN is an array of HF radars, which covers most of the northern and southern high-latitude regions. The primary goal of this array is to study the dynamics of the large-scale convection pattern in order to understand the Solar wind - Magnetosphere - Ionosphere coupling (SW-M-I). Wide area coverage of the SuperDARN radars made it possible to detect some of the proxies for the magnetospheric landmarks and boundaries on a global scale and shed some light on some of the fundamental problems in the SW-M-I coupling process. One of the recent discoveries is that SuperDARN radar E region backscatter boundary in the dusk-midnight sector can be used as a proxy for the inner boundary of the ion plasma sheet. This discovery made it possible to study the boundary dynamics on a more global scale for the first time. The boundary undergoes seasonal, diurnal, and substorm associated variations. One of the outstanding questions in the SW-M-I coupling research is how fast Magnetosphere-Ionosphere system reacts to the changes in the Interplanetary-Magnetic-Field (IMF). There are two schools of thoughts with regards to the changes in the ionospheric convection one being instantaneous and the other being delayed response. In this paper we present a study of the response of the equatorward boundary of the ion auroral oval on a global scale to the changes in the IMF. We have used the wide area coverage of the SuperDARN radar to investigate the response of the boundary to the changes in the upstream IMF. Estimation of the delay from the changes in the solar wind and IMF from an upstream satellite to the ionosphere is sometimes ambiguous. In order to avoid this ambiguity we have also used the changes in the central polar cap convection (both direction and speed) related to the changes in the IMF. This method also helps to precisely test the hypothesis of the fast and or slow changes. We will also compare the response of the ion auroral oval and the open/closed field line boundary detected using the ground based photometers in order to better understand the sequence of response from the changes in IMF to the changes in the polar cap convection, to the open/closed field line boundary and the equatorward boundary of the ion auroral oval.

Author

*Convection; Interplanetary Magnetic Fields; Magnetosphere-Ionosphere Coupling; Polar Caps; Polar Regions; Solar Wind; Solar Terrestrial Interactions; Solar Activity Effects; Auroral Zones; Radar*

**20080021225** National Observatory of Athens, Greece

**The European Server for Ionospheric Specification and Forecasting: Final Results from DIAS Project**

Behlakeri, A.; Cander, Lj.; Zolesi, B.; Bremer, J.; Juren, C.; Stanislawski, I.; Dialetis, D.; Hatzopoulos, M.; Characterising the Ionosphere; June 2006, pp. 22-1 - 22-8; In English; See also [20080021218](#); Original contains color illustrations

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The main objective of DIAS (European Digital Upper Atmosphere Server) project is to develop a pan-European digital data collection on the state of ionospheric part of the upper atmosphere, based on real-time information and historical data collections provided by most operating ionospheric stations in Europe (Athens, Rome, Ebre, Juliusruh, Chilton, Pruhonice, Lycksele and Warsaw). Based on the raw data collection, DIAS system develops and distributes several products required by various groups of users for nowcasting and forecasting purposes. The DIAS server (<http://www.iono.noa.gr/DIAS>) operates since May 2005 and the basic products that are delivered are real-time and historical ionograms from all DIAS ionospheric stations, frequency plots and maps of the ionosphere over Europe based on the foF2, M(3000)F2, MUF and electron density parameters, as well as long term and short term forecasting up to 24 hour ahead. The paper reports on the operation of this



new system, giving information on the models applied for the specification and forecasting of the ionosphere over the European region, and on the users experience.

Author

*Upper Atmosphere; Ionospheres; Forecasting; Real Time Operation; Critical Frequencies; Data Acquisition; Electron Density (Concentration); F 2 Region*

**20080021226** Andhra Univ., VISHAKHAPATNAM, India

**Morphological Characteristics of L-Band Scintillations and their Impact on GPS Signals - A Quantitative Study on the Precursors for the Occurrence of Scintillations**

Rao, P. V. S. Rama; Ram, S. Tulasi; Krishna, S. Gopi; Niranjan, K.; Prasad, D. S. V. V. D.; Characterising the Ionosphere; June 2006, pp. 6-1 - 6-22; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 6; Copyright; Avail.: CASI: [A05](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The scintillation data (S4-index) at the L-band frequency of 1.575 GHz recorded from 18 GPS receivers installed at different locations in India under the GAGAN project has given an unique opportunity, for the first time in the Indian region, to make a simultaneous study of spatio-temporal and intensity characteristics of the trans-ionospheric scintillations during the low sunspot activity (LSSA) period from January 2004 to July 2005. During this period the occurrence of intense ( $S4 > 0.45$  approximately equals 10 dB) scintillations are found to be mostly confined to the pre-midnight hours of equinoctial months and around the equatorial ionization anomaly (EIA) region of geographic latitudes from 15 deg to 25 deg N in the Indian sector. These scintillations are often accompanied by the TEC depletions with durations ranging from 5 to 25 minutes and magnitudes from 5 to 15 TEC units that are found to affect the positional accuracy of GPS by about 1 to 3 meters. Further, during the times of intense scintillations, the GPS receivers are found to loose their lock for a short duration of 1 to 4 min increasing the error bounds and thus effecting the integrity of the SBAS operation, which may substantially increase during the high sunspot activity periods. The pre-reversal enhancement (PRE) in ExB drift is the most important parameter in controlling the occurrence of scintillations. Also, these drifts are found to decrease with increasing geomagnetic activity ( $K_p$ ), more significantly during equinoctial months. On a day-to-day basis, it is found that an upward drift velocity 30 m/s at the equator, is the necessary condition for strong scintillations to occur over Waltair (20 deg N dip) on magnetically quiet days with average  $K_p \leq 2$  (6 hrs prior to the local sunset) during the high sunspot year of 2001. This threshold value of the upward drift reduces to 20 m/s during the low sunspot activity year of 2004. Further, it is found that the post sunset vertical drifts at the equator are found to increase linearly with the increase in the anomaly gradients in TEC during afternoon hours. Also, strong ( $\Rightarrow 10$  dB) L-band scintillations are observed during the days on which this afternoon anomaly gradient exceeds 1.25 and the PRE ExB drift exceeds 20 m/s, suggesting that a well developed anomaly around the afternoon to early evening hours is a precursor for large post sunset vertical drifts at the equator and a subsequent occurrence of scintillations.

Author

*Anomalies; Equatorial Regions; Scintillation; Ultrahigh Frequencies; Earth Ionosphere; Radio Communication; Global Positioning System*

**20080021227** SRI International Corp., Menlo Park, CA, USA

**Studies of Ionospheric Processes in the Atmosphere and the Laboratory**

Slanger, T. G.; Characterising the Ionosphere; June 2006, pp. 1-1 - 1-12; In English; See also [20080021218](#); Original contains color and black and white illustrations

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The ionosphere can be studied in a variety of ways observation, modeling, and the simulation of ionospheric processes in the laboratory. Over the last several years we have carried out such studies in two ways, from ground-based observations using astronomical sky spectra, and from laboratory investigations. At altitudes above 200 km, the dominant atmospheric particles are oxygen atoms, and for any collisional studies it is always necessary to inquire as to the role of these atoms. One example is given by the oxygen red line, a ubiquitous emission in dayglow, nightglow, and aurorae, both artificial and induced. In order to understand both the intensity and the decay of this long-lived emission, one must establish the effect of collisions of the red line emitter -  $O((sup 1)D)$  - with ground-state O-atoms. The conclusion reached from application of the laboratory results to atmospheric observations is that the dominant loss process at altitudes relevant to ionospheric modification experiments is in fact collisions with  $O((sup 3)P)$ . It follows that measuring the  $O((sup 1)D)$  decay rate provides a measure of the local O-atom density. Another example comes from observation of the O<sub>2</sub> Atmospheric bands, which normally emit in the mesosphere, but can also be seen from the lower thermosphere. Again, it is essential to find out how the excited O<sub>2</sub>

molecules interact with O-atoms. In this paper we demonstrate how laboratory studies are used to address these questions, how the results are applied to atmospheric issues, and also what we are being taught by the high resolution nightglow spectra accessible from astronomical systems.

Author

*Ionospheric Disturbances; Decay Rates; Thermosphere; Mesosphere; Oxygen Atoms; Collisions; Astronomy*

**20080021228** Hermanus Magnetic Observatory, Hermanus, South Africa

**Characterization of the Ionosphere over the South Atlantic Ocean by Means of Ionospheric Tomography Using Dual Frequency GPS Signals Received On Board a Research Ship**

Cilliers, Pierre J.; Mitchell, Cathryn N.; Opperman, Ben D. L.; Characterising the Ionosphere; June 2006, pp. 28-1 - 28-18; In English; See also [20080021218](#); Original contains color illustrations

Report No.(s): Paper 28; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper reports a novel approach to extend the coverage of terrestrial ionospheric measurements over a poorly characterized region of the South Atlantic Ocean, including the South Atlantic Anomaly, by using dual frequency GPS signals received on board the South African polar research ship SA Agulhas. The routes of the SA Agulhas to the South Atlantic Islands, Gough (40deg17'S, 9deg58'W, Mag lat 42degS) and Marion (46deg52S, 37deg51'E, Mag lat 51degS) and the South African Antarctic base SANAE IV (71 40 S, 2deg51 W, Mag lat 61degS) present unique locations for investigating the variability of the upper atmosphere in the high latitudes in the vicinity of the South Atlantic Anomaly and its link with the near-Earth space environment.

Author

*Global Positioning System; Aerospace Environments; Anomalies; Polar Regions; Tomography; Upper Atmosphere; Tracking Networks; Ionospheric Propagation; Earth Ionosphere*

**20080021229** EISCAT Scientific Association, Ramfjordbotn, Norway

**What Can We Learn About the Ionosphere Using the EISCAT Heating Facility?**

Rietveld, Michael T.; Characterising the Ionosphere; June 2006, pp. 25-1 - 25-10; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 25; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Apart from being used for plasma physics, the HF facility near Tromso, Norway, can be used to perturb the ionosphere at various heights in different ways, thereby giving information about the ionosphere. The co-located incoherent scatter radars are probably the most powerful instrument for probing the ionosphere, but HF techniques can complement the radars and even have some advantages. The principal perturbation method is to increase the electron temperature in a controlled way, some examples of which are presented here. Artificial electron heating in the E and F regions is useful for testing aeronautical models. More recently it has been discovered that electron heating can dramatically affect polar mesospheric echoes observed by VHF and UHF radars. Particularly the overshoot effect promises to be a powerful diagnostic of the physics and chemistry related to the formation of these layers, which are thought to involve dust, ice particles and aerosols. Radio induced optical emissions provide a way of measuring the lifetimes of excited species at different heights in the ionosphere, thereby providing a way of measuring the neutral density which is one of the most important parameters determining the lifetime. The technique of creating artificial periodic irregularities set up in the standing wave pattern of the upgoing and ionospherically reflected HF wave provides valuable information all heights below reflection. One particular feature of this method is that it can detect the presence of layers around 50 km and measure vertical winds, and electron densities and temperatures at various heights.

Author

*EISCAT Radar System (Europe); Mesosphere; Ionospheres; Perturbation Theory; Plasma Physics; Plasma Heating; Reflected Waves; Electron Energy; F Region*

**20080021230** Naval Research Lab., Washington, DC, USA

**Quasi-Analytic Models for Density Bubbles and Plasma Clouds in the Equatorial Ionosphere**

Bernhardt, Paul A.; Characterising the Ionosphere; June 2006, pp. 18-1 - 18-46; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 18; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The equatorial ionosphere contains imbedded bubbles that rise through a horizontally stratified plasma. The motion of the

bubbles are affected by gravity, neutral winds or external electric fields which produce electric fields in the F-Region density perturbations of the bubbles. Exact solutions for the electric potentials are derived assuming linear or circular symmetry to the density structures imbedded in the background plasma. A wide variety of analytic solutions for electric potentials are found for both density cavities and density enhancements. An analytic description of a rising bubble can be constructed by attaching a tail to the top half of a circular hole to form the electron density solution. The potential for this plume structure is a weighted sum of the analytic solutions for each separate piece. Using this electric potential, quasi-analytic solutions for the transport of the bubbles are derived using the continuity equation for the plasma with production and loss terms neglected. The analytic models of the electric fields provide incompressible motion that transports the locations of 'plasma cells' but does not change the density of the plasma in each cell. This Lagrangean approach employs a time dependent coordinate mapping of the undisturbed layer grid. Using internal electric potentials of the bubbles and external polarizations of the F-layer as a whole, a transport model yields tilted plasma plumes that move through the F-Region. This time-dependent computer model provides useful plasma densities in a fraction of the time for fully numerical simulations.

Author

*Computerized Simulation; Mathematical Models; Winds Aloft; Ionospheric Electron Density; Plasma Bubbles; Plasma Density; Atmospheric Models*

**20080021233** Texas Univ., Austin, TX, USA

### **Review of the Current Status of Four-Dimensional Ionospheric Imaging**

Bust, G. S.; Mitchell, C. N.; Characterising the Ionosphere; June 2006, pp. 31-1 - 31-18; In English; See also [20080021218](#); Original contains color and black and white illustrations

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Recent developments in tomographic imaging allow the use of GPS satellite data to image the Earth's ionosphere. Ground-based GPS receivers monitor the Earth's ionosphere continuously and a comprehensive database of ionospheric measurements suitable for tomographic processing now exists. The tomographic inversion of these GPS data in a three-dimensional time-dependent inversion algorithm can reveal the spatial and temporal distribution of ionospheric electron density. This new technique is unique for studying ionospheric physics because it gives a time-continuous near-global view of the ionosphere. The tomographic algorithms have been under continuous development for several years and are now yielding new geophysical results.

Author

*Algorithms; Earth Ionosphere; Imaging Techniques; Ionospheric Electron Density; Satellite Imagery; Tomography; Image Processing; Image Enhancement*

**20080021234** Greifswald Univ., Germany

### **European Space Weather Activities**

Jansen, Frank; Characterising the Ionosphere; June 2006, pp. 13-1 - 13-10; In English; See also [20080021218](#); Original contains color and black and white illustrations

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Many space weather activities were carried out in the last ten years in Europe. These activities are several studies, projects and actions as well as different workshops, conferences, space weather weeks, outreach and educational initiatives. This paper also describes scientific and user orientated efforts towards an European Space Weather Programme (ESWP).

Author

*Space Weather; European Space Agency; Climate; Education*

**20080021235** Bath Univ., Bath, UK

### **Real-Time Imaging of the Ionosphere over the UK - Preliminary Results**

Meggs, Robert W.; Mitchell, Cathryn N.; Watson, Robert J.; Dear, Richard M.; Characterising the Ionosphere; June 2006, pp. 27-1 - 27-6; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 27; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A novel ionospheric imaging technique has recently been developed at the University of Bath. Known as Multi-Instrument

Data Analysis System (MIDAS), this technique is a tomographic algorithm that inverts dual-frequency carrier-phase measurements of Total Electron Content (TEC) to produce maps of ionospheric electron concentration in space and time. Using freely available GPS observation data from a large number of fixed dual-frequency GPS receivers, the MIDAS method has been very successful in mapping the horizontal distribution of vertical Total Electron Content (TEC) over the European region. There is, however, a latency of at least 24 hours in the availability of the GPS observation data. Furthermore, the density of receivers located on the mainland UK is very small. This makes it difficult to produce maps that show small-scale variations in vertical TEC over the UK. In this paper, we describe a project to produce detailed maps of vertical TEC in near real time over the mainland UK. Through a collaboration with BAE SYSTEMS, the UK Meteorological Office and the Ordnance Survey, a network of fixed GPS receivers will be used to facilitate the mapping of small-scale variations in vertical TEC. The GPS observation data from this network will be streamed directly to the University of Bath, where it will be processed using the MIDAS algorithm. It is intended that spatially detailed images of the ionosphere over the UK will be then available within one hour, using a purpose designed user interface.

Author

*Algorithms; Imaging Techniques; Tomography; Ionospheric Electron Density; Earth Ionosphere*

**20080021237** Massachusetts Inst. of Tech., Westford, MA, USA

### **Observations of the Tongue of Ionization with GPS TEC and SuperDARN**

Coster, Anthea; Colerico, M.; Foster, J. C.; Ruohoniemi, J. M.; Characterising the Ionosphere; June 2006, pp. 7-1 - 7-14; In English; See also [20080021218](#); Original contains color illustrations

Contract(s)/Grant(s): NSF Grant No. 0455831

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Tongue of ionization (TOI) events in both the northern and southern hemisphere have been identified with polar maps of total electron content (TEC) derived from the global network of GPS receivers. The TOI, as observed by GPS, extends through the dayside cusp, across the polar cap to the nightside, in both hemispheres. The TOI is a source of ionospheric irregularities. Its distribution across the high latitude ionosphere is believed to be controlled by plasma convection. The GPS maps show the development of TOI from mid-latitude plumes of ionization known as storm enhanced density (SED) [1]. The SED feature is observed to be magnetically conjugate, although data coverage is considerably more sparse in the southern hemisphere. In this paper, SuperDARN HF radar observations of the high-latitude convection pattern have been overlaid onto the GPS TEC polar plots for multiple TOI events. It is observed quantitatively that the GPS TEC observations of the TOI match the SuperDARN estimates of the convection pattern. Using SuperDARN observations of the evolving convection pattern, we study the evolution of the TOI and the associated redistribution of plasma structure. The locations and conditions under which HF backscatter occurs in the vicinity of the TOI plumes are examined. We explore the similarities between TOI events observed simultaneously in the two hemispheres and look especially for the impact of convection-induced asymmetries. Gradients, irregularities, and velocities are examined between the two hemispheres. Spatial and temporal estimates of the TEC at individual locations along the SED plume and the TOI are studied in an attempt to quantify the percentage of the TEC that enters into the trans-polar convection pattern.

Author

*Ionospheric Disturbances; Electron Density (Concentration); Temperate Regions; Polar Regions; Ionization; Radar Tracking; Plasma Dynamics; Ionospheres; Storms*

**20080021238** Bath Univ., Bath, UK

### **An Investigation into the Relationship between Ionospheric Scintillation and Loss of Lock in GNSS Receivers**

Meggs, Robert W.; Mitchell, Cathryn N.; Smith, Andrew M.; Characterising the Ionosphere; June 2006, pp. 5-1 - 5-10; In English; See also [20080021218](#); Original contains color illustrations

Report No.(s): Paper 5; Copyright; Avail.: CASI: [A04](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Irregularities in the ionospheric electron density can cause a phenomenon known as scintillation, in which the phase and amplitude of transiting radio signals fluctuate rapidly. Scintillation can have an adverse effect on Global Navigation Satellite Systems (GNSS) signals as they pass from a satellite to a receiver, and extreme cases can cause a GNSS receiver to lose lock on the signal. This limits the availability of path-length measurements, and compromises the integrity of the navigation solution. Scintillation is not, however, the only mechanism that can cause a receiver to lose lock on a signal. For example, local multipath and shadowing can also contribute to the loss of phase lock. In this work, we examine the correlation between phase and amplitude scintillations and loss of phaselock events in co-located GPS receivers to establish whether loss-of-lock



is associated with scintillation or multipath. One phase and amplitude scintillation receiver was deployed at each of the three European Incoherent Scatter (EISCAT) radar sites in Northern Scandinavia in the summer of 2004, and they have since provided an ongoing data record. In this paper we focus on the ionospheric storm period of November 2004. Using scintillation data from these receivers in conjunction with GPS observation data from the IGS receivers at Troms, Kiruna and Sodankyl, we attempt to identify those losses of phase lock for which scintillation was the cause, and distinguish them from losses of phase lock caused by local multi-path and shadowing effects.

Author

*Ionospheric Electron Density; Ionospheric Storms; Scintillation; Earth Ionosphere; Global Positioning System*

**20080021240** Academy of Sciences (Russia), Irkutsk, Russian Federation

**GPS Users Positioning Errors during Disturbed Near-Earth Space Conditions**

Afraimovich, E. L.; Demyanov, V. V.; Tatarinov, P. V.; Astafieva, E. I.; Zhivetiev, I. V.; Characterising the Ionosphere; June 2006, pp. 29-1 - 29-14; In English; See also [20080021218](#); Original contains black and white illustrations

Report No.(s): Paper 29; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Operation quality of the Global Navigation Satellite Systems (GNSS) appreciably depends on condition of the near-Earth space environment. Afraimovich et al. (GPS Solutions, 2003, V7, N2, 109) showed, that during geomagnetic disturbances in the near space deterioration of GNSS operation quality is appeared and, as consequence, reduction of positioning accuracy and occurrence of failures in definition of ground based users coordinates are observed. Application of GNSS for the decision of orbital objects navigation tasks allows to increase considerably accuracy of coordinates and parameters of movement definition of such objects. Wickert et al. (J. Communications Technology and Electronics, 2004, V49, N10, 1184) found strong amplitude and phase fluctuations of L-band radio waves on line-of-sight satellite-to-satellite. However from the viewpoint of GNSS users research of positioning accuracy is of much greater interest. The aim of our research is estimation of GPS ground and orbital users positioning accuracy in different geomagnetic conditions. Interrelation between total electron content (TEC) variations and positioning accuracy during the strong magnetic storms on 29-31 October 2003 we observed on the territory of Northern America. It should be noted that GPS positioning errors increased significantly not only within auroral area but also in the south- west of Northern America, at low enough latitudes (30-35deg N; 240-255deg E). High absolute values and steep TEC gradients were observed in this region concurrently. TEC variations intensity in the period range of 1-10 min increases by one order as intensive LS AGW propagates from the northeast to the southwest of the USA. Space-time characteristics of GPS positioning errors are close to the corresponding intensity characteristics of small-scale irregularities. It is in accord with the existing idea that phase slips are caused by GPS radio signals scattering on small-scale irregularities. Latitudinal dependence of GPS-stations positioning accuracy was obtained on a basis of analysis more then 600 GPS-stations which have well known X(sub 0), Y(sub 0), Z(sub 0) coordinates. It was found that absolute errors of coordinate determination are usually greater for GPS-stations at high- and low latitude comparing to these ones at mid latitudes. This dependence is more apparent under magnetic storm condition. The pointed latitudinal dependence is the most noticed for Z coordinate determination errors: this value is grater then X and Y ones and it depends on geomagnetic condition to the greatest extent in all cases we were considered. Low Earth orbiter CHAMP (CHALLENGING Minisatellite Payload) with two-frequency GPS receiver onboard has been chosen for experiment. We used the RINEX (Receiver Independent Exchange format) files and the files containing precision coordinates of CHAMP given by the Information system and Data Center at GeoForschungZentrum Potsdam (<http://isdg.gfzpotdam.de/champ>). More than 100 passes under undisturbed and about 70 passes under disturbed geomagnetic conditions during January-December 2003 have been processed. We found that both in undisturbed, and in the disturbed geomagnetic conditions, the most probable error of CHAMP positioning is less then 10 m. However in disturbed geomagnetic conditions probability of a significant error occurrence more than 30 m in 1,5 times is higher, then in undisturbed conditions.

Author

*Global Positioning System; Positioning; Errors; Magnetic Disturbances; Magnetic Storms; Polar Regions; Ultrahigh Frequencies; Aerospace Environments*

**20080021242** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The International Reference Ionosphere - Climatological Standard for the Ionosphere**

Bilitza, Dieter; Characterising the Ionosphere; June 2006, pp. 32-1 - 32-12; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 32; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The International Reference Ionosphere (IRI) a joint project of URSI and COSPAR is the defacto standard for a



climatological specification of ionospheric parameters. IRI is based on a wide range of ground and space data and has been steadily improved since its inception in 1969 with the ever-increasing volume of ionospheric data and with better mathematical descriptions of the observed global and temporal variation patterns. The IRI model has been validated with a large amount of data including data from the most recent ionospheric satellites (KOMPSAT, ROCSAT and TIMED) and data from global network of ionosondes. Several IRI teams are working on specific aspects of the IRI modeling effort including an improved representation of the topside ionosphere with a seamless transition to the plasmasphere, a new effort to represent the global variation of F2 peak parameters using the Neural Network (NN) technique, and the inclusion of several additional parameters in IRI, e.g., spread-F probability and ionospheric variability. Annual IRI workshops are the forum for discussions of these efforts and for all science activities related to IRI as well as applications of the IRI model in engineering and education. In this paper I will present a status report about the IRI effort with special emphasis on the presentations and results from the most recent IRI Workshops (Paris, 2004; Tortosa, 2005) and on the most important ongoing IRI activities. I will discuss the latest version of the IRI model, IRI-2006, highlighting the most recent changes and additions. Finally, the talk will review some of the applications of the IRI model with special emphasis on the use for radiowave propagation studies and communication purposes.

Author

*Ionosondes; Climatology; Plasmasphere; Temporal Distribution; Neural Nets; Ground Tests; Earth Ionosphere*

**20080021244** Alaska Univ., Fairbanks, AK, USA

**Space Weather Applications of the UAF Eulerian Parallel Polar Ionosphere Model (EPPIM)**

Maurits, Sergei; Kulchitsky, Anton; Watkins, Brenton; Characterising the Ionosphere; June 2006, pp. 11-1 - 11-14; In English;

See also [20080021218](#); Original contains color illustrations

Report No.(s): Paper 11; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

University of Alaska Fairbanks (UAF) EPPIM is the first principles theoretical model of the polar ionosphere, which covers region pole ward from 50 deg. N of geomagnetic latitude, and altitudes from 80 to 900-1000 km. If available, the model can input real data or, conversely, it is capable of generating all necessary inputs using statistical modules (e.g., MSIS, electric field, precipitation intensity, etc.) incorporated into the model and driven by the standard set of geophysical indices (F(sub 10.7), Ap/Kp, IMF). UAF EPPIM is a computationally robust scaleable high-resolution model, capable of running on a range of platforms from desktop to a parallel supercomputer. Its real-time performance with useful resolution of 30x30x10 km or better can be achieved on a low-cost workstation. The model real-time continuous operation is arranged at the Arctic Region Supercomputing Center (ARSC) of the University of Alaska Fairbanks (UAF). It is based on automatic updates of the UAF EPPIM standard inputs (F10.7, Ap/Kp, and IMF), which are regularly fetched from the NOAA Space Environment Center (SEC) online depository. The solar wind IMF information from the upstream-located ACE satellite is available with advance of up to 2 hours, which facilitates forecasting mode of the ionospheric model. The model time is shifted forward to accommodate this time advance for the arriving solar wind. The forecast products in a number of formats are output in to the model WWW-site (<http://www.arsc.edu/SpaceWeather>) for immediate dissemination to the users and for past analysis and archiving. Statistical determination of the forecasting accuracy is performed by massive comparisons (>200,000 per year) with the NOAA SEC ionosonde data. The emulated critical frequency foF2 is automatically compared to the real-time data from about twenty sounding stations situated inside the model domain. The model statistical bias and RMS are determined on monthly basis for the daytime, twilights, and the night-time conditions. Such comparisons cover more than three-year period during current solar minimum, starting from September 2002 to present time. The collected archive demonstrates that RMS accuracies of the foF2 forecast are typically in the range of 10-20% (summer, daytime) to 20-40% (winter, night-time). It is shown that statistical bias is a convenient metrics for elimination of the systematic errors in the model. Empirical correction for the nighttime downward flux as a function of season and location for the upper boundary condition was performed to minimize the nighttime statistical bias. It resulted in reduction of the initial nighttime forecasting error by a factor of 2-3. This study demonstrates that ionospheric model of polar and adjacent mid-latitude region continuously operated with statistical inputs, which, in turn, are driven by the period-specific series of geophysical indices is capable of providing useful space weather forecasts. Further improvement of the forecasts by applying data assimilation techniques is discussed as future work.

Author

*Arctic Regions; Atmospheric Models; Critical Frequencies; Earth Ionosphere; Forecasting; Mathematical Models; Polar Regions; Space Weather; Aerospace Environments*

**20080021245** Los Alamos National Lab., NM, USA

**Theoretical and Observational Studies of Meteor Interactions with the Ionosphere**

Colestock, P.; Close, S.; Zinn, John; Characterising the Ionosphere; June 2006, pp. 12-1 - 12-12; In English; See also [20080021218](#); Original contains color and black and white illustrations

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

An intense flux of small-mass meteors has been seen in large-aperture radar scattering for many years. At high altitudes, these meteoroids routinely damage orbiting satellites by both direct impact as well as spacecraft charging. This flux is believed to make up the major portion of mass flux from space. At lower altitudes, meteoroids affect ionospheric and thermospheric processes by depositing heavy metallic atoms, ions and dust. Preliminary analysis of meteors has shown that meteoroids can disrupt and halt radio communication by creating plasma density structures that are several orders of magnitude greater than those seen in the background ionosphere. To understand this phenomenon better, we have undertaken a theoretical and an observational campaign that is designed to determine empirically the mass flux coupled with a detailed plasma expansion model of the ablating material as the meteors disintegrate in the ionosphere. We will discuss our findings to date as well as our expected future program development in this area.

Author

*Meteoroids; Ablative Materials; Ionospheres; Radar Scattering; Heavy Ions; Thermosphere; High Altitude; Plasma Density; Dust; Metal Ions*

**20080021246** Wales Univ., Aberystwyth, Wales, UK

**Large-Scale Plasma Structure in the Polar and Auroral Ionosphere: Experimental Observations and Modelling**

Pryse, S. E.; Middleton, H. R.; Dewis, K. L.; Wood, A. G.; Whittick, E. L.; Balthazor, R. L.; Characterising the Ionosphere; June 2006, pp. 15-1 - 15-10; In English; See also [20080021218](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): PPA/G/O/2003/00017

Report No.(s): Paper 15; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Radiotomography provides observations of ionospheric electron density structure on horizontal scales of tens to hundreds of kilometres. Routine measurements over extended periods of time and geographic areas have the potential for parameterising the structure of the polar and auroral ionosphere. Averaged electron densities characteristic of different ionospheric features, locations, local times, Universal Times, seasons, geomagnetic activity and solar conditions can be compared with ionospheric models and used to test and develop the models. Tomographic images are presented of plasma structures characteristic of the polar and auroral ionosphere. Results from initial comparisons of the measurements with the Sheffield University Coupled Thermosphere-Ionosphere-Plasmasphere (CTIP) model are also discussed. General broad agreement is seen between the model and observations but discrepancies are also evident.

Author

*Earth Ionosphere; Thermosphere; Plasmasphere; Plasmas (Physics); Auroras; Geomagnetism; Time Measurement*

**20080021247** Bath Univ., Bath, UK

**Polar Ionospheric Imaging at Storm Time**

Yin, Ping; Mitchell, Cathryn; Bust, Gary; Characterising the Ionosphere; June 2006, pp. 3-1 - 3-12; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 3; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During periods of major geomagnetic storms the polar ionosphere becomes very variable. Ground-based measurements, such as Navy Ionospheric Monitoring System (NIMS), GPS or ionosonde data are too sparse to do tomographic imaging, however, combination of these data sources as well as other available measurements, such as satellitebased data, may have the possibility to monitor the structure of the disturbed polar ionosphere. In this paper, LEO-based GPS data onboard CHAMP as well as ground-based GPS and ionosonde observations are input into a four dimensional tomographic algorithm -- MIDAS (Multi-Instrument Data Analysis System) to image the disturbed ionosphere at Alaska and Greenland as well as over Europe for the major storm in October 2003. In contrast, electron density images produced by another independent method -- IDA3D (Ionospheric Data Assimilation Three Dimensional), which assimilates primarily NIMS data and other data source, are

involved to perform comparisons. A general good agreement can be obtained between them. As a result, the addition of LEO-based GPS data presents a great potential in polar ionospheric imaging.

Author

*Global Positioning System; Imaging Techniques; Ionospheric Disturbances; Tomography; Earth Ionosphere; Polar Regions*

**20080021248** Saskatchewan Univ., Saskatoon, Saskatchewan, Canada

**VLF Phase Perturbations Produced by the Variability in Large (V/m) Mesospheric Electric Fields in the 60-70 km Altitude Range**

Manson, A. H.; Meek, C. E.; Martynenko, S. I.; Rozumenko, V. T.; Tyrnov, O. F.; Characterising the Ionosphere; June 2006, pp. 8-1 - 8-24; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 8; Copyright; Avail.: CASI: [A04](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The large (V/m) mesospheric electric fields have been identified as a possible cause of VLF phase perturbations. These fields affect the fundamental processes that govern the lower D region parameters, primarily the electron temperature and effective collision frequency. The main ionospheric parameter needed to calculate VLF phase perturbations is the low-frequency electron plasma conductivity. All the electric field data available to 1990 were collected with electric field sensors on board more than 50 rockets launched over approximately 30 years in the USSR and the U.S.A., which were insufficient to address VLF phase perturbations. This paper discusses the progress made in addressing large (V/m) mesospheric electric fields between 60- and 70-km altitudes since 1990. It focuses on achieving the breakthrough, the development of a radio wave technique for sensing large electric fields remotely by using MF radar, and on the fact that the electric field variability leads to the variability of ionospheric conduction contours by a few kilometers in altitude. The statistical analysis of the large mesospheric electric field data acquired in the 60- and 67-km altitude region in Canada and Ukraine suggests that large mesospheric electric fields may occur during about 70% of all the time. However, reasonable assessments of VLF phase perturbations need information on the temporal and especially spatial variability of conduction contours, which remains a major challenge within this problem. First, the technique developed to specify electric fields requires signal-to-noise ratios in excess of a factor of five, which is achieved irregularly with the MF radars used at present. Second, the existing MF radars do not permit the observations of the spatial evolution of these fields at all. The latter problem can be overcome by developing dedicated radar. Meanwhile, co-located VLF phase perturbation measurements and electric field observations by existing MF radars may be combined to produce a pre-intermediate capability. Eventually, a better understanding of the dynamics and mesospheric and ionospheric D-region chemistry, which establish conductivity patterns, will require the combined efforts of the entire scientific community.

Author

*Mesosphere; Perturbation; Atmospheric Chemistry; Electron Energy; Signal to Noise Ratios; Electric Fields; Plasma Conductivity; Very Low Frequencies*

**20080021728** ENSCO, Inc., Cocoa Beach, FL, USA

**Peak Wind Tool for General Forecasting**

Barrett, Joe H., III; Short, David; April 2008; 63 pp.; In English; Original contains color and black and white illustrations  
Contract(s)/Grant(s): NNK06MA70C

Report No.(s): NASA/CR-2008-214743; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021728>

This report describes work done by the Applied Meteorology Unit (AMU) in predicting peak winds at Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS). The 45th Weather Squadron requested the AMU develop a tool to help them forecast the speed and timing of the daily peak and average wind, from the surface to 300 ft on KSC/CCAFS during the cool season. Based on observations from the KSC/CCAFS wind tower network, Shuttle Landing Facility (SLF) surface observations, and CCAFS soundings from the cool season months of October 2002 to February 2007, the AMU created multiple linear regression equations to predict the timing and speed of the daily peak wind speed, as well as the background average wind speed. Several possible predictors were evaluated, including persistence, the temperature inversion depth and strength, wind speed at the top of the inversion, wind gust factor (ratio of peak wind speed to average wind speed), synoptic weather pattern, occurrence of precipitation at the SLF, and strongest wind in the lowest 3000 ft, 4000 ft, or 5000 ft.

Author

*Meteorology; Wind Velocity; Temperature Inversions; Gusts; Forecasting; Linear Equations; Predictions*

**20080021729** ENSCO, Inc., Cocoa Beach, FL, USA

**Situational Lightning Climatologies for Central Florida: Phase III**

Barrett, Joe H., III; April 2008; 31 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNNK06MA70C

Report No.(s): NASA/CR-2008-214742; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021729>

This report describes work done by the Applied Meteorology Unit (AMU) to add composite soundings to the Advanced Weather Interactive Processing System (AWIPS). This allows National Weather Service (NWS) forecasters to compare the current atmospheric state with climatology. In a previous phase, the AMU created composite soundings for four rawinsonde observation stations in Florida, for each of eight flow regimes. The composite soundings were delivered to the NWS Melbourne (MLB) office for display using the NSHARP software program. NWS MLB requested that the AMU make the composite soundings available for display in AWIPS. The AMU first created a procedure to customize AWIPS so composite soundings could be displayed. A unique four-character identifier was created for each of the 32 composite soundings. The AMU wrote a Tool Command Language/Tool Kit (TcVtk) software program to convert the composite soundings from NSHARP to Network Common Data Form (NetCDF) format. The NetCDF files were then displayable by AWIPS.

Author

*Climatology; Forecasting; Rawinsondes; Meteorology; Command Languages; Lightning*

**20080021838** Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA

**AFOSR(Air Force Office of Scientific Research) Chemical and Atmospheric Sciences Program Review (33rd) FY88**

Wodarczyk, Francis J; Faustman, Catherine; Jul 1990; 234 pp.; In English

Contract(s)/Grant(s): Proj-2303; Proj-310

Report No.(s): AD-A477654; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477654>

A review is presented of research efforts sponsored by the Directorate of Chemical and Atmospheric Sciences which have completed their period of support. Illustrated accounts resulting from the basic research programs in the Atmospheric and Chemical Sciences are highlighted. The Atmospheric Sciences is concerned with meteorology and upper atmospheric structure and dynamics. The Chemical Sciences deal with chemical techniques, chemical structures, surface chemistry, chemical dynamics, synthesis and properties of materials, and computational chemistry.

DTIC

*Atmospheric Chemistry; Atmospheric Physics; Chemical Reactions; Computational Chemistry; Gravity Waves; Meteorology; Surface Reactions; Upper Atmosphere*

**20080021942** National Hurricane Center, Miami, FL, USA

**Tropical Cyclone Report: Tropical Storm Barry (AL022007), June 1-2, 2007**

Avila, L. A.; Jun. 22, 2007; 12 pp.; In English

Report No.(s): PB2007-112887; No Copyright; Avail.: National Technical Information Service (NTIS)

The precursor of Barry was associated with a westward moving tropical wave that spawned a broad area of low pressure near the eastern coast of the Yucatan Peninsula on 30 May. By 31 May, surface observations indicated that a circulation had developed with the area of minimum pressure centered southeast of Cozumel, Mexico. At that time, the system was not classified as a tropical depression because the shower activity was disorganized and well-removed from the area of low pressure. As the low moved north-northeastward over the northwestern Caribbean Sea and the southeastern Gulf of Mexico, the deep convection became somewhat concentrated near the center and it is estimated that a tropical depression formed just to the northwest of the western tip of Cuba at 1200 UTC 1 June. Thereafter, the shower activity increased further and the surface circulation become a little better organized.

NTIS

*Cyclones; Storms; Tropical Storms*

**20080022184** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Seasonal Correlations of SST, Water Vapor, and Convective Activity in Tropical Oceans: A New Hyperspectral Data Set for Climate Model Testing**

Aumann, Hartmut H.; Gregorich, David T.; Broberg, Steven E.; Elliott, Denis A.; Geophysical Research Letters; August 15, 2007; Volume 24; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2006GL029191>; <http://hdl.handle.net/2014/40815>

The analysis of the response of the Earth Climate System to the seasonal changes of solar forcing in the tropical oceans



using four years of the Atmospheric Infrared Sounder (AIRS) and Advanced Microwave Sounding Unit (AMSU) data between 2002 and 2006 gives new insight into amplitude and phase relationships between surface and tropospheric temperatures, humidity, and convective activity. The intensity of the convective activity is measured by counting deep convective clouds. The peaks of convective activity, temperature in the mid-troposphere, and water vapor in the 0 - 30 N and 0 - 30 S tropical ocean zonal means occur about two months after solstice, all leading the peak of the sea surface temperature by several weeks. Phase is key to the evaluation of feedback. The evaluation of climate models in terms of zonal and annual means and annual mean deviations from zonal means can now be supplemented by evaluating the phase of key atmospheric and surface parameters relative to solstice. The ability of climate models to reproduce the statistical flavor of the observed amplitudes and relative phases for broad zonal means should lead to increased confidence in the realism of their water vapor and cloud feedback algorithms. AIRS and AMSU were launched into a 705 km altitude polar sun-synchronous orbit on the EOS Aqua spacecraft on May 4, 2002, and have been in routine data gathering mode since September 2002.

Author

*Meteorological Parameters; Climate Models; Annual Variations; Atmospheric Sounding; Atmospheric Temperature; Climate Change; Sea Surface Temperature; Convection*

**20080022191** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Diagnostic Comparison of Meteorological Analyses during the 2002 Antarctic Winter**

Manney, Gloria L.; Allen, Douglas R.; Kruger, Kirstin; Naujokat, Barbara; Santee, Michelle L.; Sabutis, Joseph L.; Pawson, Steven; Swinbank, Richard; Randall, Cora E.; Simmons, Adrian J.; Long, Craig; *Monthly Weather Review*; May 2005; Volume 133, Issue 5, pp. 1261-1278; In English; Original contains color and black and white illustrations; Copyright;

Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40817>; <http://dx.doi.org/10.1175/MWR2926.1>

Several meteorological datasets, including U.K. Met Office (MetO), European Centre for Medium-Range Weather Forecasts (ECMWF), National Centers for Environmental Prediction (NCEP), and NASA's Goddard Earth Observation System (GEOS-4) analyses, are being used in studies of the 2002 Southern Hemisphere (SH) stratospheric winter and Antarctic major warming. Diagnostics are compared to assess how these studies may be affected by the meteorological data used. While the overall structure and evolution of temperatures, winds, and wave diagnostics in the different analyses provide a consistent picture of the large-scale dynamics of the SH 2002 winter, several significant differences may affect detailed studies. The NCEP-NCAR reanalysis (REAN) and NCEP-Department of Energy (DOE) reanalysis-2 (REAN-2) datasets are not recommended for detailed studies, especially those related to polar processing, because of lower-stratospheric temperature biases that result in underestimates of polar processing potential, and because their winds and wave diagnostics show increasing differences from other analyses between similar to 30 and 10 hPa (their top level). Southern Hemisphere polar stratospheric temperatures in the ECMWF 40-Yr Re-analysis (ERA-40) show unrealistic vertical structure, so this long-term reanalysis is also unsuited for quantitative studies. The NCEP/Climate Prediction Center (CPC) objective analyses give an inferior representation of the upper-stratospheric vortex. Polar vortex transport barriers are similar in all analyses, but there is large variation in the amount, patterns, and timing of mixing, even among the operational assimilated datasets (ECMWF, MetO, and GEOS-4). The higher-resolution GEOS-4 and ECMWF assimilations provide significantly better representation of filamentation and small-scale structure than the other analyses, even when fields gridded at reduced resolution are studied. The choice of which analysis to use is most critical for detailed transport studies (including polar process modeling) and studies involving synoptic evolution in the upper stratosphere. The operational assimilated datasets are better suited for most applications than the NCEP/CPC objective analyses and the reanalysis datasets.

Author

*Meteorological Parameters; Remote Sensing; Weather Forecasting; Atmospheric Temperature; Earth Observations (From Space)*

**20080022233** National Hurricane Center, Miami, FL, USA

**Tropical Cyclone Report: Sub tropical Storm Andrea (AL012007), May 9-11, 2007**

Rheme, J. R.; Beven, J.; Willis, M.; Jun. 01, 2007; 16 pp.; In English

Report No.(s): PB2007-112886; No Copyright; Avail.: National Technical Information Service (NTIS)

Andrea formed from a large extratropical cyclone that originated just offshore the mid-Atlantic USA coast on 6 May. This pre-Andrea cyclone deepened steadily that day, with the central pressure falling 16 mb in the 24-hour period ending at 0600 UTC 7 May, the extratropical cyclone lost most of its baroclinic support and development ended. However, interaction of the low and strong high pressure to the north produced hurricane-force winds. The resulting large area of high winds, along with the slow motion of the extratropical low, generated large waves that impacted much of the coast of the southeastern USA and



the Bahamas Islands. On 8 May, the low weakened and began drifting westward over progressively warmer waters in the western Atlantic. Along this track, vertical shear also decreased allowing for the generation of deeper convection around the center. By early on 9 May, convection had become symmetric about the low-level circulation center, the cyclone had lost all of its frontal and cold core structure, and the wind field had contracted.

NTIS

*Cyclones; Storms; Tropical Storms*

## 48

### OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also 43 *Earth Resources and Remote Sensing*.

**20080021753** University of Southern California, Los Angeles, CA USA; Joint Inst. for the Study of the Atmosphere and Ocean, Seattle, WA, USA; Middle East Technical Univ., Ankara, Turkey; National Oceanic and Atmospheric Administration, Seattle, WA, USA

#### **Standards, Criteria, and Procedures for NOAA Evaluation of Tsunami Numerical Models**

Synolakis, C. E.; Bernard, E. N.; Titov, V. V.; Kanoglu, U.; Gonzalez, F. I.; May 2007; 60 pp.; In English

Report No.(s): PB2007-109601; NOAA/TM/OAR/PMEL-135; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Oceanic and Atmospheric Administration (NOAA) is the federal agency charged with mitigating tsunami hazards in the USA. NOAA's National Weather Service operates the two Tsunami Warning Center (TWCs) in the U.S., and NOAA has spearheaded the national effort to develop inundation maps for evacuation planning through the National Tsunami Hazard Mitigation Program (NTHMP). The latter was formed through a directive of the U.S. Senate Appropriations Committee in 1994 to develop a plan for a tsunami warning system that reduces the risk to coastal residents.

NTIS

*Mathematical Models; Tsunami Waves; Warning Systems; Numerical Weather Forecasting; Meteorological Parameters; Oceanography*

## 51

### LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

**20080021396** Macula (Anthony J.), Geneseo, NY USA

#### **Superimposed Code Theoretic Analysis of DNA Codes and DNA Computing**

Macula, Anthony; Bishop, Morgan; Jan 2008; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0007; Proj-230T

Report No.(s): AD-A477398; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Large collections of carefully constructed single stranded DNA sequences, called DNA Libraries, can be algorithmically filtered to encode solutions to numerical questions. To date, there has been no simple way to decode these solutions. One possible decoding method is to further augment or embed the original encoded DNA library strands with synthetic reading strands made from the blueprints of classical superimposed codes. This can make the DNA output readable without complicated chemical separation or isolation protocols.

DTIC

*Coding; Deoxyribonucleic Acid*

**20080021746** Van Deuren (Reinhart Boerner) S.C., Milwaukee, WI, USA

#### **Self-Assembling Peptide Amphiphiles and Related Methods for Growth Factor Delivery**

Stupp, S. I., Inventor; Donners, J. J. M., Inventor; Silva, G. A., Inventor; Behanna, H. A., Inventor; Anthony, S. G., Inventor; 6 Dec. 04; 18 pp.; In English

Contract(s)/Grant(s): DE-FG02-00ER54810

Patent Info.: Filed Filed 6 Dec. 04; US-Patent-Appl-SN-11-005-552

Report No.(s): PB2007-111063; No Copyright; Avail.: CASI: A03, Hardcopy

Amphiphilic peptide compounds comprising one or more epitope sequences for binding interaction with one or more corresponding growth factors, micellar assemblies of such compounds and related methods of use.

NTIS

*Peptides; Molecules; Binding; Cells (Biology); Compounds*

**20080021754** Institute of Space Medico-Engineering, Beijing, China

**Space Medicine and Medical Engineering (Hangtian Yixue yu Yixue Gongcheng), Volume 20, No. 2, April 2007**

Chen, S. G.; Apr. 2007; 84 pp.; In Chinese

Report No.(s): PB2007-109571; No Copyright; Avail.: National Technical Information Service (NTIS)

Contents: An Accurately Represented Finite Element Model of Lumbar Motion Segment; Difference of Responses of Males and Females under -30 degrees Head-down Tilt; Comparison of Morphological Features in Soleus between Tail-Suspended and 30-Month-Old Rats; Effects of Push-Pull Maneuver on GFAP Expression of Rat Brain; Specific Lysis of CTLs Induced by Dendritic Cells-Added to HLA-A2 Restricted Epitopes Derived from alpha-fetoprotein Against HCC In Vitro; Preliminary Assessment of Biologic Security of A Membrane Penetrating Peptide McClock's DNA-BIND as A Drug-Carrier; Effects of Degradation Products of SSCP on Migration, Proliferation and F-Actin Reorganization of Vascular Endothelial Cells; Effect of 30 Hz Whole Body Vibration on Osteoporosis; A Study on the Decomposition of Surface EMG Signals Based on Second Order Non-Stationary Source Separation; A Two-step MREIT Algorithm for Head Times Based on Radial Basis Function Neural Network; A Study in Inhomogeneous Spull Phantoms Based on Electrical Impedance Tomography; Estimation of Uniaxial Modulus of Articular Cartilage Based on Inhomogenous 4 Parameters Triphasic Mode; A Method for Automatic Generation of Finite Element Head Models Based on Segmented Computer Tomography Data; and An Image Processing Method Used in Nystagmus Detecting Systems.

NTIS

*Aerospace Medicine; Medical Science; Physiology; Biology*

**20080021803** Army Medical Dept. Center and School, Fort Sam Houston, TX USA

**Policy Options for Sharing Activities between the Department of Veterans Affairs and the Department of Defense**

VanBrooklyn, Gary S; Jun 14, 2007; 52 pp.; In English

Report No.(s): AD-A477530; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477530>

The Department of Veterans Affairs (VA) and the Department of Defense (DoD) have failed to advance sharing efforts to the extent that the legislative and executive branches of the USA Government intended them to do since the Veterans Administration and the Department of Defense Health Resources Sharing and Emergency Operations Act was passed in 1982. Although numerous barriers exist to increased sharing, a fundamental one that exists in both organizations is the structural inertia inherent in large bureaucracies. Against the backdrop of a rapidly changing health care environment in the USA, the model of punctuated equilibrium was employed as a means of determining those circumstances more likely to bring about transformational, revolutionary organizational change along the lines envisioned by the executive and legislative branches. As a result, the adoption of federal policy calling for compulsory, large-scale sharing throughout all domains of both the VA and the DoD health care organizations is recommended. Adoption of this policy is the best means of ensuring cost efficiency, greater access to care, and quality care for the health care beneficiaries of both the VA and the DoD.

DTIC

*Defense Program; Medical Services; Military Personnel; Policies; Resources Management*

**20080021805** Naval Health Research Center, San Diego, CA USA

**Determining Hospital Ship (T-AH) Staffing Requirements for Humanitarian Assistance Missions**

Negas, Tracy; Brown, Carrie; Konoske, Paula J; Oct 16, 2007; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-M0095

Report No.(s): AD-A477534; NHRC-07-44; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477534>

The primary mission of the hospital ship is to provide acute medical and surgical services to forces ashore and afloat during military operations. In addition, the hospital ship also has the mission of providing a hospital asset in support of disaster relief (DR) and humanitarian assistance (HA) operations. This secondary mission requires the hospital ship to provide medical

care to a different population with a set of medical conditions not common to combat casualty care, thus affecting the manning requirements. To better plan the medical response to HA/DR scenarios, knowledge of the mission requirements and the anticipated patient workload is required. With this information the appropriate mix of personnel, supplies and equipment can be projected. The goals of this project were to gather subject matter expert (SME) data, medical treatment data, and medical mission support information to determine the optimal staffing mix (military/civilian, nongovernmental organization) aboard the hospital ship during HA/DR missions. Information from a variety of sources was used to better understand humanitarian missions conducted by the hospital ship. Factors such as time on site, security threats, and location characterize the mission. Patient encounter data from previous missions were used to determine expected patient conditions encountered in various HA operations. Support task information was gathered from subject matter experts. These data points were used to project the medical and support tasks required for future missions. The authors conclude that, to conduct a successful HA mission on a hospital ship caring for surgical patients, outpatients ashore, and capacity-building activities, a minimum staff of 228 medical and 288 nonmedical personnel would be required. Humanitarian missions accomplish more than just the number of patients seen -- effective HA helps host nations build their health care infrastructure so that they can become self-sufficient.

DTIC

*Hospitals; Manpower; Medical Personnel; Medical Services; Requirements; Ships*

**20080021810** Yale Univ., New Haven, CT USA

**Microtubule-Associated Protein Expression and Predicting Taxane Response**

Baquero, Maria T; Oct 2007; 81 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W-81XWH-06-1-0746

Report No.(s): AD-A477584; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477584>

We hypothesized that in addition to its predictive value, the microtubule-associated marker tau (MAP-tau) may also function as a prognostic biomarker. The dual functionality of MAP-tau may translate into increased tumor molecular screening information for patients with breast cancer resulting in better treatment options. The results of this work indicate that MAP-tau functions as a prognostic marker for paclitaxel sensitivity when examined using automated quantitative analysis (AQUA) and tissue arrays YTMA 49-5 and YTMA 49-6. Each array contained approximately 750 tumor histospots. This work demonstrates that MAPtau may be useful for further differentiating ER (+) and ER (-) patients and that increased MAP-tau expression in newly diagnosed breast cancer patients is associated with better outcome. Our findings suggest that MAP-tau may be a useful prognostic marker in addition to its predictive value for taxane response.

DTIC

*Breast; Cancer; Mammary Glands; Predictions; Proteins*

**20080021812** Stanford Univ., Stanford, CA USA

**PTEN Regulates Beta-Catenin in Androgen Signaling: Implication in Prostate Cancer Progression**

Sun, Zijie; Mar 1, 2007; 52 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0090

Report No.(s): AD-A477586; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477586>

The androgen-signaling pathway is essential in male sexual development and in normal and malignant prostate cell growth and survival. PI3K/Akt plays a critical role in prostate cancer cell growth and survival. Recent studies demonstrate that the effect of PI3K/Akt in prostate cells is mediated through androgen signaling. The PI3K inhibitor LY294002 and a tumor suppressor PTEN negatively regulate the PI3K/Akt pathway and repress the androgen receptor (AR) activity. However the molecular mechanisms whereby PI3K/Akt and PTEN regulate the androgen pathway are currently unclear. During this funding year we continue examining whether p-catenin is a major downstream effector of the PI3K/Akt and PTEN pathways in androgen-induced cell growth. Several sets of in vivo and in vitro experiments have been performed in this regard. The results suggest that the interactions between PI3K, Wnt, and androgen pathways are the key events in the tumorigenesis of prostate cancer.

DTIC

*Cancer; Hormones; Males; Prostate Gland*

**20080021813** General Accounting Office, Washington, DC USA

**DOD and VA. Preliminary Observations on Efforts to Improve Care Management and Disability Evaluations for Servicemembers**

Bertoni, Daniel; Pendleton, John H; Feb 27, 2008; 30 pp.; In English

Report No.(s): AD-A477587; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477587>

Why GAO Did This Study. In February 2007, a series of Washington Post articles about conditions at Walter Reed Army Medical Center highlighted problems in the Army's case management of injured servicemembers and in the military's disability evaluation system. These deficiencies included a confusing disability evaluation process and servicemembers in outpatient status for months and sometimes years without a clear understanding about their plan of care. These reported problems prompted various reviews and commissions to examine the care and services to servicemembers. In response to problems at Walter Reed and subsequent recommendations, the Army took a number of actions and DOD formed a joint DOD-VA Senior Oversight Committee. This statement updates GAO's September 2007 testimony and is based on ongoing work to (1) assess actions taken by the Army to help ill and injured soldiers obtain health care and navigate its disability evaluation process; and to (2) describe the status, plans, and challenges of DOD and VA efforts to implement a joint disability evaluation system. GAO's observations are based largely on documents obtained from and interviews with Army, DOD, and VA officials. The facts contained in this statement were discussed with representatives from the Army, DOD, and VA.

DTIC

*Disabilities; Medical Services; Military Personnel; Patients*

**20080021814** Duke Univ., Durham, NC USA

**Automation and Preclinical Evaluation of a Dedicated Emission Mammotomography System for Fully 3-D Molecular Breast Imaging**

Cutler, Spencer J; Oct 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0765

Report No.(s): AD-A477591; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477591>

The overall objective of this proposal is to fully automate and optimize the performance of a 3-D dedicated emission mammotomography system for enhanced semi-automated clinical testing. A retrospective study of 103 clinical MRI uncompressed breast scans was conducted to create surface renderings of the uncompressed breasts and analyze how to adapt existing acquisition orbits for varying breast shapes. Laser ribbon ranging sensors and associated hardware to fully automate the radius of rotation were acquired and tested. An observer based 3D contrast-detail study was performed in an effort to evaluate the limits of object detectability for the dedicated CZT-based SPECT mammotomography imaging system under various imaging conditions. Other aspects of the training program were also initiated including clinical shadowing in the mammography, nuclear medicine, and breast oncology divisions at Duke University.

DTIC

*Breast; Cancer; Imaging Techniques; Mammary Glands*

**20080021816** Georgetown Univ., Washington, DC USA

**Inflammatory Cytokines Induce Ubiquitination and Loss of the Prostate Suppressor Protein NKX3.1**

Muhlbradt, Erin E; Oct 2007; 69 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0590

Report No.(s): AD-A477595; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477595>

During the normal aging process in the prostate a variety of histologic changes are seen including regions termed inflammatory atrophy where mononuclear infiltrating cells are seen adjacent to atrophic glands. Moreover both clinical and subclinical prostatitis is a risk factor for the development of prostate cancer. This thesis describes a causative link between prostatic inflammatory processes and reductions in expression of the prostate suppressor protein NKX3.1. Reduction of the suppressor protein NKX3.1 by either loss of heterozygosity at 8p21, gene methylation or both is an early event in prostate cancer. We have found that the inflammatory cytokines TNF-alpha and IL-1beta induce rapid ubiquitination and proteasomal degradation of NKX3.1 in vitro. Within 2 hours of exposing LNCaP cells to TNF-alpha we observed marked reductions of either endogenous or exogenously expressed NKX3.1. Inhibitors of proteasomal degradation blocked the loss of NKX3.1 and allowed accumulation of NKX3.1 protein complexed with polyubiquitin. The C-terminal domain of NKX3.1 representing the 51 amino acids distal to the homeodomain can undergo posttranslational modification to regulate ubiquitination and turnover

of NKX3.1. Deletion of the C-terminal domain results in prolonged protein half life and absence of ubiquitination in response to TNF-alpha. The C-terminus directs ubiquitination but is not the site for ubiquitin ligation since site-directed mutation of either or both of the two lysines (193 and 201) in the C-terminal domain affects neither ubiquitination nor protein half-life. The ubiquitination signal can be localized to amino acids (184-192) in the C-terminal domain and mutation of serine 185 prolonged NKX3.1 half-life but did not affect TNF-alpha induced ubiquitination. Mutation of serine 196 inhibited TNF-alpha induced ubiquitination and degradation demonstrating differential regulation of NKX3.1 levels by inflammatory cytokines versus basal protein turnover.

DTIC

*Atrophy; Cancer; Genes; Losses; Prostate Gland; Proteins; Suppressors*

**20080021818** Ohio State Univ., Columbus, OH USA

**Genetic Analysis of Ets-2 in Tumor-Associated Macrophages During Breast Cancer Progression**

Zabuawala, Tahera; Oct 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W-81-XWH-06-1-0735

Report No.(s): AD-A477608; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477608>

While it is known that the most common human tumors are derived from epithelial cells that have undergone multiple genetic alterations, it is also becoming clear that the alterations in the tumor micro-environment are necessary for tumor progression. One such stromal component is the macrophage. Recent studies have shown that deletion of CSF-1, an essential growth factor for growth and differentiation of macrophages, delays pulmonary metastasis in the PyMT breast cancer model in mice. Previous work from our lab has demonstrated that Ets-2 is a nuclear effector of the Ras-Raf-MAP kinase pathway. My hypothesis is that CSF-1 mediates its pro-tumorigenic effects in macrophages via activation of Ets-2. To test this hypothesis, my project aims to analyze the effects of Ets-2 deletion specifically in the tumor-associated macrophages (TAMs) in the breast tumor microenvironment. To achieve this, I am using a conditional Ets-2 'floxed' allele available in our lab. I am using a non-inducible Lys-Cre transgene to delete Ets-2 specifically in the macrophages. Preliminary results with this system indicate that the gross tumor volume in the experimental animals is similar to that of the controls. Interestingly, the area of the lung lesions is significantly less in the experimentals as compared to those of the controls. At present I am trying to determine whether it is the exit from the primary tumor site or growth in the lungs which is affected in the experimentals. Microarray and real-time PCR analysis of mammary TAMs indicate that antiangiogenic factors may be downregulated in the Ets-2 deleted TAMs.

DTIC

*Breast; Cancer; Genetics; Macrophages; Mammary Glands; Metastasis; Tumors*

**20080021819** Naval Health Research Center, San Diego, CA USA

**Using the Estimating Supplies Program to Develop Material Solutions for the U.S. Air Force Medical Gynecological Treatment Team (FFGYN)**

Hopkins, Curt; Nix, Ralph; Konoske, Paula; Pang, Gerry; Onofrio, Kathleen; Dec 10, 2007; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477610; NHRC-08-1A; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477610>

The U.S. Air Force Medical Support Agency, Surgeon General Support Logistics Office, requested that the Naval Health Research Center (NHRC) conduct a proof of concept study to assess the validity and feasibility of using NHRC's medical modeling tool for the development and management of Air Force medical Allowance Standards as a baseline for standardization throughout the services. The primary objective of this study was to provide the Air Force with the ability to validate the clinical requirements of the Medical Gynecological Treatment Team. The Air Force Allowance Standard (AS) addresses the equipment, medicines, consumables, and durables required for a 30-day period. This study was accomplished in two phases. The first phase entailed an understanding of the mission capability requirements in order to (1) understand the operating environment in which the Gynecological Unit Type Code AS is employed, (2) determine the level of care it supports, (3) develop the range of patient conditions the AS must be capable of treating, and (4) better understand its mission scope. Concurrently, NHRC initiated e-mails, teleconferences, and face-to-face meetings with subject matter experts to determine the likelihood of each patient condition occurring. In phase two, following the NHRC process of modeling clinical requirements for field medical facilities, the Estimating Supplies Program database of medical task and supply profiles was used as a



template to identify patient conditions appropriate to this capability and to match gynecological supplies to clinical tasks, medical equipment, and supplies.

DTIC

*Estimating; Gynecology; Medical Equipment; Medical Personnel; Medical Services; Military Operations; Supplying; Teams*

**20080021825** General Accounting Office, Washington, DC USA

**Chemical and Biological Defense: DOD and VA Need to Improve Efforts to Identify and Notify Individuals Potentially Exposed during Chemical and Biological Tests**

D'Agostino, Davi M; Repasky, Robert L; Baril, Tommy; Brown, Renee S; Pegram, Brian D; Putansu, Steven; Richardson, Terry L; Thornton, Karen; Feb 2008; 50 pp.; In English

Report No.(s): AD-A477635; GAO-08-366; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477635>

Tens of thousands of military personnel and civilians were potentially exposed to chemical or biological substances through Department of Defense (DoD) tests since World War II. DoD conducted some of these tests as part of its Project 112 test program, while others were conducted as separate efforts. GAO was asked to do the following: (1) assess DoD's efforts to identify individuals who were potentially exposed during Project 112 tests, (2) evaluate DoD's current effort to identify individuals who were potentially exposed during tests conducted outside of Project 112, and (3) determine the extent to which DoD and the Department of Veterans Affairs (VA) have taken action to notify individuals who might have been exposed during chemical and biological tests. GAO analyzed documents and interviewed officials from DoD, VA, the Department of Labor, and a veterans service organization. GAO suggests that Congress direct DoD to develop guidance to notify potentially exposed civilians. GAO also recommends that DoD and VA take steps to improve their efforts to obtain, share, and use available information to more effectively identify and notify individuals. DoD and VA generally agreed with most of the recommendations. However, DoD did not agree with the recommendation to conduct a cost-benefit analysis regarding additional Project 112 research. As a result, GAO suggests that Congress direct DoD to conduct such an analysis.

DTIC

*Biological Weapons; Chemical Tests; Chemical Warfare; Defense Program; Military Personnel; Personnel*

**20080021829** New York Medical Coll., Valhalla, NY USA

**Chemoprevention of Prostate Cancer by Phenethyl Isothiocyanate**

Chiao, J W; Mar 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DA-MD17-03-1-0111

Report No.(s): AD-A477641; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477641>

There are epidemiological conclusions for potential prevention of prostate cancer with the intake of cruciferous vegetables. The responsible dietary factors were not identified. Now, we have demonstrated that isothiocyanates, such as phenethyl isothiocyanate (PEITC), from these vegetables inhibits growth of prostate cancer cells by targeting cell cycle regulators, like up-regulating p21. Analyses of the mechanism indicated that it involves a regulation at the epigenetic level. PEITC was found to be a dual inhibitor of histone deacetylases (HDACs) and aberrant CpG island methylation. Due to HDAC inhibition, PEITC modifies histones for transcription competent chromatin to activate p21. We demonstrated, for the first time, that PEITC reverses hypermethylation and reactivates GSTP1 that is silenced in prostate tumor. The silencing of GSTP1 occurs in the vast majority of clinical tumors and is a risk factor. We also determined that PEITC represses androgen receptor (AR) via down-regulation of Sp1 and increase protein degradation. The bioassay showed that PEITC regulates the activity of testosterone, via down-regulation of AR. Thus we have demonstrated several molecular targets relevant for inhibiting prostate carcinogenesis by PEITC. They include repressing AR, inhibiting HDACs, inhibiting aberrant CpG island methylation, and activating cell cycle regulators. The chemopreventive mechanisms of isothiocyanates revealed.

DTIC

*Cancer; Chemotherapy; Health; Prostate Gland*

**20080021830** Vanderbilt Univ., Nashville, TN USA

**Identification and Characterization of an X-Linked Familial Prostate Cancer Gene**

Yaspan, Brian; Nov 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W-81-XWH-06-1-0057

Report No.(s): AD-A477644; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477644>

Prostate cancer is the most commonly diagnosed non-skin malignancy in males, with as many as one in 5 males living

in developed nations being diagnosed with prostate cancer in their lifetime. Despite the medical significance of prostate cancer our understanding of predisposition and progression in the disease remains rudimentary. Prostate cancer is estimated to have the largest heritable component of all common cancers. We will explicitly characterize ancestral versions of a gene region originally implicated in prostate cancer through study of families with multiple cases of prostate cancer (HPC) to enable us to test the hypothesis that a common disease-predisposing genetic mutation conferring modest risk is shared among present-day prostate cancer cases in the broader population by virtue of inheritance from an ancient founder. We hope the findings of this proposal will offer a promising inroad for predicting disease predisposition, for tailoring the most effective current therapy to each individual patient, and for developing rational new therapies.

DTIC

*Cancer; Prostate Gland*

**20080021841** TRICARE Regional Office, San Diego, CA USA

**The Relevant Competencies for Mid-Level Navy Nurse Corps Leadership**

Palarca, Christine C; Apr 2007; 87 pp.; In English

Report No.(s): AD-A477658; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477658>

The purpose of this research is to achieve consensus among mid-level Navy Nurse Corps officers about the relevant competencies and important skills, knowledge, and abilities (SKAs) required for mid-level leadership. Using two iterations of the Delphi technique, eight competency domains emerged: management, leadership, professional development, personal development, clinical growth and sustainment, deployment readiness and interoperability, communications, and regulatory guidelines. In Wave I, 26 out of 260 nurses identified what they considered to be the five most relevant competencies and SKAs. Reviewed by an expert panel, the results were used to develop the Wave II questionnaire to determine SKA importance ratings. Using the same 260 respondent pool, 31 nurses rated 100-SKA items. The top four rated SKAs were: 'critical thinking skills,' 'self-motivation and initiative,' 'demonstrates core values and ethical behavior,' and 'critical thinking and problem solving skills.' They are represented by the personal development and management domains.

DTIC

*Leadership; Medical Personnel; Navy*

**20080021842** Medical Univ. of South Carolina, Charleston, SC USA

**Complement and Immunotherapy of Breast Cancer**

Rapisardo, Michelle; Tomlinson, Stephen; Oct 2007; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0768

Report No.(s): AD-A477661; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477661>

A humoral immune response to breast cancer cells is generally not therapeutically effective, likely due, at least in part, to overexpression of complement inhibitors expressed on tumor cell surfaces. Here we proposed to investigate two novel fusion proteins aimed at overcoming complement inhibition of breast tumor cells. During year one it was proposed to construct plasmids encoding MUC1 and MUC1-C3d; express and purify MUC1, MUC1-C3d and the recombinant fusion protein CR2-Fc; characterize CR2-Fc in vitro; and perform the MUC1 vaccination study. Construction and purification of MUC1 and MUC1-C3d and the MUC1 vaccination study has been achieved. A small, but significant, increase in the immune response was seen in mice vaccinated with MUC1-C3d. This indicates that C3d is functioning as an effective molecular adjuvant when linked to a tumor associated self antigen. Further experiments are needed to determine if this effect is protective and to possibly further increase the immune response if it is not. Technical difficulties have delayed expression and purification of mouse CR2-Fc, however efforts are underway to construct a new plasmid and in vitro characterization will proceed as soon as the problem is resolved.

DTIC

*Breast; Cancer; Mammary Glands*

**20080021845** Weed Army Community Hospital, Fort Irwin, CA USA

**A Business Case Analysis for Implementing and Optimizing Telemedicine at Fort Irwin**

Martin, Dean L; Jun 15, 2007; 78 pp.; In English

Report No.(s): AD-A477668; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477668>

Teleradiology, telepsychiatry, and teledermatology are three existing telemedicine services at Fort Irwin's Weed Army

Community Hospital. This research study provides an analysis on the qualified and quantifiable financial costs and benefits of these services over the past year as well as implementing a telepharmacy program using the cost model and benefits rationale scenario-building tools. The hospital's Governing Body will have the objective scrutiny to support their business decisions regarding telemedicine services as part of the organization's Fiscal Year 2008 Business Plan.

DTIC

*Commerce; Cost Analysis; Cost Effectiveness; Hospitals; Medical Services; Military Operations; Telemedicine*

**20080021846** Advanced Research and Technology Inst., Indianapolis, IN USA

**Incubation and Growth of Life Sciences, Medical and Biotechnology Businesses in Proteomics, Genomics, Medicine, and Dentistry**

Long, Mark S; Laughlin, Brian C; Wiseman, Justin M; Pyle, Timothy; Boscacci, Kevin J; Rothhaar, Katia; Helphingstine, Cynthia J; Apr 2007; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0626

Report No.(s): AD-A477669; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477669>

Trace level detection of chemical warfare agent simulants and biological toxins by desorption electrospray ionization (DESI) has been demonstrated. The detection of several chemical agent simulants as well as peptide and fungal toxins was shown at picogram levels from a variety of surfaces and in the presence of potential matrix interferences. In addition the detection of intact bacterial cells was also demonstrated. Smears of cells taken from cultures were analyzed yielding characteristic mass spectra for the different species studied. Ions arising from samples of *Pseudomonas aeruginosa* have been successfully identified as quinoline intercellular signaling molecules. Ions from other species have not yet been identified. Finally a prototype DESI wand was developed for the sampling of object not accessible by the standard mass spectrometer interface. The device extended approximately 20 cm from the mass spectrometer and was equipped with an array of both DESI spray heads and ion collection tubes enabling higher surface area scanning than is possible with a single spray head/ion collection tube combination

DTIC

*Bacteria; Biotechnology; Commerce; Dentistry; Desorption; Ionization; Life Sciences; Proteome; Pseudomonas*

**20080021870** Army Inst. of Surgical Research, Fort Sam Houston, TX USA

**In vitro Models of Laser Induced Injury: Pathophysiology and Cytoprotection**

Bowman, Phillip D; Schuschereba, Steven T; Oct 29, 2007; 56 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477739; USAISR-TR-2007-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477739>

Lasers generating predominantly thermal energy are used in medicine and research for a variety of purposes including surgical excision, pan retinal photocoagulation for treating diabetic retinopathy, cornea shape remodeling, treatment of photoaged skin, and hair removal. Not surprisingly, there has been an increase in the number of laser injuries, especially eye injuries, due to laser misuse or accidents over the last four decades. When sufficient energy is provided, most visible and near infrared wavelength laser systems will damage the retinal pigment epithelium (RPE). This damage is generally due to thermal injury. Of particular concern is thermal laser injury to the macular region of the retina, which may result in a blinding trauma that produces an immediate psychological and physical debilitation. To provide rational treatments for laser-induced injury, a better understanding of the nature of this injury is required. To this end, we established methods for studying laser-induced injury with in vitro models utilizing cultured human cells.

DTIC

*In Vitro Methods and Tests; Injuries; Laser Damage; Lasers; Retina*

**20080021879** Naval Undersea Warfare Center, Newport, RI USA

**Structural Analysis of the Two-Side Expandable ISO Shelter: A Floor Vibrations Mitigation Study**

Cavallaro, Paul V; Jee, Melvin; Cullinane, James; Reynolds, Thomas; Roche, John; Jan 14, 2008; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477760; NUWC-NPT TR-11; 846; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477760>

The TwoSide Expandable ISO S-786 Shelter is a tactical shelter fitted for 100-A electrical service that can be adapted for

numerous civilian and military operations. Users of the surgical versions of these shelters, namely, the U.S. Army Medical Materiel Development Agency, have reported undesirable bounce or springing effects when personnel traverse the floor regions. This report documents the structural analysis of the S-786 shelter in the fully deployed position that was conducted to determine if the shelter floor vibrations could be mitigated.

DTIC

*Floors; Shelters; Structural Analysis; Surgery; Vibration*

**20080021883** Army Tank-Automotive and Armaments Command, Picatinny Arsenal, NJ USA

**Development of Bio-Kinetic Model for Lubricants**

In-Sik, Rhee; Jul 30, 2004; 11 pp.; In English

Report No.(s): AD-A477774; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477774>

Biodegradation is a natural process caused by the action of microorganisms, in the presence of oxygen, nitrogen, phosphorous, and trace minerals. Organic pollutants can support microbial growth and are converted into a series of oxidation products that generally conclude with carbon dioxide and water. Modern lubricants are formulated with petroleum based oils or ester oils derived from renewable resources, or chemical synthetic sources. Their biodegradation process is somewhat similar to the fermentation process wherein hydrocarbons are converted into carbon dioxide by the action of metabolism of microorganisms. This biodegradation technology is currently used to remove hazardous materials contaminated in soil, sludge and ground water. Wastewater treatment process is one of its application areas. Recently, the ASTM D-2 Subcommittee 12 on Environmental Standard of Lubricants has developed the ASTM D 5864, Standard Test Method for Determining Aerobic Biodegradation of Lubricants and Their Components. This test method is a version of the Organization for Economic Co-Operation and Development (OECD) Stum test that closely simulates the wastewater biodegradation conditions and was designed to determine the degree of aerobic aquatic biodegradation of lubricants on exposure to an inoculum under laboratory conditions. In this test, the biodegradability of a lubricant is expressed as the percentage of maximum carbon conversion under well -controlled conditions for a period of 28 days. This test method has been widely used to determine the biodegradability of lubricants in the laboratory. The advantages of this test method are to provide a meaningful data and its low cost of the test apparatus. But the test method requires a long testing time, the knowledge of microorganisms, and manpower. In addition, it has very poor precision due to the various and multiple inoculums sources.

DTIC

*Biodegradation; Lubricants; Microorganisms*

**20080021884** Army Medical Dept. Center and School, Fort Sam Houston, TX USA

**Executive Competencies and Skills Required by USA Coast Guard Health Care Administrators**

Snyder, Guy L; Aug 1999; 91 pp.; In English

Report No.(s): AD-A477780; AMEDDCS-33-99; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477780>

This research identifies the most important domains in Coast Guard health care administration. It further delineates the Skills, Knowledge and Abilities (SKAs) required to be successful in today's environment and for the next five years. This paper reports the results from a Delphi study conducted among Coast Guard health care administrators and Commanding Officers of units with large medical facilities. The Delphi study was conducted in two iterations and resulted in 101 specific SKAs being identified. These SKAs fell into 15 rank ordered domains which were: Managed Care, Cost/Finance, Personnel, Technology, Leadership, Education, Business, Strategic Management, Quality, Healthcare Delivery, Readiness, Access, Professional Staff Relations, Marketing and Ethics. Analysis of the results indicates that leadership skills are key elements while an advanced education is seen as less important. A detailed description of the study is included and the implications of the findings are discussed as they pertain to the USA Coast Guard as well as the Department of Defense.

DTIC

*Coasts; Health; Information Management; Leadership; Management Systems; Medical Services; Strategic Materials; United States*

**20080021885** Air Force Hospital, Lackland AFB, TX USA

**The Balanced Scorecard: A Management System for Wilford Hall Medical Center - The Premier Air Force Medical Enterprise**

Hawk, Richard T; Apr 1999; 52 pp.; In English

Report No.(s): AD-A477782; 33A-99; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477782>

The Balanced Scorecard Management System (BSMS) at Wilford Hall Medical Center (WHMC) is a strategic management and measurement system that translates the organization's vision, mission and goals into a comprehensive set of performance measures. The BSMS allows leaders to manage the organization by focusing on the critical issues that define the organization's contributions to the enterprise. The scorecard was built by aligning performance measurements within the four key scorecard perspectives of Learning & Growth, Internal Business Processes, Customer and Financial. Additionally, balance in the scorecard was achieved with the measurements (either quantitative or qualitative), by focusing on both outcome measures and performance drivers. This paper describes the work that went into building the BSMS at the premier Air Force medical enterprise. From a discussion of the conditions that prompted the study to a look at the statement of the problem, the author explores the history and use of the balanced scorecard concept in civilian business, industry and healthcare. From that point the author discusses the BSMS as it applied directly to WHMC, from an early focus on defining the mission, vision and goals of the organization, through development of Mission Essential Tasks to measurements. The final product of the efforts applied was an Intranet-based, database automated, Balanced Scorecard Management System.

DTIC

*Management Planning; Management Systems; Measurement; Medical Services; Organizations*

**20080021888** Department of the Army, Falls Church, VA USA

**Assessment of Detainee Medical Operations for OEF, GTMO, and OIF (REDACTED)**

Apr 13, 2005; 216 pp.; In English

Report No.(s): AD-A477794; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477794>

On 12 November 2004, The Army Surgeon General, LTG Kevin C. Kiley, directed the Commander of the U.S. Army Medical Research and Materiel Command, MG Lester Martinez-Lopez, to lead a multidisciplinary Functional Assessment Team (the Team) to assess detainee medical operations in Operation Enduring Freedom (OEF), Guantanamo Bay, Cuba (GTMO) and Operation Iraqi Freedom (OIF). LTG Kiley specifically directed the team to look at 14 assessment questions with respect to Army active component (AC) and reserve component (RC) medical personnel providing support and/or care to detainees in Afghanistan, Cuba, and Iraq. In formulating the assessment approach, the team reviewed previous assessments related to detainee operations and investigations of detainee abuse, as well as policies, regulations, and field manuals outlining the precepts of detainee operations. The medical assessment focused on aspects related to: (1) detainee medical policies and procedures, (2) medical records management, and (3) the incidence and reporting of alleged detainee abuse by medical personnel; the fourth focus area of training medical personnel for the detainee health care mission was addressed within focus areas (2) and (3). The Team found a dedicated and committed cadre of medical personnel whose goal and desire were to provide high quality healthcare for each patient they treated, regardless of status. While medical personnel faced numerous challenges in a stress-filled environment, the interviewees continually described the compassionate and dedicated care they provided to detainees. Many medical personnel described the extraordinary measures and efforts put forth to care for and save the lives of detainees. Our medical Soldiers represent the best our country has to offer and they truly gave of themselves to serve our Nation.

DTIC

*Cuba; Medical Services*

**20080021915** Army Engineer Research and Development Center, Vicksburg, MS USA

**A Summary of Eelgrass (*Zostera marina*) Reproductive Biology with an Emphasis on Seed Biology and Ecology from the Chesapeake Bay Region**

Orth, Robert J; Marion, Scott R; Moore, Kenneth A; Dec 2007; 12 pp.; In English

Report No.(s): AD-A477866; ERDC/TN-SAV-07-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477866>

Interest in seagrass restoration is increasing worldwide as the value of seagrass ecosystems is recognized by scientists, managers and regulators (Orth et al. 2000, 2006b, 2006c). Seagrass transplanting projects have traditionally relied on adult plants (Fonseca et al. 1998) using a variety of manual and mechanical techniques (Fonseca et al. 1998, Fishman et al. 2004,



Treat and Lewis 2006). However, most techniques using adult plants are laborintensive and time-consuming, requiring physical excavation of the donor material, which could be deleterious to the donor bed s survival. In addition, transporting adult plants can present logistical constraints if the transplant site is located at significant distances from the donor site, or if the methodology requires moving sediment along with the plants. One of the key advantages of transplanting adult plants is the immediate creation of habitat for fauna, which have been shown to colonize these areas rapidly (Fonseca et al. 1996). While most seagrass restoration projects cover small areas of meters to tens of meters squared, efforts to restore larger areas may be necessary to significantly enhance recovery. Seeds offer the potential to restore large, genetically diverse populations of submerged aquatic vegetation (SAV) in a manner that avoids the damage to donor beds caused by harvesting adult transplants. Seagrass seeds have been shown to be critical in natural bed recovery following disturbances (Plus et al. 2003) and in initiating recovery in systems where seed recruitment is rare (Orth et al. 2006d). Much of the research on the use of seeds in SAV restoration has focused on a single species, *Zostera marina* (eelgrass) (Figure 1). As a result, more is known about the seed ecology of *Z. marina* than any other seagrass species.

DTIC

*Aquatic Plants; Chesapeake Bay (US); Ecology; Habitats; Seeds*

**20080021992** Library of Congress, Washington, DC USA

**Project BioShield**

Gottron, Frank; May 20, 2003; 7 pp.; In English

Report No.(s): AD-A477907; CRS-RS21507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many potential biological terrorism agents lack available countermeasures. President Bush proposed Project BioShield to encourage companies to develop new bioterror countermeasures. The main provisions of that proposal include the following: (1) relaxing procedures for bioterrorism-related procurement and peer review; (2) guaranteeing a market through contract authority granted to the Secretary of Health and Human Services (HHS) to buy countermeasures following Presidential approval, funded by a permanent, indefinite appropriation; and (3) allowing the Secretary of HHS to permit the emergency use of unapproved countermeasures. S. 15 (Gregg) incorporates these proposals. H.R. 2122 (Tauzin) is similar to S. 15. The largest difference is rather than creating a permanent, indefinite appropriation, H.R. 2122 establishes a special fund and authorizes the subsequent appropriation of up to \$5.593 billion for the purchase of countermeasures through fiscal year 2013. Some provisions of Project BioShield are controversial. Some critics suggest that biotechnology and pharmaceutical companies will require even more incentives than are contained in these proposals. Additional incentives being considered by the 108th Congress include protection from litigation because of adverse reactions to the countermeasures, and tax and intellectual property incentives (S. 666, Lieberman). Other options include directly funding development or increasing the scope of existing federal programs designed to encourage technology commercialization. This report will be updated in response to legislative developments.

DTIC

*Biological Weapons; Countermeasures; Government Procurement; Law (Jurisprudence); Therapy; United States*

**20080021993** Library of Congress, Washington, DC USA

**Project BioShield**

Gottron, Frank; Jul 11, 2003; 7 pp.; In English

Report No.(s): AD-A477908; CRS-RS21507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many potential biological terrorism agents lack available countermeasures. President Bush proposed Project BioShield to encourage companies to develop new bioterror countermeasures. The main provisions of that proposal include the following: (1) relaxing procedures for bioterrorism-related procurement and peer review; (2) guaranteeing a market through contract authority granted to the Secretary of Health and Human Services (HHS) to buy countermeasures following Presidential approval, funded by a permanent, indefinite appropriation; and (3) allowing the Secretary of HHS to permit the emergency use of unapproved countermeasures. S. 15 (Gregg) incorporates these proposals. H.R. 2122 (Tauzin) is similar to S. 15. The largest difference is rather than creating a permanent, indefinite appropriation, H.R. 2122 establishes a special fund and authorizes the subsequent appropriation of up to \$5.593 billion for the purchase of countermeasures through fiscal year 2013. Some provisions of Project BioShield are controversial. Some critics suggest that biotechnology and pharmaceutical companies will require even more incentives than are contained in these proposals. Additional incentives being considered by the 108th Congress include protection from litigation because of adverse reactions to the countermeasures, and tax and intellectual property incentives (S. 666, Lieberman). Other options include directly funding development or increasing the

scope of existing federal programs designed to encourage technology commercialization. This report will be updated in response to legislative developments.

DTIC

*Biological Weapons; Countermeasures; Government Procurement; Law (Jurisprudence); Therapy; United States*

**20080021994** Library of Congress, Washington, DC USA

#### **Project BioShield**

Gottron, Frank; Jul 23, 2003; 7 pp.; In English

Report No.(s): AD-A477909; CRS-RS21507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many potential biological terrorism agents lack available countermeasures. President Bush proposed Project BioShield to encourage companies to develop new bioterror countermeasures. The main provisions of that proposal include the following: (1) relaxing procedures for bioterrorism-related procurement and peer review; (2) guaranteeing a market through contract authority granted to the Secretary of Health and Human Services (HHS) to buy countermeasures following Presidential approval, funded by a permanent, indefinite appropriation; and (3) allowing the Secretary of HHS to permit the emergency use of unapproved countermeasures. S. 15 (Gregg) incorporates these proposals. H.R. 2122 (Tauzin) is similar to S. 15. The largest difference is rather than creating a permanent, indefinite appropriation, H.R. 2122 establishes a special fund and authorizes the subsequent appropriation of up to \$5.593 billion for the purchase of countermeasures through fiscal year 2013. Some provisions of Project BioShield are controversial. Some critics suggest that biotechnology and pharmaceutical companies will require even more incentives than are contained in these proposals. Additional incentives being considered by the 108th Congress include protection from litigation because of adverse reactions to the countermeasures, and tax and intellectual property incentives (S. 666, Lieberman). Other options include directly funding development or increasing the scope of existing federal programs designed to encourage technology commercialization. This report will be updated in response to legislative developments.

DTIC

*Biological Weapons; Countermeasures; Government Procurement; Law (Jurisprudence); Therapy; United States*

**20080022002** Library of Congress, Washington, DC USA

#### **Project BioShield**

Gottron, Frank; Jun 10, 2005; 7 pp.; In English

Report No.(s): AD-A477928; CRS-RS21507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many potential biological terrorism agents lack available countermeasures. President Bush proposed Project BioShield to address this need. The 108th Congress considered this proposal in S. 15 (Gregg), S. 1504 (Gregg), and H.R. 2122 (Tauzin). President Bush signed S. 15 into law on July 21, 2004 (The Project BioShield Act of 2004, P.L. 108-276). The main provisions of this law include the following; (1) relaxing procedures for bioterrorism-related procurement, hiring, and awarding research grants; (2) guaranteeing a federal government market for new biomedical countermeasures; and (3) permitting emergency use of unapproved countermeasures. Project BioShield countermeasure procurement is funded by the Department of Homeland Security Appropriations Act, 2004 (P.L. 108-90) which advance-appropriated \$5.593 billion for FY2004-FY2013. Additional measures to encourage the development of countermeasures are being considered by the 109th Congress in S. 3 (Gregg) and S. 975 (Lieberman). This report will be updated in response to legislative developments.

DTIC

*Biological Weapons; Countermeasures; Government Procurement; Law (Jurisprudence); Therapy; United States*

**20080022003** Library of Congress, Washington, DC USA

#### **Project BioShield**

Gottron, Frank; Sep 23, 2003; 7 pp.; In English

Report No.(s): AD-A477929; CRS-RS21507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many potential biological terrorism agents lack available countermeasures. President Bush proposed Project BioShield to encourage companies to develop new bioterror countermeasures. The main provisions of that proposal include the following: (1) relaxing procedures for bioterrorism-related procurement and peer review; (2) guaranteeing a market through contract authority granted to the Secretary of Health and Human Services (HHS) to buy countermeasures following Presidential approval, funded by a permanent, indefinite appropriation; and (3) allowing the HHS Secretary to permit the emergency use of unapproved countermeasures. S. 15 (Gregg) incorporates these proposals. H.R. 2122 (Tauzin) and S. 1504 (Gregg) are similar to S. 15. The largest difference is rather than creating a permanent, indefinite appropriation, H.R. 2122 and S. 1504

authorize the appropriation of up to \$5.593 billion for the purchase of countermeasures through FY2013. H.R. 2122 creates a special reserve fund for these appropriations while S. 1504 does not. Some provisions of Project BioShield are controversial. Some critics suggest that biotechnology and pharmaceutical companies will require even more incentives than are contained in these proposals. Additional incentives being considered by the 108th Congress include protection from litigation because of adverse reactions to the countermeasures, and tax and intellectual property incentives (S. 666, Lieberman). Other options include directly funding development or increasing the scope of existing federal programs designed to encourage technology commercialization. This report will be updated in response to legislative developments. For a detailed comparison of these bills, see CRS Report RL32067 'Side-by-Side Comparison of Project BioShield Legislation: H.R. 2122, S. 15, and S. 1504.'

DTIC  
*Biological Weapons; Countermeasures; Government Procurement; Law (Jurisprudence); Therapy; United States*

**20080022004** Library of Congress, Washington, DC USA

### **Project BioShield**

Gottron, Frank; Aug 25, 2003; 7 pp.; In English

Report No.(s): AD-A477930; CRS-RS21507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many potential biological terrorism agents lack available countermeasures. President Bush proposed Project BioShield to encourage companies to develop new bioterror countermeasures. The main provisions of that proposal include the following: (1) relaxing procedures for bioterrorism-related procurement and peer review; (2) guaranteeing a market through contract authority granted to the Secretary of Health and Human Services (HHS) to buy countermeasures following Presidential approval, funded by a permanent, indefinite appropriation; and (3) allowing the Secretary of HHS to permit the emergency use of unapproved countermeasures. S. 15 (Gregg) incorporates these proposals. H.R. 2122 (Tauzin) and S. 1504 (Gregg) are similar to S. 15. The largest difference is rather than creating a permanent, indefinite appropriation, H.R. 2122 and S. 1504 authorize the appropriation of up to \$5.593 billion for the purchase of countermeasures through FY2013. R. 2122 creates a special reserve fund for these appropriations while S. 1504 does not. Some provisions of Project BioShield are controversial. Some critics suggest that biotechnology and pharmaceutical companies will require even more incentives than are contained in these proposals. Additional incentives being considered by the 108th Congress include protection from litigation because of adverse reactions to the countermeasures, and tax and intellectual property incentives (S. 666, Lieberman). Other options include directly funding development or increasing the scope of existing federal programs designed to encourage technology commercialization. This report will be updated in response to legislative developments.

DTIC

*Biological Weapons; Countermeasures; Government Procurement; Law (Jurisprudence); Therapy; United States*

**20080022010** Rosalind Franklin Univ. of Medicine and Science, Chicago, IL USA

### **Improving Quality of Life in Ovarian Cancer Patients: A Brief Intervention for Patients and Their Partners**

Zakowski, Sandra G; Sep 2007; 18 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0722

Report No.(s): AD-A477939; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The current study examines the effects of a psychological intervention that encourages emotional expression in ovarian cancer patients and their partners. Ovarian cancer patients (n=130) and their partners are randomly assigned to an intervention or a control group. Following Pennebaker's model, subjects in the intervention group are asked to write about their deepest thoughts and feelings regarding their cancer experience for 20 minutes each day for three consecutive days. The control group is asked to write about trivial non-emotional topics. Outcome variables including psychological distress, quality of life, and physical symptoms is assessed at baseline and over a period of nine months after the intervention (one week, three, six, and nine months). In accordance with our approved Statement of Work data collection is currently underway. 88 subjects completed the data collection process. Data processing is completed, including data entry and verification. Preliminary data analyses are ongoing.

DTIC

*Cancer; Ovaries; Patients; Signs and Symptoms*

**20080022013** Medical Coll. of Wisconsin, Milwaukee, WI USA

**Proteinated Subnano Particles of Elemental Selenium for the Treatment of Breast Cancer**

Sieber, Fritz; Sep 2007; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0525

Report No.(s): AD-A477942; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this award is to test in preclinical models the hypothesis that cytotoxic conjugates of elemental selenium and proteins are safe and effective for the systemic therapy of invasive breast cancer. The grant has three specific aims, 1) to evaluate the safety and efficacy of systemically administered Se(0)-protein conjugates in athymic nude mice bearing xenografts of human breast cancer cells, 2) to assess the functional integrity of conjugate-treated normal human hematopoietic stem cells, and 3) to determine by use of the combination index method how Se(0)-protein conjugates interact with standard chemotherapeutic agents that are commonly used in the treatment of breast cancer. We report here on the development and evaluation of improved methods for the generation of high-potency cytotoxic Se(0)-protein conjugates, the interactions of Se(0)-protein conjugates with standard chemotherapeutic agents, and the interference of certain antibiotics with the photochemical generation of Se(0)-protein conjugates.

DTIC

*Breast; Cancer; Chemotherapy; Drugs; Mammary Glands; Selenium*

**20080022016** Baylor Coll. of Medicine, Houston, TX USA

**A Fusogenic Oncolytic Herpes Simplex Virus for Therapy of Advanced Ovarian Cancer**

Zhang, Xiaoliu; Jun 2007; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0434

Report No.(s): AD-A477944; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The underlying hypothesis for this project is that incorporation of cell membrane fusion function into an oncolytic herpes simplex virus (HSV) can significantly enhance the anti-tumor effect of the virus. Three specific aims have been proposed and they are: 1) to demonstrate that fusogenic oncolytic HSVs are a potent anti-tumor agent for advanced ovarian cancer; 2) to prove that fusogenic oncolytic HSVs have the same safety profile as their non-fusogenic counterparts; 3) to explore novel delivery strategies that can evade host's anti-viral immunity for repeated delivery. During the funding period, these aims have been mostly achieved. Our data show that incorporation of a fusogenic glycoprotein (GALV.fus) into an oncolytic herpes simplex virus through a novel controlling mechanism can significantly enhance the antitumor potency of the virus without significantly increasing its toxicity. In the efforts to identify a strategy that can deliver an oncolytic HSV to tumor tissues systemically in the presence of host's antiviral immunity, we demonstrate that delivery of an oncolytic HSV as a DNA form rather than the traditional viral particles represents a possibility. We also show that blood cells such as monocytes/macrophages from STAT1-deficient background could function as cell carriers for systemic delivery of these oncolytic viruses. Several publications have been produced during the funding period. One of the oncolytic viruses that were studied during the funding period is currently being evaluated for translation into clinical testing for treating solid tumors including ovarian cancer.

DTIC

*Blood Cells; Cancer; Ovaries; Therapy; Viruses*

**20080022017** Vanderbilt Univ., Nashville, TN USA

**Nf-Kappab as a Critical Biological Link Between Psychological Stress and Breast Cancer**

Yull, Fiona; Nov 2007; 14 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0575

Report No.(s): AD-A477945; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is a widespread belief that psychological stress is a major factor in breast cancer. However, the biological pathways that link stress to increased breast cancer risk are not well understood. The nuclear factor-kappaB (NF-kB) family of transcription factors is recognized as linking inflammation and immunity to cancer. NF-kB signaling is positioned as a pivotal regulator of aberrant responses that lead to cancer. We tested the hypothesis that NF-kB is a critical biological link between psychological stress and breast cancer. We made innovative use of reporter transgenic mice to measure NF-kB responses to acute and chronic stress and subsequent effects on breast cancer progression. Our data suggest that NF-kB activity is changed in response to both acute and chronic stress and that this impacts both primary tumor formation and subsequent metastasis to the lung.

DTIC

*Breast; Cancer; Mammary Glands; Risk; Stress (Psychology)*

**20080022019** Rochester Univ., NY USA

**Potential of Prostate Cancer Radiotherapy Using Antiangiogenic and Antitumor Therapies**

Fenton, Bruce M; Oct 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0827

Report No.(s): AD-A477949; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The focus of this grant was to gauge the pathophysiological effects of combinations of radiotherapy and a variety of antiangiogenic agents by studying corresponding changes in vascular maturity and function in PC-3 and DU145 human prostate xenografts. Perfusion, apoptosis, proliferation, and hypoxia indices as well as pericyte and basement membrane coverage were quantified using image analysis of immunohistochemically stained frozen tumor sections. Results argue against a treatment-induced functional normalization of the tumor vasculature following combination therapy. Rather than tightening pericytes, combination treatments loosened pericyte-vessel and pericytebasement membrane associations. Despite reductions in oxygenation and vessel densities, tumor progression was minimal during extended combination treatment, most likely due to continued vascular destruction and the prevention of new vessel growth. Surprisingly, alternative scheduling of antiangiogenic drugs and radiation had minimal effects on tumor progression or pathophysiology.

DTIC

*Cancer; Prostate Gland; Radiation Therapy; Therapy*

**20080022020** Social Sectors Development Strategies, Inc., Boston, MA USA

**Risk Factors for Discharge from the Army with a Permanent Disability**

Schwartz, Carolyn; Bell, Nicole S; Hollander, Ilyssa E; Jul 2007; 80 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-2-0028

Report No.(s): AD-A477951; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report outlines progress made during the first year of the Risk Factors for Discharge from the Army with a Permanent Disability research project. Scope: The study's overall goal is to identify factors associated with the Army's rapidly increasing disability discharges rates in order to develop targeted and cost-efficient disability reduction strategies. We hypothesize that disability is the result of a combination of health, occupational, and personal risk factors that can be identified prior to the onset of a potentially disabling condition. It is further hypothesized that many of these factors are modifiable. With appropriate identification and intervention, disability among at-risk soldiers can be prevented. Major Findings to date: Underlying Army demographic changes over time do not explain the overall increases in disability rates. While increases in disability are generally experienced across all military demographic groups, fastest growing rates were observed among women, junior enlisted, younger soldiers and those without college degrees. The primary cause of increasing disability and disability overall is the adverse effects of acute and chronic injury. More research is needed to understand the etiology of these conditions and should include multivariate predictive models to assess independent effects of gender, education, rank and age.

DTIC

*Conditions; Disabilities; Epidemiology; Hazards; Injuries; Risk*

**20080022021** Cold Spring Harbor Lab., New York, NY USA

**A Strategy to Rapidly Re-Sequence the NF1 Genomic Loci Using Microarrays and Bioinformatics for Molecular Classification of the Disease**

Kamalakaran, Sitharthan; Dubnau, Josh; Dec 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0127

Report No.(s): AD-A477952; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Neurofibromatosis (NF) are disorders caused by mutations in NF1/NF2 genes and characterized by fibromatous tumors on nerves, skin, and bones. A method to rapidly and cheaply re-sequence the NF loci would greatly aid in the molecular classification of the disease by forging links between sequence variations and clinical manifestations. We propose to develop a technique to rapidly re-sequence genomic loci using microarray hybridization and bioinformatics. The NF locus is first amplified using a high processivity polymerase and hybridized on a custom microarray containing all possible 10mer combinations of the four deoxy-ribonucleotides. A virtual profile of a hybridization map of the locus is generated using the available sequence information. This map is then compared to an actual hybridization. If the sequences are identical, then the two images would superimpose. Using the differences in the virtual and real hybridization, we propose to map the mutations in the locus.

DTIC

*Classifications; Diseases; Genome; Loci; Nervous System*



**20080022022** Michigan Univ., Ann Arbor, MI USA

**Function of p53 in Regulation of TSC Mutant Cell Apoptosis**

Guan, Hun-Liang; May 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0505

Report No.(s): AD-A477953; No Copyright; Avail.: Defense Technical Information Center (DTIC)

TSC1 and TSC2 are tumor suppressor genes that are mutated in tuberous sclerosis complex (TSC). Mutation in either TSC1 or TSC2 results in a constitutively activation of mammalian target of rapamycin (mTOR) therefore promoting cell growth. mTOR activity is regulated by intracellular signals including growth factors and cellular energy level. Energy starvation such as glucose deprivation inhibits mTOR activity via the activation of TSC2. We have observed that TSC cells are very sensitive to cellular energy starvation. This is because TSC cells fail to stop growth even in the absence of glucose while normal cells will stop grow under glucose starvation. The energy starvation induced cell death is due to apoptosis. P53 is the most frequently mutated human tumor suppressor. It has been reported that p53 is stabilized by AMPK which is activated by energy starvation. The major goal of this proposal is to investigate the functional importance of p53 in energy starvation induced apoptosis in TSC tumor cells. We will test whether p53 phosphorylation and protein levels are accumulated in TSC tumor cells. Furthermore we will investigate the function of TSC1 and TSC2 in p53 regulation. Completion of this proposal will establish a functional relationship between TSC1/TSC2 and p53 tumor suppressors.

DTIC

*Apoptosis; Neoplasms; Phosphorylation*

**20080022024** Western Inst. of Biomedical Research, Salt Lake City, UT USA

**Development of Osseointegrated Implants for Soldier Amputees Following Orthopaedic Extremity Trauma**

Bloebaum, Roy D; Bachus, Kent; Kopp, Derinna; Aug 2007; 77 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0574

Report No.(s): AD-A477957; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This is the first year annual report of this four year research program to develop osseointegrated implants for amputees. This research will provide the basic foundations for the safe and efficacious design of implants for above the knee active amputees. These implants will allow for direct loading of the bone and have a safety release mechanism to prevent abutment and bone- implant interface failure and bone fracture. The first year of research focused on determining morphometric variations in the internal structure of the human femur as a function of gender age and ethnic background. Anthropometric studies were conducted along the length of the femur to develop sizing and design criteria. It has been a productive and challenging first year. The challenge of obtaining human cadaver specimens delayed our timeline but we will complete the task within the first quarter of the second year. We believe we have established the imaging principles for developing customized osseointegrated implants.

DTIC

*Implantation; Injuries; Orthopedics*

**20080022040** Vector, Inc., San Antonio, TX USA

**Can Episode-of-Care Grouper Software be Used to Augment the Military Healthcare System Modeling Efforts**

Forrest, Ann L; Dec 10, 2001; 63 pp.; In English

Report No.(s): AD-A478031; AMDCS-34-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A computer model that behaves like the healthcare system would be a valuable tool enabling administrators to evaluate the impact of changes to the healthcare system prior to implementation. The Military Healthcare System (MHS) is the leader in creating computerized models that represent large complex healthcare systems. Despite the potential benefits of modeling a healthcare system, modeling remains in its infancy. The fundamental building block of a healthcare system model is the quantification of care that patients received as they maneuver their way through the system. Newly-developed software programs known as episode groupers uncover these patterns and organize them into clinically meaningful packages. This study is an exploratory glimpse into the obstacles within the MHS that makes utilizing one of these software products particularly challenging. A year's worth of healthcare records from San Diego's direct care system, as well as the network, were gathered, formatted, and processed through the episode grouper. MHS data did not perform as well as civilian healthcare data; 23% of the records were ungroupable vice 14%. The majority of these orphan records (70%) were ancillary and pharmaceutical records that could not be linked to the outpatient visit that generated them. Some of the contributing factors include inadequate

capture of data within the MHS, the mobility of the population served, military-unique medical codes, and inadequate coding. The MHS has made improvements since the time frame of this study that should vastly improve its performance with episode groupers. After additional reliability and validity testing has occurred, episode groupers could be utilized to uncover healthcare delivery patterns and incorporated into the next wave of MHS healthcare computer models.

DTIC

*Computer Programs; Management Systems; Medical Services*

**20080022042** Air Force Research Lab., Tyndall AFB, FL USA

**Demonstration of Bioaugmentation at Kelly AFB: Cost & Performance Report**

Newsome, Kolin C; Feb 2007; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER-9914

Report No.(s): AD-A478038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Chlorinated ethenes such as tetrachloroethene (PCE) and trichloroethene (TCE) are some of the most common groundwater contaminants found at Department of Defense (DoD) facilities. In addition to their common presence, these compounds are persistent under most natural geochemical conditions at these contaminated sites. Remediation of these sites through biodegradation of the chlorinated ethenes is a promising alternative at many of the sites. Reductive dechlorination is the primary pathway for biodegradation of chlorinated solvents. With this pathway, the chlorine atoms on the ethenes are sequentially replaced by hydrogen atoms through a biologically-mediated process. Generally, the hydrogen is generated through fermentation of an electron donor. Although many microorganisms are capable of mediating the reductive dechlorination process, only *Dehalococcoides ethenogenes* is known to completely reduce PCE and TCE to ethene. Unfortunately, *D. ethenogenes* is not present at all chloroethene-contaminated sites and the reductive dechlorination process stalls at *cis*-1,2-dichloroethene (*c*-DCE). Under conditions such as these, the application of enriched cultures containing *D. ethenogenes* or closely related microorganisms is used to complete the reductive dechlorination process. The primary objective of the demonstration was to determine if complete reductive dechlorination could be stimulated through the introduction of a culture known to contain halorespiring bacteria. Secondary objectives involved testing the robustness of the applied culture by depriving it of electron donor and adding sulfate to the system. Samples were collected at a frequency and analyses were performed to evaluate the objectives of the demonstration. The results of the chemical analyses indicated that the complete dechlorination was achieved through the addition of the microbial culture.

DTIC

*Augmentation; Biodegradation; Chlorination; Contamination; Costs; Ground Water*

**20080022044** Mount Sinai School of Medicine, New York, NY USA

**Analysis of Alk-1 Signaling in Endothelial Cells and its Role in Breast Tumor Angiogenesis. Addendum**

Kretzschmar, Marcus; Snoeck, Hans-Willem; Sep 2005; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0335

Report No.(s): AD-A478040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The process of tumor angiogenesis i.e. the vascularization of the tumor mass by formation of new blood vessels is important for tumor growth and metastasis. Inhibition of tumor angiogenesis is therefore an important goal for therapeutic intervention in breast cancer. Understanding the regulation of tumor angiogenesis at the molecular level is a prerequisite for successful manipulation of this process. Angiogenesis is regulated by the coordinated action of various growth factors and their receptors among the Alk-1 a member of the TGF-beta receptor family. While convincing genetic evidence has demonstrated an essential role of Alk-1 in developmental angiogenesis and the maintenance of the vascular system in the adult the possible role of Alk-1 in tumor angiogenesis as well as its cellular and molecular functions in endothelial cells need to be investigated. To this end we have generated a variety of tools for the analysis of Alk-1 function and have made further progress in elucidating its role in the regulation of endothelial cell growth and survival. These studies have the potential of leading to the identification of novel targets in the TGF-beta signaling system for anti-angiogenic intervention in breast cancer.

DTIC

*Angiogenesis; Breast; Cancer; Endothelium; Mammary Glands; Therapy; Tumors*

**20080022048** Children's Hospital, Washington, DC USA

**Incontinentia Pigmenti**

Hsieh, David T; Moorjani, Bhagwan; Jan 2008; 19 pp.; In English

Report No.(s): AD-A478060; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Incontinentia pigmenti is an X-linked dominant disorder with characteristic skin lesions and anomalies of teeth, hair, nails, eyes, and central nervous system. Cutaneous lesions are the most common identifiable abnormality and characterized in 4 stages. ONS abnormalities are the cause of most morbidity in this disorder. The NEMO gene is identified with this disorder. In this update, Drs. David Hsieh and Bhagwan Moorjani from Children's National Medical Center in Washington, DC highlight the reporting of reversible brain lesions by MRI, and the addition of the gothic palate in the spectrum of oral and dental anomalies in incontinentia pigmenti.

DTIC

*Abnormalities; Anomalies; Central Nervous System; Lesions*

**20080022049** Hawaii Univ., Honolulu, HI USA

**Water Sparing in Chronic Ethanol Exposure is Associated With Elevated Renal Estrogen Receptor Beta and Vasopressin V2 Receptor mRNA in the Female Rat**

Huckstep, Odaro J; Dec 2007; 41 pp.; In English

Report No.(s): AD-A478071; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Fluid handling is known to differ between males and females. Interactions between sex steroids such as estrogen with fluid regulating hormones like vasopressin (VP) are likely key to establishing these differences. Research has identified estrogen receptor (ER) alpha and Beta in renal tissue which may affect renal fluid handling. Thus, this study hypothesized that chronic ethanol exposure would elicit different alterations to water load excretion between male and female Sprague Dawley (SD) rats due to changes in renal VP V2 receptor (V2R) or ER mRNA expression. Therefore, in this study we compared 120 minute excretion of a 2% Body Weight (BW) water load between male control (n=6) and ethanol-fed (n=14) rats, and female control (n=26) and ethanol-fed (n=26) rats. Additionally renal papilla mRNA expression of V2R, ERalpha, and ERbeta was compared between male control (n=5) and ethanol-fed (n=5) rats, and female control (n=12) and ethanol-fed (n=17) rats. Female ethanol fed rats showed a 16% reduction in water load excretion (p<0.05) compared to controls. RT-PCR analysis revealed that the decreased water excretion in ethanol-fed females was accompanied by a 40% increase in V2R mRNA (p<0.05) and a 146% increase in ERbeta mRNA (p<0.05) in renal papilla tissue compared to controls. In contrast, ethanol treatment in male rats resulted in no difference in water excretion, and yielded no change to V2R or ERbeta mRNA expression in the renal papilla. ERbeta expression was not different between males and females, nor affected by ethanol treatment. Overall, these results suggest that females can better compensate for the dehydrating effects of ethanol exposure by increasing renal responsiveness to VP via upregulating renal V2R. Also, ethanol specifically upregulates the ER $\beta$  subtype in the female kidney which may modulate renal sensitivity to VP.

DTIC

*Antidiuretics; Calculi; Estrogens; Ethyl Alcohol; Exposure; Females; Hormones; Rats; Ribonucleic Acids; Vasopressins; Water*

**20080022080** Army War Coll., Carlisle Barracks, PA USA

**1918 Flu Pandemic: Implications for Homeland Security in the New Millennium**

Kirkland, Stephen M; May 9, 2007; 31 pp.; In English

Report No.(s): AD-A478212; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The National Strategy for Pandemic Influenza notes that pandemic flu could overwhelm the health and medical capabilities of the USA, cause hundreds of thousands of deaths, millions of hospitalizations, and cost hundreds of billions of dollars. The consensus within scientific circles is that the nation will likely face one or more pandemics in this century, although there is disagreement as to the probable timing of such an event. Studying the 1918 pandemic will assist modern day planners in mitigating the effects of pandemic flu and the contingency planning will have widespread applicability to other events, both natural and manmade, that may significantly impact the nation's health and security. This paper reviews the 1918 pandemic, explores concerns about the avian influenza virus H5N1, and considers current planning for pandemic flu. Weaknesses in the current schema are examined and recommendations are offered to facilitate both enhanced pandemic planning efforts and Homeland Security.

DTIC

*Influenza; Planning; Security*

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*.

**20080021669** NASA Langley Research Center, Hampton, VA, USA

**Prebreathe Protocol for Extravehicular Activity Technical Consultation Report**

Ross, Jerry; Duncan, Michael; April 2008; 174 pp.; In English; See also 20080021670 - 20080021674; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.06.07.03.99

Report No.(s): NASA/TM-2008-215124; NESC-RP-05-91/05-032-E; L-19465; No Copyright; Avail.: CASI: [A08](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021669>

In the performance of EVA by that National Aeronautics and Space Administration (NASA) astronauts, there exists a risk of DCS as the suit pressure is reduced to 4.3 pounds per square inch, absolute (psia) from the International Space Station (ISS) pressure of 14.7 psia. Several DCS-preventive procedures have been developed and implemented. Each of these procedures involve the use of oxygen (O<sub>2</sub>) prebreathe to effectively washout tissue nitrogen (N<sub>2</sub>). The management of the ISS Programs convened an expert independent peer review Team to conduct a review of the Decompression Sickness (DCS) risks associated with the Extra Vehicular Activity (EVA) Campout Prebreathe (PB) protocol for its consideration for use on future missions. The major findings and recommendations of the expert panel are: There is no direct experimental data to confirm the potential DCS risks of the Campout PB protocol. However, based on model data, statistical probability, physiology, and information derived from similar PB protocols, there is no compelling evidence to suggest that the Campout PB protocol is less safe than the other NASA approved PB protocols.

Author

*Decompression Sickness; Extravehicular Activity; International Space Station; Nitrogen; Oxygen; Astronauts; NASA Programs*

**20080021670** NASA Langley Research Center, Hampton, VA, USA

**Notes and Analysis of NASA Shuttle and ISS Prebreathe Options with Special Reference to ‘Campout’ Prebreathe**

Conkin, Johnny; Prebreathe Protocol for Extravehicular Activity Technical Consultation Report; April 2008, pp. 39-69; In English; See also [20080021669](#); Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021670>

The International Space Station (ISS) will operate at 14.7 psi, requiring crews to ‘campout’ in the airlock at 10.2 psi. The constraints associated with campout (crew isolation, oxygen usage, and waste management), provided the rationale to develop a prebreathe protocol. This presentation offers analyses of NASA shuttle and prebreathe operations, specifically the campout prebreathe protocol. Portions of the demonstration highlight decompression stress during extravehicular activities in microgravity and models of exercise prebreathe.

Derived from text

*Extravehicular Activity; International Space Station; Microgravity; Stress (Physiology); Decompression Sickness; Aerospace Medicine; Bioastronautics*

**20080021671** NASA Johnson Space Center, Houston, TX, USA

**Acceptability of Campout Prebreathe Protocol for ISS EVA Operations**

Dervay, Joe; Prebreathe Protocol for Extravehicular Activity Technical Consultation Report; April 2008, pp. 70-95; In English; See also [20080021669](#); Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021671>

This viewgraph presentation reviews the study of the campout protocol for International Space Station (ISS) Extra Vehicular Activities (EVA) The objective of this study is to review and determine the acceptability of the Campout Prebreathe Protocol for ISS EVA Operations. Driven by MOD/XA operational desires on EVA day (e.g. time efficiencies, elimination of potential scheduling constraint violations)

CASI

*Extravehicular Activity; International Space Station; Respiration; Breathing*

**20080021672** NASA Langley Research Center, Hampton, VA, USA

**EVA Prebreathe Protocol Comparison: Operational Drivers**

Prebreathe Protocol for Extravehicular Activity Technical Consultation Report; April 2008, pp. 145-167; In English; See also [20080021669](#); Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080021672>

This viewgraph presentation reviews the types of prebreathe protocols for Astronauts assigned to Extra Vehicular Activity (EVA). The type of EVA is important to determine the type of prebreathe protocol is appropriate. The types of EVA prebreathe protocols are reviewed, and described.

CASI

*Astronauts; Extravehicular Activity; Pressure Breathing; Decompression Sickness*

**20080021673** National Space Biomedical Research Inst., Houston, TX, USA

**Estimated Risk of DCS and VGE in ISS Campout Prebreathe**

Conkin, Johnny; Prebreathe Protocol for Extravehicular Activity Technical Consultation Report; April 2008, pp. 129-144; In English; See also [20080021669](#); Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080021673>

This viewgraph presentation reviews the risk of Decompression Sickness (DCS) and Venous Gas Emboli (VGE) in relation to the International Space Station Prebreathe protocol. Mathematical Models of the risks are reviewed, and charts and graphs are presented. The limitations of risk estimate of the campout protocol are discussed.

CASI

*Aeroembolism; Decompression Sickness; Risk; Countermeasures*

**20080021674** NASA Langley Research Center, Hampton, VA, USA

**Overview of Shuttle and ISS Exercise Prebreathe Protocols and ISS Protocol Accept/Reject Limits**

Gernhardt, Mike; Prebreathe Protocol for Extravehicular Activity Technical Consultation Report; April 2008, pp. 96-125; In English; See also [20080021669](#); Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080021674>

This presentation addresses the prebreathe protocol for extravehicular activity (EVA) and reviews the International Space Station protocol for accept and reject limits. Tables are included that list altitude decompression sickness (DCS) symptoms, type II DCS in diving and that compare altitude versus diving DCS. Additional slides review ground-level treatment with 100% oxygen and gas bubble size reduction comparison. Shuttle protocol ground trials were tested to arrive at flight approved flight prebreathe protocols and EVA simulations were developed to model shuttle contingency tasks associated with failures of the payload bay doors and latch mechanisms. Prebreathe exercise and microgravity simulation-enabling research findings are presented. A DCS risk definition is offered and contingency plan processes are outlined. Models of accept/reject limits for protocol trials, prebreathe trials, and shuttle 10.2 psi staged protocol are provided.

Author

*Oxygen Breathing; Decompression Sickness; Extravehicular Activity; International Space Station; Stress (Physiology); Aerospace Medicine; Bioastronautics*

**20080021759** McKinney and Stringer, P.C., Oklahoma City, OK, USA

**Delivery of Bioactive Substances to Target Cells**

Seeney, C. E., Inventor; Dormer, K. J., Inventor; Kopke, R. D., Inventor; 18 Jun 04; 9 pp.; In English

Contract(s)/Grant(s): NCRADA-NMCSO-03-110

Patent Info.: Filed Filed 18 Jun 04; US-Patent-Appl-SN-10-871-243

Report No.(s): PB2007-109288; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A system for introducing a bioactive substance into a target cell within a body. The bioactive substance is transported to the target cell using a superparamagnetic nanoparticle and a controllable magnetic field generator that is capable of moving the nanoparticle to the target cell through the body in three dimensions. The nanoparticle may be covered with a biocompatible shell that forms a covalent bond with the bioactive substance. In an alternative embodiment, the bioactive substance and a plurality of nanoparticles are supported by a bioerodable matrix that forms a nanosphere. The nanosphere may be moved into



the target cell using an external magnetic field that is controllable to move the nanosphere in three dimensions through the body and the bioactive substance is released from the nanosphere once inside the target cell.

NTIS

*Targets; Cells (Biology); Activity (Biology); Materials*

**20080021786** California Inst. of Tech., Pasadena, CA USA

**Chimeric Pro-Caspases and Methods of Using Same**

Baltimore, D., Inventor; Yang, X., Inventor; Chang, H. Y., Inventor; 6 Jul 05; 27 pp.; In English

Contract(s)/Grant(s): NIH-RO1 CA51462

Patent Info.: Filed Filed 6 Jul 05; US-Patent-Appl-SN-11-176-129

Report No.(s): PB2007-109282; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates to a chimeric pro-caspase, which contains a pro-caspase domain and an oligomerizing domain. The invention also relates to an antibody that reacts specifically with a chimeric pro-caspase. In addition, the invention further relates to a polynucleotide encoding a chimeric pro-caspase, and to nucleotide sequences, which can hybridize specifically with a polynucleotide encoding a chimeric pro-caspase. The present invention also relates to a method of inducing apoptosis in a cell by providing a chimeric pro-caspase in the cell, wherein the chimeric pro-caspase includes a pro-caspase domain and an oligomerizing domain, whereby the chimeric pro-caspase forms an oligomer in the cell, thereby activating caspase activity of the chimeric pro-caspase and inducing apoptosis in the cell. The present invention further relates to a method of reducing the severity of a pathologic condition in a subject, by providing cells of the subject that are involved in the pathologic condition with a chimeric pro-caspase comprising a pro-caspase domain and an oligomerizing domain, whereby the chimeric pro-caspase forms an oligomer in the cells, thereby activating caspase activity of the chimeric pro-caspase, inducing apoptosis in the cells, and reducing the severity of the pathologic condition in the subject.

NTIS

*Cysteine; Protease; Differentiation (Biology); Oligomers; Cells (Biology)*

## 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*.

**20080021426** Ohio State Univ., Columbus, OH, USA; ICF Consulting, Fairfax, VA, USA; ENSCO, Inc., Springfield, VA, USA

**Relative Risk of Workload Transitions in Positive Train Control**

Wreathall, J.; Woods, D. D.; Bing, A. J.; Chrisoffersen, K.; Mar. 31, 2007; 63 pp.; In English

Contract(s)/Grant(s): DTFR53-00-D-00030

Report No.(s): PB2007-112266; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This work proceeded along two parallel paths. First, the research team performed a review and analysis of the fundamental human factors and systems performance issues associated with workload and workmode transitions involving technologies like positive train control (PTC) that can lead to safety and operational problems. These include concerns associated with over-reliance, fixation, skill loss, and shifts in authority between components in the system. Second, the team has examined proposed PTC systems and their intended roles in rail operations to provide an analysis of the risks of the different transitions as they relate to the use of PTC systems in railroading. The opportunities for the high risk failures is greater with PTC systems that provide only an overlay safety function, and are virtually out of sight during normal operations, because the primary risks are associated with the reduction of people's awareness of the system operating state. People tend to rely on protection equipment that is normally functioning and forget when it is inoperative.

NTIS

*Rail Transportation; Risk; Workloads (Psychophysiology); Human Performance; Mental Performance*

**20080021438** Foster-Miller Associates, Inc., Waltham, MA, USA

**Development of a Preliminary Set of Human Factors Functional Design Guidelines for Remote Control Locomotive Systems**

Reinach, S.; Viale, A.; Jul. 2007; 59 pp.; In English

Contract(s)/Grant(s): DTFR53-01-D-00029

Report No.(s): PB2007-112479; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This report summarizes work to develop a set of preliminary human factors functional design guidelines for remote

control locomotive (RCL) systems, in particular the design of the operator control unit (OCU). To carry out the work, researchers first conducted a human factors analysis of existing RCL OCUs to better understand current OCU designs. Analysis looked for instances of 13 different human factors design issues that can induce human error. The research team analyzed four different OCUs. Human factors issues that were found included: 16 instances of inappropriate use of color in displays, 15 instances of poor color choices for critical controls, 12 instances of symmetry issues, 5 adjacency issues, and 1 instance of a critical control that was not protected. Next, researchers identified emerging technologies and capabilities that may be incorporated into next generation RCL systems. Third, human factors standards and guidelines relevant to RCL systems were reviewed. Lastly, a preliminary set of human factors, top-level functional design guidelines are recommended. Researchers identified and organized a total of 51 preliminary human factors functional design guidelines into the following 7 categories: general design, general function, feedback, labels, use of color, visual displays and indicators, and auditory displays and alarms.

NTIS

*Human Factors Engineering; Locomotives; Rail Transportation; Remote Control*

**20080021731** Bureau of Reclamation, Denver, CO USA

**Diving Safe Practices Manual. Underwater Inspection Program**

Harris, R. L.; Nov. 2006; 208 pp.; In English

Report No.(s): PB2007-109622; No Copyright; Avail.: CASI: [A10](#), Hardcopy

The Bureau of Reclamation (Reclamation) conducts a variety of underwater inspection and maintenance programs that include the use of divers. In order to ensure employee safety and regulatory compliance, Reclamation has developed this Diving Safe Practices Manual (DSPM). This manual is intended to be the baseline for diving policy and is designed to address the most common Reclamation diving activities. For operations extending beyond the scope of this manual, additional specific instructions must be prepared and maintained by the dive team performing diving operations, subject to approval of the Regional Diving Advisory Committee (RDAC) and the Reclamation Diving Safety Advisory Board (RDSAB).

NTIS

*Diving (Underwater); Inspection; Policies; Procedures; Reclamation*

**20080021801** Humansystems, Inc., Guelph, Ontario Canada

**SIHS TD Literature Review: Issues in Restorative Hearing**

Morton, Andrew; Apr 2006; 57 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W7711-037880/001/TOR; Proj-12QG01

Report No.(s): AD-A477128; DRDC-TORONTO-CR-2006-222; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477128>

The auditory sense is a significant perceptual component of the dismounted infantry soldier's situation awareness. However, battlefield noise hazards necessitate the use of perceptually isolating hearing protection. This report seeks to review the progress made and key issues identified in developing a system to restore hearing capabilities to the protected listener. The auditory needs of the dismounted infantry soldier are described, followed by a description of the noise hazards encountered by the soldier. The implications of hearing protection and additional issues in restoring hearing are discussed. Scientific studies of restorative hearing systems are then detailed, starting from the simplest passive level-dependent systems and culminating in the most sophisticated transparent hearing systems, using a common protection, detection, localization, and speech intelligibility framework. Conclusions and recommendations for test criteria for future restorative hearing systems are given.

DTIC

*Auditory Perception; Combat; Ear Protectors; Hearing; Optimization; Personnel*

**20080021849** Battelle Memorial Inst., Columbus, OH USA

**Technology Survey for Enhancement of Chemical Biological Radiological and Nuclear Respiratory Protection**

Richardson, Aaron W; Hofacre, Kent C; Gardner, Paul D; Feb 2008; 78 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): SP0700-00-D-3180; Proj-BO07PRO100

Report No.(s): AD-A477685; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477685>

A technology survey was conducted to identify enhancement technologies that offer the most promise for significant advancements in chemical, biological, radiological, and nuclear individual respiratory protection. The focus was on two

enhancement areas: protection and physiology. Novel sealing concepts based on responsive materials were sought that offer potential for performance enhancement. The search for cooling technologies focused on air-management systems (i.e., miniature fans and blowers) and thermoelectric devices. Finally, non-carbon based filtration systems that offer improved protection capabilities were sought.

DTIC

*Air Conditioning Equipment; Augmentation; Radiation Protection; Respirators; Surveys; Technology Assessment*

## 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*.

**20080021263** NASA Langley Research Center, Hampton, VA, USA

#### **Theory of the Lattice Boltzmann Equation: Symmetry properties of Discrete Velocity Sets**

Rubinstein, Robert; Luo, Li-Shi; January 2007; 26 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 599489; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021263>

In the lattice Boltzmann equation, continuous particle velocity space is replaced by a finite dimensional discrete set. The number of linearly independent velocity moments in a lattice Boltzmann model cannot exceed the number of discrete velocities. Thus, finite dimensionality introduces linear dependencies among the moments that do not exist in the exact continuous theory. Given a discrete velocity set, it is important to know to exactly what order moments are free of these dependencies. Elementary group theory is applied to the solution of this problem. It is found that by decomposing the velocity set into subsets that transform among themselves under an appropriate symmetry group, it becomes relatively straightforward to assess the behavior of moments in the theory. The construction of some standard two- and three-dimensional models is reviewed from this viewpoint, and procedures for constructing some new higher dimensional models are suggested.

Author

*Lattices (Mathematics); Boltzmann Transport Equation; Symmetry; Group Theory*

**20080021266** NASA Langley Research Center, Hampton, VA, USA

#### **A Note on Inconsistent Axioms in Rushby's Systematic Formal Verification for Fault-Tolerant Time-Triggered Algorithms**

Pike, Lee; May 2005; 5 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): 23-063-30-RF; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021266>

I describe some inconsistencies in John Rushby's axiomatization of time-triggered algorithms that he presents in these transactions and that he formally specifies and verifies in a mechanical theorem-prover. I also present corrections for these inconsistencies.

Author

*Fault Tolerance; Theorem Proving; Algorithms; Program Verification (Computers)*

**20080021359** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

#### **Multiclass Reduced-Set Support Vector Machines**

Tang, Benyang; Mazzoni, Dominic; July 25, 2006; 8 pp.; In English; 23rd International Conference on Machine Learning, 25-29 Jun. 2006, 23rd International Conference on Machine Learning, USA; Original contains black and white illustrations;

Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40771>

There are well-established methods for reducing the number of support vectors in a trained binary support vector machine, often with minimal impact on accuracy. We show how reduced-set methods can be applied to multiclass SVMs made up of several binary SVMs, with significantly better results than reducing each binary SVM independently. Our approach is based on Burges' approach that constructs each reduced-set vector as the pre-image of a vector in kernel space, but we extend this by recomputing the SVM weights and bias optimally using the original SVM objective function. This leads to greater accuracy for a binary reduced-set SVM, and also allows vectors to be 'shared' between multiple binary SVMs for greater multiclass accuracy with fewer reduced-set vectors. We also propose computing pre-images using differential evolution, which we have

found to be more robust than gradient descent alone. We show experimental results on a variety of problems and find that this new approach is consistently better than previous multiclass reduced-set methods, sometimes with a dramatic difference.

Author

*Vector Spaces; Kernel Functions; Gradients*

**20080021440** College of William and Mary, Williamsburg, VA, USA

**MELISSES Continuous Performance Profiler. DOE/ECPI Award DE-FG02-ER25689. Final Technical Report**

Nikolopoulos, D. S.; Nov. 14, 2006; 2 pp.; In English

Contract(s)/Grant(s): DE-FG02-ER25689

Report No.(s): DE2007-908411; DOE/ER-25689-1; No Copyright; Avail.: Department of Energy Information Bridge

The research conducted until 08/14/06 has led to the implementation of the MELISSES continuous performance profiler. More specifically, we have designed, implemented, robustified and released PACMAN, an implementation of our continuous profiler which provides accurate hardware event counters on a thread-local basis, at sub-microsecond granularity on Intel Hyperthreaded processors. PACMAN has been used to implement a number of performance and power-related optimizations for multithreaded codes running on layered parallel architectures. The first successful demonstration of MELISSES capabilities was a profile-driven parallelization scheme for multithreaded codes, in each parallel regions was parallelized individually using either speculative precomputation with helper threads, or non-speculative thread-level parallelization. Regions that exhibit ample instruction-level parallelism with low memory access rates are parallelized with conventional TLP methods, whereas regions with limited instruction-level parallelism and high memory access rates are not parallelized. They are executed instead with speculative precomputation, which preexecutes long-latency memory accesses. MELISSES assists in locating the critical memory accesses that are responsible for most of memory latency and are offloaded for precomputation on helper threads. Runtime mechanisms and schemes for combining TLP with speculative precomputation via the use of MELISSES were presented in publications.

NTIS

*Multiprocessing (Computers); Computer Storage Devices; Robustness (Mathematics); Optimization*

**20080021444** Lawrence Livermore National Lab., Livermore, CA USA

**Certification of Completion of Item 2 of ASC FY07 Level-2 Milestone ID Number 2380**

Lipari, D. A.; Apr. 03, 2007; 11 pp.; In English

Report No.(s): DE2007-908136; UCRL-TR-229657; No Copyright; Avail.: Department of Energy Information Bridge

This report documents the completion of Item 2 of the three milestone deliverables that comprise Milestone ID Number 2380: Deploy selected Tri-Lab resource manager at LLNL and develop support model. Specifically: LLNL will integrate and support a commercial resource manager software product at LLNL to be used across the tri-lab HPC facilities.

NTIS

*Certification; Computer Programs*

**20080021515** Helsinki Univ., Helsinki, Finland

**Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1**

Martio, Olli, Editor; 2008; ISSN 1239-629X; 326 pp.; In English; See also 20080021516 - 20080021536; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: A Flower Structure of Backward Flow Invariant Domains for Semigroups; The Hessian of the Distance from a Surface in the Heisenberg Group; Mappings of Finite Distortion: Composition Operator; An Application of the Topological Rigidity of the Sine Family; New Characterizations of Bergman Spaces; Lower Schwarz-Pick Estimates and Angular Derivatives; New Bounds for A(infinity) Weights; Fourier Multipliers for L2 Functions with Values in Nonseparable Hilbert Spaces and Operator-Valued H(sup p) Boundary Functions; An Extension Theorem for Supertemperatures; On Planar Beltrami Equations and Hoelder Regularity; Topological Equivalence of Metrics in Teichmueller Space; Superharmonic Functions and Differential Equations Involving Measures for Quasilinear Elliptic Operators with Lower Order Terms; Euclidean Quasiconvexity; Aleksandrov-Clark Measures and Semigroups of Analytic Functions in the Unit Disc; On Boundary Homeomorphisms of Trans-Quasiconformal Maps of the Disk; On Harmonic Quasiconformal Self-Mappings of the Unit Ball; A Note on a Theorem of Chuaqui and Gevirtz; Local Convexity Properties of j-Metric Balls; ACL and Differentiability of Q-Homeomorphisms; Distances from Bloch Functions to Some Moebius Invariant Spaces; and On

Lipschitz Continuity of Harmonic Quasiregular Maps on the Unit Ball in  $\mathbb{R}(\sup n)$ .

Derived from text

*Group Theory; Theorems; Estimates; Differential Equations; Boundaries; Euclidean Geometry; Derivation; Analytic Functions; Equivalence*

**20080021516** Helsinki Univ., Helsinki, Finland

### **An Application of the Topological Rigidity of the Sine Family**

Zhang, Gaofei; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 81-85; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

By using a result of Dominguez and Sienna on the topological rigidity of the Sine family, we give a different proof of a result in [8] which says that, for any bounded type irrational number  $0 < \theta < 1$ , the boundary of the Siegel disk of  $e(\sup 2\pi(i)\theta) \sin(\zeta)$  is a quasi-circle passing through exactly two critical points  $\pi/2$  and  $-\pi/2$ .

Author

*Boundaries; Circles (Geometry); Critical Point*

**20080021517** National Academy of Sciences of the Ukraine, Donetsk, Ukraine

### **ACL and Differentiability of Q-Homeomorphisms**

Salimov, Ruslan; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 295-301; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

It is established that a  $Q$ -homeomorphism in  $\mathbb{R}(\sup n)$ ,  $n$  greater than or equal to 2, is absolute continuous on lines, furthermore, in  $W(1,1/loc)$  and differentiable a.e. whenever  $Q$  always equals  $L(1/loc)$ . This class of  $Q$ -homeomorphisms was first introduced and studied in [MRSY1]-[MRSY3]. The main goal of the theory of  $Q$ -homeomorphisms is to clear up various interconnections between properties of the majorant  $Q(x)$  and the corresponding properties of the mappings themselves. In particular, the problem of the local and boundary behavior of  $Q$ -homeomorphisms has been studied in  $\mathbb{R}^n$  first in the case  $Q \in BMO$  (bounded mean oscillation) in the papers [MRSY1]-[MRSY3] and [RSY1]-[RSY2], and then in the case of  $Q \in FMO$  (finite mean oscillation) and other cases in the papers [IR1]-[IR2], [RS] and [RSY3]-[RSY6].

Author

*Boundaries; Goal Theory; Oscillations; Transformations (Mathematics)*

**20080021518** Belgrade Univ., Serbia; Helsinki Univ., Helsinki, Finland

### **On Lipschitz Continuity of Harmonic Quasiregular Maps on the Unit Ball in $\mathbb{R}(\sup n)$**

Arsenovic, Milos; Kojic, Vesna; Mateljevic, Miodrag; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 315-318; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

We show that Lipschitz continuity of  $\phi: S(\sup n-1)$  approaches  $\mathbb{R}(\sup n)$  implies Lipschitz continuity of its harmonic extension  $u = P[\phi] : B(\sup n)$  approaches  $\mathbb{R}(\sup n)$ , provided  $u$  is a quasiregular map. Our aim is to show that Lipschitz continuity is preserved by harmonic extension, if the extension is quasiregular. The analogous statement is, as noted, true for Holder continuity without assumption of quasiregularity.

Author

*Continuums; Lipschitz Condition; Harmonic Functions; Nonlinearity*

**20080021519** Helsinki Univ., Helsinki, Finland

### **New Characterizations of Bergman Spaces**

Pavlovic, Miroslav; Zhu, Kehe; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 87-99; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

We obtain several new characterizations for the standard weighted Bergman spaces  $A(\sup P\text{-infinity})$ , on the unit ball of  $C(\sup n)$  in terms of the radial derivative, the holomorphic gradient, and the invariant gradient.

Author

*Derivation; Gradients; Boundaries*

**20080021520** Helsinki Univ., Helsinki, Finland

### **A Flower Structure of Backward Flow Invariant Domains for Semigroups**

Elin, Mark; Shoikhet, David; Zalcman, Lawrence; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 3-34; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

In this paper, we study conditions which ensure the existence of backward flow invariant domains for semigroups of



holomorphic self-mappings of a simply connected domain  $D$ . More precisely, the problem is the following. Given a one-parameter semigroup  $\gamma$  on  $D$  find a simply connected subset  $R \subset D$  such that each element of  $\gamma$  is an automorphism of  $R$ , in other words, such that  $\gamma$  forms a one-parameter group on  $R$ . On the way to solving this problem, we prove an angle distortion theorem for starlike and spirallike functions with respect to interior and boundary points. Let  $D$  be a simply connected domain in the complex plane  $C$ . By  $\text{Hol}(D, R)$  we denote the set of all holomorphic functions on  $D$  with values in a domain  $R$  in  $C$ . We write  $\text{Hol}(D)$  for  $\text{Hol}(D, D)$ , the set of holomorphic self-mappings of  $D$ . This set is a topological semigroup with respect to composition. We denote by  $\text{Aut}(D)$  the group of all automorphisms of  $D$ ; thus  $F \in \text{Aut}(D)$  if and only if  $F$  is univalent on  $D$  and  $F(D) = D$ .

Author

*Analytic Functions; Group Theory; Automorphisms; Boundaries; Distortion*

**20080021521** Helsinki Univ., Helsinki, Finland

**On Harmonic Quasiconformal Self-Mappings of the Unit Ball**

Kalaj, David; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 261-271; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

It is proved that any family of harmonic  $K$ -quasiconformal mappings  $\{u = P[f], u(0) = 0\}$  of the unit ball onto itself is a uniformly Lipschitz family providing that  $f$  always equals  $C(\sup 1, \alpha)$ . Moreover, the Lipschitz constant tends to 1 as  $K$  approaches 1.

Author

*Harmonic Functions; Partial Differential Equations; Lipschitz Condition*

**20080021522** Helsinki Univ., Helsinki, Finland

**A Note on a Theorem of Chuaqui and Gevirtz**

Kim, Yong Chan; Sugawa, Toshiyuki; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 273-279; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

For a subdomain  $R$  of the right half-plane  $H$ , Chuaqui and Gevirtz showed the following theorem: the image  $f(D)$  of the unit disk  $D$  under an analytic function  $f$  on  $D$  is a quasidisk whenever  $f'(D) \subset \Omega$  if and only if there exists a compact subset  $K$  of  $H$  such that  $sK \cap (H \setminus \Omega)$  does not equal  $\phi$  for any positive number  $s$ . We show that this condition is equivalent to the inequality  $W(\Omega) < 2$ , where  $W(\Omega)$  stands for the circular width of the domain  $\Omega$ .

Author

*Analytic Functions; Half Planes; Inequalities*

**20080021523** Helsinki Univ., Helsinki, Finland

**An Extension Theorem for Supertemperatures**

Watson, Neil A.; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 131-141; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

We present an analogue for supertemperatures of a well-known extension theorem on superharmonic functions. We call solutions of the heat equation temperatures, and the corresponding supersolutions supertemperatures. See [4] and [5] for details. The purpose of this paper is to present an analogue for supertemperatures of the following superharmonic function extension theorem. Let  $K$  be a compact subset of  $R(\sup n)$  such that  $R(\sup n) \setminus K$  is connected. If  $\mu$  is superharmonic on some open superset of  $K$ , then there exists a superharmonic function  $\mu(\text{prime})$  on  $R(\sup n)$  such that  $\mu(\text{prime}) = \mu$  on a neighbourhood of  $K$ . This result can be found in [I], p. 192. For the case of supertemperatures on open subsets of  $R(\sup n+1)$ , the condition that the complement of  $K$  be connected is still necessary, but is no longer sufficient.

Author

*Analogues; Thermodynamics; High Temperature*

**20080021524** Helsinki Univ., Helsinki, Finland

**Local Convexity Properties of  $j$ -Metric Balls**

Klen, Riku; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 281-293; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

This paper deals with local convexity properties of the  $j$ -metric. We consider convexity and star likeness of the  $j$ -metric balls in convex, star like and general sub domains of  $R(\sup n)$ . The  $j$ -distance was first introduced by Gehring and Palka [GP] in 1976 in a slightly different form and in the above form, by Vuorinen [Vu2] in 1985. The  $j$ -distance is actually a metric and

a proof of the triangle inequality valid for general metric spaces is given in [S]. Previously the  $j$ -metric has been studied in connection with the study of other metrics [GO, H, S, V, Vu21]. See also recent papers [HL, L]. In spite of these studies many basic questions of the  $j$ -metric remain open and some of them will be studied here. The purpose of this paper is to study metric spaces  $(G, j(\text{sub } G))$  and especially local convexity properties of  $j$ -metric balls or in short  $j$ -balls

Author

*Metric Space; Convexity; Inequalities; Proving*

**20080021525** Helsinki Univ., Helsinki, Finland; State Univ. of New York, Brockport, NY, USA

#### **Distances from Bloch Functions to Some Moebius Invariant Spaces**

Zhao, Ruhan; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 303-313; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

Distance formulas from Bloch functions to some Mobius invariant function spaces are given. These results generalize the distance formula from Bloch functions to BMOA by Peter Jones. As consequences, we have characterized the closures of these Mobius invariant function spaces in the Bloch space.

Author

*Closures; Distance; Function Space*

**20080021526** Helsinki Univ., Helsinki, Finland

#### **The Hessian of the Distance from a Surface in the Heisenberg Group**

Arcozzi, Nicola; Ferrari, Fausto; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 35-63; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

Given a smooth surface  $S$  in the Heisenberg group, we compute the Hessian of the function measuring the Carnot-Charatheodory distance from  $S$  in terms of the mean curvature of  $S$  and of an 'imaginary curvature' which was introduced in [2] in order to find the geodesics which are metrically normal to  $S$ . Explicit formulae are given when  $S$  is a plane or the metric sphere.

Author

*Heisenberg Theory; Distance; Geodesic Lines; Spheres*

**20080021527** Helsinki Univ., Helsinki, Finland

#### **Topological Equivalence of Metrics in Teichmueller Space**

Liu, Lixin; Sun, Zongliang; Wei, Hanbai; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 159-170; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

For  $d(\text{sub } \tau)$ ,  $d(\text{sub } L)$  and  $d(\text{sub } p_i)$ ,  $i = 1, 2$ , the Teichmueller metric, the length spectrum metric and the Thurston's pseudo-metrics on Teichmueller space  $\tau(X)$ , we first give some estimations of the above (pseudo)metrics on the thick part of  $\tau(X)$ . Then we show that there exist two sequences  $\{\tau(\text{sub } n)\}_{n=1}^{\infty}$  and  $\{\tau(\text{prime})(\text{sub } n)\}_{n=1}^{\infty}$  in  $\tau(X)$ , such that as  $n$  approaches infinity,  $d(\text{sub } L)(\tau(\text{sub } n), \tau(\text{prime})(\text{sub } n))$  approaches 0,  $d(\text{sub } p_1)(\tau(\text{sub } n), \tau(\text{prime})(\text{sub } n))$  approaches 0,  $d(\text{sub } p_2)(\tau(\text{sub } n), \tau(\text{prime})(\text{sub } n))$  approaches 0, while  $d(\text{sub } \tau)(\tau(\text{sub } n), \tau(\text{prime})(\text{sub } n))$  approaches infinity. As an application, we give a proof that for certain topologically infinite type Riemann surface  $X$ ,  $d(\text{sub } L)$ ,  $d(\text{sub } p_1)$ , and  $d(\text{sub } p_2)$ , are not topologically equivalent to  $d(\text{sub } \tau)$  on  $\tau(X)$ , a result originally proved by Shiga [18]. From this we obtain a necessary condition for the topological equivalence of  $d(\text{sub } \tau)$  to any one of  $d(\text{sub } L)$ ,  $d(\text{sub } p_1)$ , and  $d(\text{sub } p_2)$  on  $\tau(X)$ .

Author

*Metrology; Sequencing; Equivalence; Proving*

**20080021528** Helsinki Univ., Helsinki, Finland

#### **Lower Schwarz-Pick Estimates and Angular Derivatives**

Anderson, J. Milne; Vasil'ev, Alexander; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 101-110; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

The well-known Schwarz-Pick lemma states that any analytic mapping  $\phi$  of the unit disk  $U$  into itself satisfies the inequality This estimate remains the same if we restrict ourselves to univalent mappings. The lower estimate is  $[(\phi)'(z)]$  greater than or equal to 0 generally or  $[(\phi)'(z)]$  greater than 0 for univalent functions. To make the lower estimate nontrivial

we consider univalent functions and fix the angular limit and the angular derivative at some points of the unit circle. In order to obtain sharp estimates we make use of the reduced moduli of digons.

Author

*Estimates; Derivation; Circles (Geometry); Inequalities*

**20080021529** Helsinki Univ., Helsinki, Finland

**Super-harmonic Functions and Differential Equations Involving Measures for Quasilinear Elliptic Operators with Lower Order Terms**

Ono, Takayori; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 171-204; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

We consider super-harmonic functions relative to a quasi-linear second order elliptic differential operator  $L$  with lower order term and weighted structure conditions. We show that, given a nonnegative finite Radon measure  $\nu$ , there is a super-harmonic function  $\mu$  satisfying  $L(\mu) = \nu$  with weak zero boundary values. Moreover, we give a pointwise upper estimate for super-harmonic functions in terms of the Wolff potential.

Author

*Differential Equations; Harmonic Functions; Operators (Mathematics)*

**20080021530** Helsinki Univ., Helsinki, Finland

**Mappings of Finite Distortion: Composition Operator**

Hencl, Stanislav; Koskela, Pekka; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 65-80; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

We give sharp integrability conditions on the distortion function of a homeomorphism  $f$  of finite distortion, under which  $f$  induces a composition operator between two Sobolev spaces.

Author

*Distortion; Domains; Proving; Inequalities; Regularity*

**20080021531** Helsinki Univ., Helsinki, Finland

**Euclidean Quasiconvexity**

Hakobyan, Hrant; Herron, David A.; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 205-230; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

We exhibit compact totally disconnected sets in  $\mathbb{R}^n$ , with Hausdorff dimension  $n-1$ , whose complements fail to be quasiconvex, and similar sets with positive  $n$ -measure whose complements are quasiconvex. We characterize the finitely connected quasiconvex plane domains. We present related results for bounded turning.

Author

*Euclidean Geometry; Domains; Function Space; Inequalities; Metric Space; Curvature*

**20080021532** Helsinki Univ., Helsinki, Finland

**New Bounds for  $A(\text{sub infinity})$  Weights**

Radice, Teresa; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 111-119; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

Two new constants  $G(\text{sub } 1)(\mu)$  and  $A(\text{sub infinity})(\mu)$  are studied for weights  $\mu: \mathbb{R}^n \rightarrow [0, \infty)$ , which are simultaneously finite exactly for  $A(\text{sub infinity})$  weights. The special case  $\mu = h'$ ,  $w = (h(\text{sup } 1))'$  where  $h: \mathbb{R} \rightarrow \mathbb{R}$  is an increasing homeomorphism induces the identity  $A(\text{sub infinity})(w) = G(\text{sub } 1)(\mu)$ . Other identities are established for such constants, when different measures are involved.

Author

*Coordinates; Identities; Cubes (Mathematics); Axes (Reference Lines)*

**20080021533** Helsinki Univ., Helsinki, Finland

**Fourier Multipliers for  $L_2$  Functions with Values in Nonseparable Hilbert Spaces and Operator-Valued  $H(\text{sup } p)$  Boundary Functions**

Mikkola, Kalle M.; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 121-130; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

We extend the standard Fourier multiplier result to square integrable functions with values in (possibly nonseparable)

Hilbert spaces. As a corollary, we extend the standard Hardy class boundary trace result to HP (even Nevanlinna or bounded type) functions whose values are bounded linear operators between Hilbert spaces. Both results have been well-known in the case that the Hilbert spaces are separable. Naturally, the results apply to functions over the unit circle/disc or over the real-line/half-plane or over other similar domains, even multidimensional in the case of the multiplier result. We briefly treat some related results, generalizations to Banach spaces and counter-examples.

Author

*Fourier Analysis; Multipliers; Linear Operators; Banach Space*

**20080021534** Helsinki Univ., Helsinki, Finland

**On Boundary Homeomorphisms of Trans-Quasiconformal Maps of the Disk**

Zakeri, Saeed; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 241-260; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

This paper studies boundary homeomorphisms of trans-quasiconformal maps of the unit disk. Motivated by Beurling-Ahlfors's well-known quasi-symmetry condition, we introduce the 'scalewise' and 'pointwise' distortions of a circle homeomorphism and formulate conditions in terms of each that guarantee the existence of a David extension to the disk. These constructions are also used to obtain extension results for maps with sub-exponentially integrable dilatation as well as BMO-quasiconformal maps of the disk.

Author

*Symmetry; Circles (Geometry); Boundaries; Stretching*

**20080021535** Helsinki Univ., Helsinki, Finland

**Aleksandrov-Clark Measures and Semigroups of Analytic Functions in the Unit Disc**

Bracci, Filippo; Contreras, Manuel D.; Diaz-Madrigal, Santiago; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 231-240; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

In this paper we prove a formula describing the infinitesimal generator of a continuous semigroup  $(\rho)_t$  of holomorphic self-maps of the unit disc with respect to a boundary regular fixed point. The result is based on Aleksandrov-Clark measures techniques. In particular we prove that the Aleksandrov-Clark measure of  $(\rho)_t$  at a boundary regular fixed point is differentiable (in the weak\*-topology) with respect to  $t$ .

Author

*Group Theory; Analytic Functions; Boundaries; Measure and Integration*

**20080021536** Helsinki Univ., Helsinki, Finland

**On Planar Beltrami Equations and Hoelder Regularity**

Ricciardi, Tonia; Annals of the Finnish Academy of Sciences: Mathematics, Volume 33, No. 1; 2008, pp. 143-158; In English; See also [20080021515](#); Copyright; Avail.: Other Sources

We provide estimates for the Hoelder exponent of solutions to the Beltrami equation  $(\Delta)f = \mu(\Delta)f + \nu(\Delta)f$ , where the Beltrami coefficients  $\mu, \nu$  satisfy  $[\mu] + [\nu]_{(\sup \infty)} < 1$  and  $\Delta(\nu) = 0$ . Our estimates depend on the arguments of the Beltrami coefficients as well as on their moduli. Furthermore, we exhibit a class of mappings of the 'angular stretching' type, on which our estimates are actually attained.

Author

*Estimates; Beltrami Flow; Exponents; Coefficients*

**20080021739** Government Accountability Office, Washington, DC, USA

**Information Technology: Treasury Needs to Strengthen Its Investment Board Operations and Oversight**

Jul. 2007; 64 pp.; In English

Report No.(s): PB2007-112063; GAO-07-865; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The Department of the Treasury relies extensively on information technology (IT) to carry out its mission. For fiscal year 2007, Treasury requested about \$2.8 billion--the third largest planned IT expenditure among civilian agencies. GAO's objectives included (1) assessing Treasury's capabilities for managing its IT investments and (2) determining any plans the agency has for improving its capabilities. GAO used its IT investment management framework (ITIM) and associated methodology to address these objectives, focusing on the framework's stages related to the investment management provisions of the Clinger-Cohen Act of 1996. While Treasury has established many of the capabilities needed to select, control, and evaluate its IT investments, the department has significant weaknesses that hamper its ability to effectively manage its

investments. Specifically, the department has executed 19 of the 38 key practices that the ITIM requires to build a foundation for IT investment management (Stage 2), including practices needed to ensure that projects support business needs and that a disciplined process exists for capturing investment information. In addition, the department has executed 11 of the 27 key practices required to manage investments as a portfolio (Stage 3), including documenting policies and procedures for conducting postimplementation reviews. However, Treasury does not have an executive investment review board--a group of executives from IT and business units that is intended to be the final decision-making authority--that is actively engaged in the investment management process. In addition, the department does not have any policies and procedures for managing its nonmajor investments, although they represent almost 70 percent of the total number of investments. Until the department addresses these weaknesses, it will not have the investment management structure needed to effectively assess and manage the risks associated with its multibillion-dollar portfolio.

NTIS

*Information Systems; Decision Making; Commerce; Policies; Procedures*

**20080021765** Lawrence Livermore National Lab., Livermore, CA USA

**LLNL 2006 Computation Directorate Annual Report**

Zosel, M.; Mar. 07, 2007; 64 pp.; In English

Report No.(s): DE2007-909175; UCRL-TR-228768; No Copyright; Avail.: National Technical Information Service (NTIS)

Computation aspires to be the preeminent high-performance computing and computer science organization in order to enable scientific discovery and Laboratory missions. Computation ensures Laboratory mission and program goals are attained by delivering outstanding computer science expertise, world-class high-performance computing capabilities, and creative technology and software solutions.

NTIS

*Computation; Research Projects; Computer Programs*

**20080021789** Government Accountability Office, Washington, DC, USA

**Information Security: Despite Reported Progress, Federal Agencies Need to Address Persistent Weaknesses**

Jul. 2007; 61 pp.; In English

Report No.(s): PB2007-113053; GAO-07-837; No Copyright; Avail.: CASI: A04, Hardcopy

For many years, GAO has reported that weaknesses in information security are a widespread problem with potentially devastating consequences--such as intrusions by malicious users, compromised networks, and the theft of personally identifiable information--and has identified information security as a governmentwide high-risk issue. Concerned by reports of significant vulnerabilities in federal computer systems, Congress passed the Federal Information Security Management Act of 2002 (FISMA), which permanently authorized and strengthened the information security program, evaluation, and reporting requirements for federal agencies. As required by FISMA to report periodically to Congress, in this report GAO discusses the adequacy and effectiveness of agencies' information security policies and practices and agencies' implementation of FISMA requirements. To address these objectives, GAO analyzed agency, inspectors general (IG), Office of Management and Budget (OMB), congressional, and GAO reports on information security.

NTIS

*Information Systems; Security*

**20080022187** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Stochastic Representation of Chaos using Terminal Attractors**

Zak, Michail; Chaos, Solutions and Fractals; May 2005; Volume 24, Issue 3, pp. 863-868; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40811>; <http://dx.doi.org/10.1016/j.chaos.2004.09.098>

A nonlinear version of the Liouville equation based upon terminal attractors is proposed for describing post-instability motions of dynamical systems with exponential divergence of trajectories such as those leading to chaos and turbulence. As a result, the post-instability motions are represented by expectations, variances, and higher moments of the state variables as functions of time. The proposed approach can be applied to conservative chaos, and in particular, to n-bodies problem, as well as to dissipative systems, and in particular, to chaotic attractors and turbulence.

Author

*Chaos; Liouville Equations; Stochastic Processes; Time Functions; Dynamical Systems; Divergence; Dissipation*



**20080022203** NASA Langley Research Center, Hampton, VA, USA

**Proceedings of the Sixth NASA Langley Formal Methods Workshop**

Rozier, Kristin Yvonne, Editor; April 30, 2008; 94 pp.; In English; Sixth NASA Langley Formal Methods Workshop, 30 Apr.-2 May 2008, Newport News, VA, USA; See also 20080022204 - 20080022232; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 645846.02.07.07.07

Report No.(s): NASA/CP-2008-215309; L-19476; Copyright; Avail.: CASI: [A05](#), Hardcopy

Today's verification techniques are hard-pressed to scale with the ever-increasing complexity of safety critical systems. Within the field of aeronautics alone, we find the need for verification of algorithms for separation assurance, air traffic control, auto-pilot, Unmanned Aerial Vehicles (UAVs), adaptive avionics, automated decision authority, and much more. Recent advances in formal methods have made verifying more of these problems realistic. Thus we need to continually re-assess what we can solve now and identify the next barriers to overcome. Only through an exchange of ideas between theoreticians and practitioners from academia to industry can we extend formal methods for the verification of ever more challenging problem domains. This volume contains the extended abstracts of the talks presented at LFM 2008: The Sixth NASA Langley Formal Methods Workshop held on April 30 - May 2, 2008 in Newport News, Virginia, USA. The topics of interest that were listed in the call for abstracts were: advances in formal verification techniques; formal models of distributed computing; planning and scheduling; automated air traffic management; fault tolerance; hybrid systems/hybrid automata; embedded systems; safety critical applications; safety cases; accident/safety analysis.

Author

*Program Verification (Computers); Scheduling; Automata Theory; Fault Tolerance; Air Traffic Control; Accident Investigation; Automatic Control; Avionics; Pilotless Aircraft*

**20080022204** Texas Univ., Dallas, TX, USA

**Verification and Planning Based on Coinductive Logic Programming**

Bansal, Ajay; Min, Richard; Simon, Luke; Mallya, Ajay; Gupta, Gopal; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 9-11; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Coinduction is a powerful technique for reasoning about unfounded sets, unbounded structures, infinite automata, and interactive computations [6]. Where induction corresponds to least fixed point's semantics, coinduction corresponds to greatest fixed point semantics. Recently coinduction has been incorporated into logic programming and an elegant operational semantics developed for it [11, 12]. This operational semantics is the greatest fix point counterpart of SLD resolution (SLD resolution imparts operational semantics to least fix point based computations) and is termed co- SLD resolution. In co-SLD resolution, a predicate goal  $p(t)$  succeeds if it unifies with one of its ancestor calls. In addition, rational infinite terms are allowed as arguments of predicates. Infinite terms are represented as solutions to unification equations and the occurs check is omitted during the unification process. Coinductive Logic Programming (Co-LP) and Co-SLD resolution can be used to elegantly perform model checking and planning. A combined SLD and Co-SLD resolution based LP system forms the common basis for planning, scheduling, verification, model checking, and constraint solving [9, 4]. This is achieved by amalgamating SLD resolution, co-SLD resolution, and constraint logic programming [13] in a single logic programming system. Given that parallelism in logic programs can be implicitly exploited [8], complex, compute-intensive applications (planning, scheduling, model checking, etc.) can be executed in parallel on multi-core machines. Parallel execution can result in speed-ups as well as in larger instances of the problems being solved. In the remainder we elaborate on (i) how planning can be elegantly and efficiently performed under real-time constraints, (ii) how real-time systems can be elegantly and efficiently model- checked, as well as (iii) how hybrid systems can be verified in a combined system with both co-SLD and SLD resolution. Implementations of co-SLD resolution as well as preliminary implementations of the planning and verification applications have been developed [4]. Co-LP and Model Checking: The vast majority of properties that are to be verified can be classified into safety properties and liveness properties. It is well known within model checking that safety properties can be verified by reachability analysis, i.e, if a counter-example to the property exists, it can be finitely determined by enumerating all the reachable states of the Kripke structure.

Author

*Logic Programming; Automata Theory; Real Time Operation; Scheduling; Enumeration*

**20080022205** Michigan State Univ., East Lansing, MI, USA

**Challenges and Demands on Automated Software Revision**

Bonakdarpour, Borzoo; Kulkarni, Sandeep S.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 26-28; In English; See also [20080022203](#); Copyright; Avail.: CASI: A01, Hardcopy

In the past three decades, automated program verification has undoubtedly been one of the most successful contributions of formal methods to software development. However, when verification of a program against a logical specification discovers bugs in the program, manual manipulation of the program is needed in order to repair it. Thus, in the face of existence of numerous unverified and un-certified legacy software in virtually any organization, tools that enable engineers to automatically verify and subsequently fix existing programs are highly desirable. In addition, since requirements of software systems often evolve during the software life cycle, the issue of incomplete specification has become a customary fact in many design and development teams. Thus, automated techniques that revise existing programs according to new specifications are of great assistance to designers, developers, and maintenance engineers. As a result, incorporating program synthesis techniques where an algorithm generates a program, that is correct-by-construction, seems to be a necessity. The notion of manual program repair described above turns out to be even more complex when programs are integrated with large collections of sensors and actuators in hostile physical environments in the so-called cyber-physical systems. When such systems are safety/mission-critical (e.g., in avionics systems), it is essential that the system reacts to physical events such as faults, delays, signals, attacks, etc, so that the system specification is not violated. In fact, since it is impossible to anticipate all possible such physical events at design time, it is highly desirable to have automated techniques that revise programs with respect to newly identified physical events according to the system specification.

Author

*Software Engineering; Program Verification (Computers); Computer Programming; Actuators; Algorithms*

**20080022206** Guelph Univ., Ontario, Canada

**Mise en Scene: A Scenario-Based Medium Supporting Formal Software Development**

Carter, John Douglas; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 66-66; In English; See also [20080022203](#); Copyright; Avail.: Other Sources; Abstract Only

The design and engineering of reliable software systems present many technical and managerial challenges. Software engineers come to the proverbial drawing board with a technical understanding of how systems are created but often have difficulties interfacing with customers to accurately elicit requirements and prioritize stakeholder needs. Project stakeholders are experts in the problem domain of the system under design; however, many times they cannot describe a satisfactory software design (I'll know it when I see it...) or may not be able to identify features lacking in a preliminary design. Scenarios bridge communication between engineers and project stakeholders. Scenarios describe the system in terms of steps its components perform to meet requirements. Scenario-based approaches provide concrete ways for engineers and stakeholders to discuss and reason about the system without premature commitment to a specific implementation. Scenarios are an excellent starting point for describing intended behavior of a system being designed, and when formalized, they can serve as the input to an automated software engineering approach, such as R2D2C, discussed next. The 'Requirements to Design to Code' (R2D2C) project of NASA's Software Engineering Laboratory is based on inferring a formal, provably-correct specification expressed in Communicating Sequential Processes (CSP) from system requirements supplied in the form of CSP traces. From such a CSP specification, software can be automatically synthesized. R2D2C is a multiinstitution, collaborative effort, including contributors from industry, NASA's Goddard Space Flight Center (GSFC), Virginia Tech and the University of Guelph. Mise en Scene contains three components. First, a scenario medium designed to be amenable to conversion to CSP traces, to be represented using Mise en Scene's trace medium (Mise en Scene's second component). The trace medium is designed for conveyance to the inference stage of R2D2C. The third component of Mise en Scene is a process for the automatic translation from scenarios to traces. I present a brief overview of the R2D2C project, the Mise en Scene scenario medium and recent work toward the automatic translation of Mise en Scene scenarios to a CSP specification.

Author

*Computer Programming; Software Engineering; Translating; Systems Engineering; Communicating*

**20080022207** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**On Limits**

Holzmann, Gerard J.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 69-69; In English; See also [20080022203](#); Copyright; Avail.: Other Sources; Abstract Only

In the last 3 decades or so, the size of systems we have been able to verify formally with automated tools has increased dramatically. At each point in this development, we encountered a different set of limits -- many of which we were eventually

able to overcome. Today, we may have reached some limits that may be much harder to conquer. The problem I will discuss is the following: given a hypothetical machine with infinite memory that is seamlessly shared among infinitely many CPUs (or CPU cores), what is the largest problem size that we could solve?

Author

*Computer Programming; Computer Programs; Software Engineering; Size (Dimensions); Length*

**20080022208** SRI International Corp., Menlo Park, CA, USA

**Distributing Formal Verification: The Evidential Tool Bus**

Kirchner, Florent; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 71-73; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

The rising diversity of verification tools proof assistants, model checkers, satisfiability solvers, predicate abstractors, to name a few can be seen as both a testament to the health of formal methods, and as an impediment to their widespread adoption. In particular, in such a rich ecosystem, the process of making an enlightened choice about the best combination of tools for a given verification task can, in itself, be fairly problematic. This choice bears even more weight considering that there is no guarantee that formal developments in a given system can be later ported to other systems. Solutions to this problem often come as adhoc implementations: mainly, translators between proof assistants [9, 14, 15, 5], and integration of solvers, model-checkers, and decision procedures into proof assistants [18, 8]. These approaches all have in common the fact that they are at the same time fragile, because any change in the source or target implementation will break the translation; and expensive to establish and maintain, since they require in-depth expertise of the systems involved. The novel concept of a formal tool bus takes a different approach towards composition and interoperability, by relying on asynchronous message passing between standalone formal verification tools. The tools behave as distributed agents that can either publish a formula they wish to see proved, or answer such a request with some evidence attesting of their success. Agents register the services they provide, as well as the syntax and semantics of their logical language, to a facilitator, that takes care of the lower-level parts of the connection. Since 2007, work has started at SRI International on a formal tool bus called Evidential Tool Bus (etb) [17], basing it on the industrial-strength distributed framework Open Agent Architecture [13], and starting with the connection of the Yices SMT-solver [7], the sal model-checking suite [2], and the pvs proof assistant [16].

Author

*Program Verification (Computers); Ecosystems; Interoperability; Messages; Semantics; Syntax*

**20080022209** Trento Univ., Italy

**From Informal Safety-Critical Requirements to Property-Driven Formal Validation**

Cimatti, Alessandro; Roveri, Marco; Susi, Angelo; Tonetta, Stefano; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 7-8; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Most of the efforts in formal methods have historically been devoted to comparing a design against a set of requirements. The validation of the requirements themselves, however, has often been disregarded, and it can be considered a largely open problem, which poses several challenges. The first challenge is given by the fact that requirements are often written in natural language, and may thus contain a high degree of ambiguity. Despite the progresses in Natural Language Processing techniques, the task of understanding a set of requirements cannot be automatized, and must be carried out by domain experts, who are typically not familiar with formal languages. Furthermore, in order to retain a direct connection with the informal requirements, the formalization cannot follow standard model-based approaches. The second challenge lies in the formal validation of requirements. On one hand, it is not even clear which are the correctness criteria or the high-level properties that the requirements must fulfill. On the other hand, the expressivity of the language used in the formalization may go beyond the theoretical and/or practical capacity of state-of-the-art formal verification. In order to solve these issues, we propose a new methodology that comprises of a chain of steps, each supported by a specific tool. The main steps are the following. First, the informal requirements are split into basic fragments, which are classified into categories, and dependency and generalization relationships among them are identified. Second, the fragments are modeled using a visual language such as UML. The UML diagrams are both syntactically restricted (in order to guarantee a formal semantics), and enriched with a highly controlled natural language (to allow for modeling static and temporal constraints). Third, an automatic formal analysis phase iterates over the modeled requirements, by combining several, complementary techniques: checking consistency; verifying whether the requirements entail some desirable properties; verify whether the requirements are consistent with selected scenarios; diagnosing inconsistencies by identifying inconsistent cores; identifying vacuous requirements; constructing multiple

explanations by enabling the fault-tree analysis related to particular fault models; verifying whether the specification is realizable.

Author

*Automatic Control; Safety; Program Verification (Computers); Natural Language (Computers); Fault Trees; Natural Language Processing*

**20080022210** Ben Gurion Univ. of the Negev, Beersheva, Israel

**Self-\* Programming Run-Time Parallel Control Search for Reflection Box**

Brukman, Olga; Dolev, Shlomi; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 20-22; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

In the early attempts to reach supersonic speeds, flight pilots experienced a strange phenomenon that made their control surfaces useless, and their aircraft uncontrollable. The airplanes were saved by either reducing the speed or changing the usual control procedure. Flying an airplane in a volcano ash cloud may stop the operation of the airplane. The airplane can still be saved if the pilots direct it out of the ash cloud, let the engines cool and then restart them. These two examples demonstrate the type of dramatic control changes that are sometimes required to be made on-line without prior experience, when the environment changes unexpectedly. Today, when a programmer creates a program, he/she designs the program for a certain environment. When the program encounters unanticipated environmental behavior, program performance may degrade drastically, it may continue to execute while producing a faulty (unexpected) output, or it may crash. Programmers and system administrators use their accumulated knowledge of the system and of the environment to investigate and solve problems by patching up the system each time a new problem is detected. In many cases, the solution is post mortem and off-line. Ideally, systems would be autonomous, i.e., the systems would be able to cope with unexpected situations dynamically and independently, without human intervention. In the example of the plane in the volcano ash cloud, imagine that the plane is able to release miniature replicas of itself into the air. Each replica is set to try a different control program. The replicas that manage to successfully get out of the ash cloud report back to the plane. The plane uses the obtained successful control to overcome the problem. This is an example of an autonomic system that is able to deal with unexpected changes in the environment. Our contribution. We assume that an environment is very large, sophisticated and dynamic. We do not make any assumptions on changes the environment may undergo. On-line learning and modeling of the typically unbounded environment automaton for every change is impossible. We choose to learn a control for a plant only, where the plant is part of the environment with which the control interacts. A plant can be either a black box or an rs-box (reflection and set box). In case of a black box plant, only the plant inputs and output are observable. Otherwise, when the plant is a rs-box plant we are able to observe the plant state and/or set the plant to a certain state.

Author

*Control Surfaces; Supersonic Speed; On-Line Systems; Electronic Equipment; Autonomy*

**20080022211** Guelph Univ., Ontario, Canada

**Getting Somewhat Formal with CSP and C++**

Gardner, William B.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 23-25; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Concurrent systems present special design challenges due to their complex interactions, both with their environment, and internally in terms of synchronization and communication among their constituent processes. This is the case whether they are single-host systems, distributed systems, or embedded systems with hardware and software components. Formal methods have been advocated as a way to verify system properties at the design stage, but industry practitioners have not been eager to adopt abstruse mathematical notations, uncommon programming languages, or additional costly engineering process steps. Thus concurrent systems often continue to be designed and tested on an ad hoc basis. There is a spectrum of formality in system development that ranges from (1) largely ad hoc vs. (2) mature, repeatable development processes at the minimal end, through (3) the use of formal specifications vs. (4) full formal development processes at the maximal end, with correspondingly greater development costs moving along the spectrum. The goal of our approach is to occupy ground between points (3) and (4): utilizing verifiable formal specifications written in CSP (Communicating Sequential Processes) for selected portions of a system-particularly the control backbone where interprocess synchronization and communication take place-and proceeding to an implementation via automated software synthesis instead of via hand translation. Modules to perform computation and I/O may be written in ordinary C++ and linked to the control backbone through CSP events and channels. This approach, based on the tool called CSP++, is described in [3] as a method of bridging the typically separate worlds of formal methods and conventional programming. Advantages of this approach, compared to hand implementation of formal specifications, include code that embodies the specification's verified properties; and, compared to full formal development, reduced cost and



development time due to less reliance on formal methods ‘gurus,’ and a role for widely-available C++ programmers.

Author

*C++ (Programming Language); Mathematical Programming; Computer Programs; Communicating; Synchronism; Programming Languages; Modules*

**20080022212** SRI International Corp., Menlo Park, CA, USA

### **An Update on Yices**

Dutertre, Bruno; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 70-70; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Recent breakthroughs in Boolean satisfiability solving have enabled new approaches to software and hardware verification. Existing SAT solvers can handle problems with millions of clauses and variables that are encountered in bounded model checking, test-case generation, and certain types of planning problems. SAT solving has thus become a major tool in automated analysis of hardware and other finite systems. Satisfiability modulo theories (SMT) generalizes SAT by adding equality reasoning, arithmetic, and other useful first-order theories. An SMT solver is a tool for deciding the satisfiability (or dually the validity) of formulas in these theories. SMT solvers enable bounded model checking of infinite systems. They have applications in theorem proving, software verification and other domains such as scheduling, temporal or metric planning, and test-case generation. Yices is an SMT solver developed at SRI International. It is capable of handling large and propositionally complex formulas in a rich combination of theories. Yices formulas can mix uninterpreted functions, linear real and integer arithmetic, bit vectors, scalar and recursive data types, and quantifiers. An important application of Yices is as a back-end solver for the SAL system. In this role, Yices supports verification of finite or infinite state-transition systems using bounded-model checking techniques. Yices is also integrated with the PVS interactive theorem prover, where it complements the existing PVS decision procedures. Other application areas include static analysis of software and software testing. We give an overview of the architecture and algorithms employed by the new Yices 2 solver planned to be released this year. We describe the logic supported by Yices 2, and the new functionality Yices 2 provides through an improved API.

Author

*Program Verification (Computers); Applications Programs (Computers); Boolean Algebra; Computer Programs; Theorem Proving; Algorithms*

**20080022213** NASA, Washington, DC, USA

### **The Nation’s Needs in Aviation Formal Methods**

Pritchett, Amy R.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 36-36; In English; See also [20080022203](#); Copyright; Avail.: Other Sources; Abstract Only

Aviation, both on-board systems and the National Airspace System, can be transformed by many current and future technical capabilities. To name but a few, improved efficiency may be achieved by integrating functions; robustness may be improved by distributing functions; and safety may be improved by building in risk mitigation through not only redundant, independent systems but also through operational concepts and effective interaction with human operators. This talk will review the key aspects of verification, validation and certification for which formal methods will provide a critical function in enabling truly revolutionary designs to enter the operational community, illustrating successes in formal modeling to date and posing further questions for the formal modeling community.

Author

*National Airspace System; Certification; Robustness (Mathematics)*

**20080022214** Northeastern Univ., Boston, MA, USA

### **Automating System Assembly of Aerospace Systems**

Manolios, Panagiotis; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 55-55; In English; See also [20080022203](#); Copyright; Avail.: Other Sources; Abstract Only

One of the major challenges in modern aerospace designs is the integration and assembly of independently developed components. We have formalized this as the system assembly problem: from a sea of available components, which should be selected and how should they be connected, integrated, and assembled so that the overall system requirements are satisfied in a certifiable way? We present a powerful framework for automatically solving the system assembly problem directly from system requirements by using formal verification technology. We also present a case study where we applied our work to large-scale industrial examples from the Boeing Dreamliner.

Author

*Systems Engineering; Computer Systems Design; Modularity; Computer Programs; Architecture (Computers)*



**20080022215** New Mexico Univ., Albuquerque, NM, USA

**Safe Upper-Bounds Inference of Energy Consumption for Java Bytecode Applications**

Navas, Jorge; Mendez-Lojo, Mario; Hermenegildo, Manuel V.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 29-32; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Many space applications such as sensor networks, on-board satellite-based platforms, on-board vehicle monitoring systems, etc. handle large amounts of data and analysis of such data is often critical for the scientific mission. Transmitting such large amounts of data to the remote control station for analysis is usually too expensive for time-critical applications. Instead, modern space applications are increasingly relying on autonomous on-board data analysis. All these applications face many resource constraints. A key requirement is to minimize energy consumption. Several approaches have been developed for estimating the energy consumption of such applications (e.g. [3, 1]) based on measuring actual consumption at run-time for large sets of random inputs. However, this approach has the limitation that it is in general not possible to cover all possible inputs. Using formal techniques offers the potential for inferring safe energy consumption bounds, thus being specially interesting for space exploration and safety-critical systems. We have proposed and implemented a general framework for resource usage analysis of Java bytecode [2]. The user defines a set of resource(s) of interest to be tracked and some annotations that describe the cost of some elementary elements of the program for those resources. These values can be constants or, more generally, functions of the input data sizes. The analysis then statically derives an upper bound on the amount of those resources that the program as a whole will consume or provide, also as functions of the input data sizes. This article develops a novel application of the analysis of [2] to inferring safe upper bounds on the energy consumption of Java bytecode applications. We first use a resource model that describes the cost of each bytecode instruction in terms of the joules it consumes. With this resource model, we then generate energy consumption cost relations, which are then used to infer safe upper bounds. How energy consumption for each bytecode instruction is measured is beyond the scope of this paper. Instead, this paper is about how to infer safe energy consumption estimations assuming that those energy consumption costs are provided. For concreteness, we use a simplified version of an existing resource model [1] in which an energy consumption cost for individual Java opcodes is defined.

Author

*Applications Programs (Computers); Data Transmission; Time Dependence; Java (Programming Language); Estimating; Autonomy*

**20080022216** Saarland Univ., Saarbruecken, Germany

**Formal Verification of Gate-Level Computer Systems**

Tverdyshev, Sergey; Shadrin, Andrey; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 56-58; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Modern computer systems are used in many safety-critical applications. In order to guarantee an error-free behavior of such a system one often employs formal methods, e.g. model checking, and theorem proving. However, most of the times formal methods are only applied to stand-alone components or to abstract models. Thus, a pervasive correctness of computer systems, with all their details, can not be guaranteed. In the Verisoft project we show that it is possible to build and to verify a computer system, which consists of a hardware platform with devices, a compiler for a C-like language, a microkernel, an operating system, and user applications. The goal is to verify these components and to guarantee formally that they can be combined into one computer system stack. In this paper, we present the verification of a complex gate-level computer system. This hardware is formally verified against an assembly-level model, i.e. a model as seen by an assembly programmer.

Derived from text

*Program Verification (Computers); Computer Systems Design; Computer Systems Performance; Software Engineering; Logical Elements*

**20080022217** Office National d'Etudes et de Recherches Aeronautiques, Toulouse, France

**Aeronautical Regulations Should Be Rigorously Developed Too!**

Ruiz, Eduardo R. Lopez; Ledru, Yves; Lemoine, Michel; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 41-43; In English; See also [20080022203](#); Original contains color illustrations; Copyright; Avail.:

CASI: [A01](#), Hardcopy

We propose the use of formal techniques, complementary to semi-formal models, to improve the contemporary rulemaking process that is used to develop aeronautical safety and security regulations. The two main contributions of this

approach are: (1) the use of rigorous methods and tools to help improve the regulation s validation process, and (2) the capacity to help identify the impact of proposed amendments on enacting regulation (while helping mitigate regressions).

Author

*Aircraft Safety; Regulations; Flight Safety; Proving; Security*

**20080022218** Mitre Corp., McLean, VA, USA

### **An Overview of Starfish: A Table-Centric Tool for Interactive Synthesis**

Tsow, Alex; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 76-78; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Engineering is an interactive process that requires intelligent interaction at many levels. My thesis [1] advances an engineering discipline for high-level synthesis and architectural decomposition that integrates perspicuous representation, designer interaction, and mathematical rigor. Starfish, the software prototype for the design method, implements a table-centric transformation system for reorganizing control-dominated system expressions into high-level architectures. Based on the digital design derivation (DDD) system a designer-guided synthesis technique that applies correctness preserving transformations to synchronous data flow specifications expressed as co- recursive stream equations Starfish enhances user interaction and extends the reachable design space by incorporating four innovations: behavior tables, serialization tables, data refinement, and operator retiming. Behavior tables express systems of co-recursive stream equations as a table of guarded signal updates. Developers and users of the DDD system used manually constructed behavior tables to help them decide which transformations to apply and how to specify them. These design exercises produced several formally constructed hardware implementations: the FM9001 microprocessor, an SECD machine for evaluating LISP, and the SchemEngine, garbage collected machine for interpreting a byte-code representation of compiled Scheme programs. Bose and Tuna, two of DDD s developers, have subsequently commercialized the design derivation methodology at Derivation Systems, Inc. (DSI). DSI has formally derived and validated PCI bus interfaces and a Java byte-code processor; they further executed a contract to prototype SPIDER-NASA's ultra-reliable communications bus. To date, most derivations from DDD and DRS have targeted hardware due to its synchronous design paradigm. However, Starfish expressions are independent of the synchronization mechanism; there is no commitment to hardware or globally broadcast clocks. Though software back-ends for design derivation are limited to the DDD stream-interpreter, targeting synchronous or real-time software is not substantively different from targeting hardware.

Author

*Broadcasting; Computer Programs; Information Flow; Software Engineering; Synchronism; Java (Programming Language); LISP (Programming Language); Digital Systems*

**20080022219** Carnegie-Mellon Univ., Pittsburgh, PA, USA

### **Combining Predicate and Numeric Abstraction for Software Model Checking**

Gurfinkel, Arie; Chaki, Sagar; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 47-49; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Predicate abstraction [6] (PA) and Abstract Interpretation [4] (AI) with numeric abstract domains, called Numeric abstraction (NA), are two mainstream techniques for automatic program verification. Although it is sometimes assumed that the difference between the two is that of precision versus efficiency, experience of projects based on PA (such as SLAM [1]) and those based on NA (such as ASTREE [3]) indicate that both techniques can balance efficiency and precision when applied to problems in a particular domain. However, the two techniques have complimentary strengths and weaknesses. Predicate abstraction reduces program verification to propositional reasoning via an automated decision procedure, and then uses a model checker for analysis. This makes PA well-suited for verifying programs and properties that are control driven and (mostly) data-independent. An example of such a program is the code fragment in Fig. 1(a). However, in the worst case, reduction to propositional reasoning is exponential in the number of predicates. Hence, PA is not as effective for data-driven and (mostly) control-independent programs and properties, such as the code fragment shown in Fig. 1(b) In summary, PA works best for propositional reasoning, and performs poorly for arithmetic. On the other hand, Numeric abstraction restricts all reasoning to conjunction of linear constraints. For instance, NA with Intervals is limited to conjunctions of inequalities of the form  $c1 \text{ less than or equal to } x \text{ less than or equal to } c2$ , where  $x$  is a variable and  $c1$ , and  $c2$  are constants. Instead of relying on a general-purpose decision procedure, NA leverages a special data structure - Numeric Abstract Domain. The data structure is designed to represent and manipulate sets of numeric constraints efficiently; and provides algorithms to encode statements as transformers of numeric constraints. Thus, in contrast to PA, NA is appropriate for verifying properties that are (mostly) control-independent, but require arithmetic reasoning. One example of such a program is the code fragment in Fig. 1(b). On the flip side, NA performs poorly when propositional reasoning (i.e., precisely representing disjunctions and negations) is

required. For example, the code fragment in Fig. 1(a) is hard for NA. In practice, precise, efficient, and scalable program analysis requires the strengths of both predicate and numeric abstraction. Consider the problem of verifying the code fragment in Fig. 1(c). In this case, propositional reasoning is needed to distinguish between different program paths, and arithmetic reasoning is needed to efficiently compute strong enough invariant to discharge the assertion.

Author

*Data Structures; Program Verification (Computers); Precision; Algorithms; Domains*

**20080022220** EDaptive Computing, Inc., Dayton, OH, USA

### **Use of Intelligent Assistants in Practical Theorem Proving**

Barton, David L.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 44-46; In English; See also [20080022203](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

At present, the greatest barrier to the full scale adoption of theorem proving in industrial practice is its intractability to the average engineering user. Model checking can be taught, or at least hidden, by fairly understandable tools. Theorem proving is another matter; intensive and time consuming training is needed before the average user can approach the use of theorem proving tools. Worse, what might be termed the style of thinking of models that are useful for theorem proving is fundamentally different from models useful in most engineering disciplines. This requires either extensive translation or a different approach to most engineering problems, a different approach that has the effect of divorcing the verification engineer from the development engineer. Such a separation is never desirable. By far the most common tool used by engineers today is MATLAB, and its graphical interface Simulink. Theorem provers that can work with MATLAB and Simulink would be most desirable; however, MATLAB and Simulink are designed for simulation and mathematical execution in ways that are fundamentally different from the kinds of manipulation required by, say, PVS. What is needed is a means of moving problems from the engineering space into the theorem proving space, proving properties of interest, and taking not only the fact of the proof, but information from the proof back into the engineering space so that it can be used appropriately. The mathematics of theorem proving and logic are such that this problem is impossible to automate generally (or if not impossible, then beyond current technology). However, for a narrow class of similar problems, automation can be provided by the use of proof assistants that consist of lemmas, proof strategies, and a friendly graphical interface. The production of these lemmas, strategies, and interfaces (hereafter grouped together and called ‘assistants’ or ‘the assistant’) is complex; the use of the assistant is simple, and brings theorem proving within that narrow range of problems into the grasp of working engineers. Figure 1 represents the entire process of shifting from the engineering space to the theorem proving space, using the theorem proving, and shifting back. A MATLAB / Simulink representation is translated into an internal representation which allows both graphical access (using Syscape™, a proprietary tool to EDaptive Computing, Inc.) and theorem proving via PVS. The automated assistance is provided via a series of PVS lemmas and proof strategies which have been provided in the field of control law development; in fact, a subset of control laws which were of interest to the customer in this case and the project, the Automated Aerial Refueling project. Access to the lemmas and strategies was given via Syscape™, which has extensive customization capabilities as seen in step 4. This allows the engineer to operate the theorem prover as a tool from the Syscape™ interface with a limited set of choices. If these choices fail, the engineer’s recourse is to a consultant or theorem proving expert.

Author

*Theorem Proving; Computer Programs; Theorems; Education; Control Theory; Proving*

**20080022221** Rice Univ., Houston, TX, USA

### **From Philosophical to Industrial Logics**

Vardi, Moshe Y.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 6-6; In English; See also [20080022203](#); Copyright; Avail.: Other Sources; Abstract Only

One of the surprising developments in the area of program verification is how several ideas introduced by logicians in the first part of the 20th century ended up yielding at the start of the 21st century industry-standard property-specification languages called PSL and SVA. This development was enabled by the equally unlikely transformation of the mathematical machinery of automata on infinite words, introduced in the early 1960s for second-order arithmetics, into effective algorithms for industrial model-checking tools. This talk attempts to trace the tangled threads of this development.

Author

*Program Verification (Computers); Automata Theory; Algorithms; Specifications*

**2008002222** Wyoming Univ., Laramie, WY, USA

**Toward a Formal Evaluation of Refactorings**

Paul, John; Kuzmina, Nadya; Gamboa, Ruben; Caldwell, James; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 33-35; In English; See also [20080022203](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Refactoring is a software development strategy that characteristically alters the syntactic structure of a program without changing its external behavior [2]. In this talk we present a methodology for extracting formal models from programs in order to evaluate how incremental refactorings affect the verifiability of their structural specifications. We envision that this same technique may be applicable to other types of properties such as those that concern the design and maintenance of safety-critical systems.

Author

*Software Engineering; Computer Programming; Proving*

**2008002223** Galois Connection, Inc., Beaverton, OR, USA

**Model Checking for the Practical Verificationist: A User's Perspective on SAL**

Pike, Lee; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 74-75; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

SRI's Symbolic Analysis Laboratory (SAL) is bad news for interactive mechanical theorem provers. SAL is so automated yet expressive that for many of the verification endeavors I might have previously used a mechanical theorem prover, I would now use SAL. The purpose of this brief report is to persuade you to do the same. To convince the reader, I highlight SAL's features that are especially useful or novel from a practitioner's perspective. With my coauthors, I have had the opportunity to use SAL in a number of applied verifications [1, 2, 3, 5, 6, 7]. These works draw from the domains of distributed systems, fault-tolerant protocols, and asynchronous hardware protocols (the most notable omission is the domain of software, although the techniques reported are not domain-specific). Specifically, in this talk, I will cover using higher-order functions in model-checking, how to use infinite-state bounded model checking (inf-bmc) to verify real-time systems, synchronous and asynchronous composition for inf-bmc, and integrating model checking in industrial projects.

Author

*Protocol (Computers); Real Time Operation; Synchronism; Theorems; Bone Mineral Content; Fault Tolerance*

**2008002224** Qualtech Systems, Inc., Wethersfield, CT, USA

**Monitoring IVHM Systems Using a Monitor-Oriented Programming Framework**

Ghoshal, Sudipto; Manimaran, Solaiappan; Rosu, Grigore; Serbanuta, Traian Florin; Stefanescu, Gheorghe; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 17-19; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

We describe a runtime verification approach to increase the safety of IVHM systems by an integration of TEAMS models and MOP (Monitor-Oriented Programming). The TEAMS model is used to automatically extract relevant runtime information from the controlled system by means of events. This information is passed on-line to the MOP engine, allowing to verify complex temporal properties and to discover running patterns which are of interest in detecting and preventing faulty behaviors.

Author

*Information Systems; On-Line Systems; Detection*

**2008002225** SRI International Corp., Menlo Park, CA, USA

**Formal Methods and Certification**

Rushby, John; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 39-39; In English; See also [20080022203](#); Copyright; Avail.: Other Sources; Abstract Only

The great strength of formal methods is that they allow consideration of all possible behaviors, and this could be of immense value in certification. However, automated formal analysis of large and complex artifacts is computationally infeasible, so compromises have to be made. These include use of interactive human guidance rather than full automation, analysis of models and abstractions rather than the real artifact, and analysis of weak properties (e.g., by static analysis) rather than full requirements. I will consider how these and other practical limitations affect the potential role of formal methods in



certification. I will also outline weaknesses in current standards- based approaches to certification and sketch how multi-legged safety cases might provide a way to incorporate formal methods into certification processes.

Author

*Certification; Methodology; Procedures; Proving*

**20080022226** NASA Langley Research Center, Hampton, VA, USA

**NASA Langley's Formal Methods Research in Support of the Next Generation Air Transportation System**

Butler, Ricky W.; Munoz, Cesar A.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 3-5; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

This talk will provide a brief introduction to the formal methods developed at NASA Langley and the National Institute for Aerospace (NIA) for air traffic management applications. NASA Langley's formal methods research supports the Interagency Joint Planning and Development Office (JPDO) effort to define and develop the 2025 Next Generation Air Transportation System (NGATS). The JPDO was created by the passage of the Vision 100 Century of Aviation Reauthorization Act in Dec 2003. The NGATS vision calls for a major transformation of the nation's air transportation system that will enable growth to 3 times the traffic of the current system. The transformation will require an unprecedented level of safety-critical automation used in complex procedural operations based on 4-dimensional (4D) trajectories that enable dynamic reconfiguration of airspace scalable to geographic and temporal demand. The goal of our formal methods research is to provide verification methods that can be used to insure the safety of the NGATS system. Our work has focused on the safety assessment of concepts of operation and fundamental algorithms for conflict detection and resolution (CD&R) and self-spacing in the terminal area. Formal analysis of a concept of operations is a novel area of application of formal methods. Here one must establish that a system concept involving aircraft, pilots, and ground resources is safe. The formal analysis of algorithms is a more traditional endeavor. However, the formal analysis of ATM algorithms involves reasoning about the interaction of algorithmic logic and aircraft trajectories defined over an airspace. These trajectories are described using 2D and 3D vectors and are often constrained by trigonometric relations. Thus, in many cases it has been necessary to unload the full power of an advanced theorem prover. The verification challenge is to establish that the safety-critical algorithms produce valid solutions that are guaranteed to maintain separation under all possible scenarios. Current research has assumed perfect knowledge of the location of other aircraft in the vicinity so absolute guarantees are possible, but increasingly we are relaxing the assumptions to allow incomplete, inaccurate, and/or faulty information from communication sources.

Author

*Air Traffic Control; Air Transportation; Trigonometric Functions; Information Theory; Algorithms; Theorems; Proving*

**20080022227** Georgia Inst. of Tech., Atlanta, GA, USA

**A Framework for Stability Analysis of Control Systems Software at the Source Code Level**

Alegre, Fernando; Feron, Eric; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 65-65; In English; See also [20080022203](#); Copyright; Avail.: Other Sources; Abstract Only

In this paper, we show how to apply the Floyd-Hoare formalism to analyze C programs implementing feedback control systems. In particular, we show that the well-known Lyapunov, non-expansivity and passivity theories can not only be applied at the specification level but also carried over to the implementation level. We demonstrate how some of those properties, such as bounded input bounded state stability, can be embedded as pre- and post-conditions of each statement in the source code and illustrate how to use this methodology in linear controllers, either subject to bounded input or to parametric uncertainties, and also in controllers with sector-bounded non-linearities. We also explain how an automatic static analyzer can propagate invariants and produce a proof of stability at the source code level. This proof, basically in the form of a Matlab program, could be independently validated. Therefore, proof generation and proof validation can be performed independently and without the need to trust each other. Similarities and differences of our framework with proof-carrying-code frameworks are also discussed.

Author

*Proving; Stability; Systems Engineering; Computer Programming; Feedback; Source Programs*

**20080022228** Minnesota Univ., Austin, MN, USA; L-3 Communications Corp, Reston, VA, USA

**Assessing Requirements Quality through Requirements Coverage**

Rajan, Ajitha; Heimdahl, Mats; Woodham, Kurt; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 12-14; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

In model-based development, the development effort is centered around a formal description of the proposed software



system the model. This model is derived from some high-level requirements describing the expected behavior of the software. For validation and verification purposes, this model can then be subjected to various types of analysis, for example, completeness and consistency analysis [6], model checking [3], theorem proving [1], and test-case generation [4, 7]. This development paradigm is making rapid inroads in certain industries, e.g., automotive, avionics, space applications, and medical technology. This shift towards model-based development naturally leads to changes in the verification and validation (V&V) process. The model validation problem determining that the model accurately captures the customer's high-level requirements has received little attention and the sufficiency of the validation activities has been largely determined through ad-hoc methods. Since the model serves as the central artifact, its correctness with respect to the users needs is absolutely crucial. In our investigation, we attempt to answer the following two questions with respect to validation (1) Are the requirements sufficiently defined for the system? and (2) How well does the model implement the behaviors specified by the requirements? The second question can be addressed using formal verification. Nevertheless, the size and complexity of many industrial systems make formal verification infeasible even if we have a formal model and formalized requirements. Thus, presently, there is no objective way of answering these two questions. To this end, we propose an approach based on testing that, when given a set of formal requirements, explores the relationship between requirements-based structural test-adequacy coverage and model-based structural test-adequacy coverage. The proposed technique uses requirements coverage metrics defined in [9] on formal high-level software requirements and existing model coverage metrics such as the Modified Condition and Decision Coverage (MC/DC) used when testing highly critical software in the avionics industry [8]. Our work is related to Chockler et al. [2], but we base our work on traditional testing techniques as opposed to verification techniques.

Author

*Biotechnology; Program Verification (Computers); Proving; Theorem Proving; Avionics*

**20080022229** Mitre Corp., Hampton, VA, USA

#### **Reuse versus Reinvention: How Will Formal Methods Deal with Composable Systems?**

Malloy, Mary Ann; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 53-54; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

This talk will survey current efforts to establish models and principles for supporting the composable system lifecycle in systematic -- rather than ad hoc -- ways, with a particular focus on developments in the field of testing composable systems / applications. Relevant questions to be addressed include: How are we coping when building a whole with parts that make incompatible assumptions about their mutual interactions? What kinds of checking and analysis can we support? What does reliability mean for a solution that will continuously evolve vice being developed, tested, configured and launched? Pointers will be provided to educational materials as well as proof-of-concept notations, models and tools available for further experimentation on the World Wide Web.

Derived from text

*Software Reuse; Computer Programming; Software Development Tools; Software Engineering; Software Reliability; Systems Engineering*

**20080022230** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

#### **Proving Correctness for Pointer Programs in a Verifying Compiler**

Kulczycki, Gregory; Singh, Amrinder; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 59-61; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

This research describes a component-based approach to proving the correctness of programs involving pointer behavior. The approach supports modular reasoning and is designed to be used within the larger context of a verifying compiler. The approach consists of two parts. When a system component requires the direct manipulation of pointer operations in its implementation, we implement it using a built-in component specifically designed to capture the functional and performance behavior of pointers. When a system component requires pointer behavior via a linked data structure, we ensure that the complexities of the pointer operations are encapsulated within the data structure and are hidden to the client component. In this way, programs that rely on pointers can be verified modularly, without requiring special rules for pointers. The ultimate objective of a verifying compiler is to prove-with as little human intervention as possible-that proposed program code is correct with respect to a full behavioral specification. Full verification for software is especially important for an agency like NASA that is routinely involved in the development of mission critical systems.

Derived from text

*Program Verification (Computers); Systems Engineering; System Effectiveness; Software Reliability; Systems Analysis; Modularity*

**20080022231** NASA Ames Research Center, Moffett Field, CA, USA

### **Certifying Auto-Generated Flight Code**

Denney, Ewen; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 40-40; In English; See also [20080022203](#); Copyright; Avail.: Other Sources; Abstract Only

Model-based design and automated code generation are being used increasingly at NASA. Many NASA projects now use MathWorks Simulink and Real-Time Workshop for at least some of their modeling and code development. However, there are substantial obstacles to more widespread adoption of code generators in safety-critical domains. Since code generators are typically not qualified, there is no guarantee that their output is correct, and consequently the generated code still needs to be fully tested and certified. Moreover, the regeneration of code can require complete recertification, which offsets many of the advantages of using a generator. Indeed, manual review of autocode can be more challenging than for hand-written code. Since the direct V&V of code generators is too laborious and complicated due to their complex (and often proprietary) nature, we have developed a generator plug-in to support the certification of the auto-generated code. Specifically, the AutoCert tool supports certification by formally verifying that the generated code is free of different safety violations, by constructing an independently verifiable certificate, and by explaining its analysis in a textual form suitable for code reviews. The generated documentation also contains substantial tracing information, allowing users to trace between model, code, documentation, and V&V artifacts. This enables missions to obtain assurance about the safety and reliability of the code without excessive manual V&V effort and, as a consequence, eases the acceptance of code generators in safety-critical contexts. The generation of explicit certificates and textual reports is particularly well-suited to supporting independent V&V. The primary contribution of this approach is the combination of human-friendly documentation with formal analysis. The key technical idea is to exploit the idiomatic nature of auto-generated code in order to automatically infer logical annotations. The annotation inference algorithm itself is generic, and parametrized with respect to a library of coding patterns that depend on the safety policies and the code generator. The patterns characterize the notions of definitions and uses that are specific to the given safety property. For example, for initialization safety, definitions correspond to variable initializations while uses are statements which read a variable, whereas for array bounds safety, definitions are the array declarations, while uses are statements which access an array variable. The inferred annotations are thus highly dependent on the actual program and the properties being proven. The annotations, themselves, need not be trusted, but are crucial to obtain the automatic formal verification of the safety properties without requiring access to the internals of the code generator. The approach has been applied to both in-house and commercial code generators, but is independent of the particular generator used. It is currently being adapted to flight code generated using MathWorks Real-Time Workshop, an automatic code generator that translates from Simulink/Stateflow models into embedded C code.

Author

*Certification; Program Verification (Computers); Real Time Operation; Embedding; Domains; Coding; Reliability; Algorithms*

**20080022232** Virginia Univ., Charlottesville, VA, USA

### **Formal Modeling of Erroneous Human Behavior and its Implications for Model Checking**

Bolton, Matthew L.; Bass, Ellen J.; Proceedings of the Sixth NASA Langley Formal Methods Workshop; April 30, 2008, pp. 62-64; In English; See also [20080022203](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Modern, safety-critical systems are inherently complex as multiple interacting subsystems and people (operators, maintenance crews, etc.) attempt to achieve multiple, often conflicting, goals. While the majority of the sub-systems (including the human-machine interfaces to control them) are well engineered, system failures still occur: airplane crashes, air-traffic conflicts, power plant failures, defense system false alarms, etc. [1]. Such failures are often due not to the breakdown of a single component, but to a series of minor events that occur at separate times, ultimately leading to dangerous outcomes. Further, more of the pre-cursor events that lead to such outcomes are the result of human error (the error resulting from the interaction between human operators and the system) rather than equipment or component failure [2]. Formal methods, and particularly model checking, have proven useful in detecting design errors that produce system failure in computer hardware and software systems. A number of techniques also exist for modeling human behavior using formal computational structure such as Goals, Operators, Methods, and Selection rules (GOMS) [4], ConcurTaskTrees (CTT) [5], and the Operator Function Model (OFM) [6]. In addition, efforts have also been made to classify human error based on its formal characteristics. While there are a number of reasons why humans may perform an erroneous act (a sequence of activities that do not produce the intended result during human-system interaction), there are very limited formal characteristics for the way that errors can manifest themselves [2]. To address this, Hollnagel [7] classified human error based on a hierarchy of phenotypes, the formal characteristics of observable erroneous behavior. Hollnagel showed that all human errors were composed of one or more of the following errors (all observable for a single act): premature start of an action, delayed start of an action, premature finishing

of an action, delayed finishing of an action, omitting an action, skipping an action, reperforming a previously performed action, repeating an action, and performing an unplanned action (an intrusion). A variety of work has investigated the use of formal system and human behavior models in order to predict and model human error (an overview can be found in [3]). However, the majority of this work has focused on discovering mode confusion and automation surprise (preconditions for a subset of human errors), or have relied on human factors experts to incorporate erroneous behavior into human-behavior models. None of these methods have integrated model checking, human behavior modeling, and human error phenotype classification to automatically model erroneous behavior and use it to predict its contribution to system failure.

Author

*Human Behavior; Human Factors Engineering; Classifications; Computer Programs; Software Engineering; Man Machine Systems; Errors; Detection*

**20080022236** Connecticut Univ., Storrs, CT USA

**Pilot for Automated Detection and Classification of Road Surface Degradation Features**

Javidi, B.; Stephens, J.; Kishk, S.; Naughton, T.; McDonald, J.; Nov. 2003; 40 pp.; In English

Report No.(s): PB2007-112742; JHR-03-293; No Copyright; Avail.: National Technical Information Service (NTIS)

This report deals with the detection and classification of pavement cracks. Currently, ConnDOT is using Wisecrax (Trade name) which is a commercial product supplied by Roadware. However, Wisecrax has some shortcomings. We proposed seemingly different techniques based on wavelet and Hough transforms; since the problem at hand must be analyzed in both the spatial and frequency domains. Two main algorithms had been developed for elimination of false detection, and for more accurate detection. The proposed techniques require less user intervention, and showed promising results. Some road images had been analyzed, specifically those which Wisecrax did not analyze well. Since we tested our algorithms against highly compressed road images, some parts of the cracks were not detected, causing errors in crack length measurements.

NTIS

*Classifications; Cracks; Degradation; Detection; Pavements; Roads*

## 61

### COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

**20080021507** Delaware Univ., Newark, DE USA

**Benchmarks for Evaluation of Distributed Denial of Service (DDoS)**

Mirkovic, Jelena; Jan 2008; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-2-0197; Proj-DHSD

Report No.(s): AD-A477417; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The main goal of our work was to develop the benchmark suite for evaluation of defenses against distributed denial-of-service (DDoS) attacks. The desired features of the benchmark suite were the following: 1. Realistic topologies, legitimate and attack traffic are represented in the suite 2. A wide variety of attack variants is present in the suite 3. Benchmarks can be used by novice experiments easily 4. There is a common, intuitive and scientifically accurate measure of an attack's impact on network services in any given scenario. This measure is easily obtained by experimenters and can be used to compare effectiveness of diverse defenses.

DTIC

*Computer Networks; Topology*

**20080021851** National Computer Security Center, Fort Meade, MD USA

**Computer Viruses: Prevention, Detection, and Treatment**

Tinto, Mario; Mar 12, 1990; 24 pp.; In English

Report No.(s): AD-A477688; C1-TR-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477688>

There has been, of late, considerable interest in the topic of computer viruses. The debate has been especially brisk since the so-called 'Internet Virus' of November 1988. At one extreme are those who declare that viruses are an essentially new phenomenon, against which we are powerless. At the other end of the spectrum are those who treat viruses as more of a semantics problem than a technical one, claiming that the problems they pose have already been solved under different

terminology. Where then is reality? This paper makes the case that the situation, while certainly not ideal, is not nearly as bleak as some of the alarmists would claim, and that existing technology and security-oriented procedures are extensible to the virus threat. Further, these are largely captured in the DoD Trusted Computer System Evaluation Criteria (TOSEC). However, while the available techniques are relevant, they supply only partial solutions; perfect and universal countermeasures against all possible virus scenarios do not exist. If we are to determine whether or not such are possible, much less develop them, further R&D activity is required.

DTIC

*Computer Viruses; Detection; Prevention; Systems Analysis*

**20080021853** General Accounting Office, Washington, DC USA

**Defense Acquisitions: Significant Challenges Ahead in Developing and Demonstrating Future Combat System's Network and Software**

Mar 2008; 44 pp.; In English

Report No.(s): AD-A477698; GAO-08-409; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477698>

It is not yet clear if or when the Army and LSI can develop, build, and demonstrate the information network that is at the heart of the FCS concept. The Army is faced with significant management and technological challenges that place development of FCS's network and software at risk. Almost 5 years into the program, the Army and LSI have not yet fully defined how the FCS network is expected to function, how they plan to build it, and how they plan to demonstrate it. The Army and LSI have identified and need to address numerous areas of high risk such as network performance and scalability, immature network architecture, and synchronization of FCS with the Joint Tactical Radio System (JTRS) and Warfighter Information Network Tactical (WIN-T) programs, which are having difficulty with technology maturation and are at risk of being delayed or delivering incomplete capabilities to FCS. Software being developed for the network and platforms by the LSI and software developers is now projected to total about 95.1 million lines of computer code, which almost triples the size since the program began in 2003. A June 2006 report issued by the Secretary of Defense's Cost Analysis Improvement Group found that the FCS program is at risk of higher costs due to, among other things, the size and complexity of the FCS software development program. This group also said the development schedule is highly likely to take several years beyond the Army's plan, and the network is at risk because it is tied to JTRS and WIN-T programs that could cause delays in FCS's development schedule. Similarly, a recent study by the Institute for Defense Analysis found that the FCS program would likely experience additional growth in unplanned software effort, unplanned rework before and after operational testing, and additional work to address system of systems integration, validation, and test after the critical design review point.

DTIC

*Combat; Computer Programs; Computer Systems Programs; Radio Equipment; System Effectiveness; Telecommunication*

**20080021882** Oak Ridge National Lab., TN USA

**Bioregional Planning in Central Georgia, USA**

Dale, Virginia; Aldridge, Matthew; Arthur, Taryn; Baskaran, Latha; Berry, Michael; Chang, Michael; Efroymson, Rebecca; Garten, Chuck; Stewart, Catherine; Washington-Allen, Robert; Nov 2, 2005; 20 pp.; In English

Report No.(s): AD-A477772; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477772>

Human influences in the five-county region around Fort Benning, Georgia, USA, have been long and intense. Only 4% of the native longleaf pine (*Pinus palustris*) forest remains intact. Besides the loss of species, habitats, and ecosystem services associated with longleaf pine forests, the environmental concerns of the region include air, water, and noise pollution. The mix of federal and private ownership in this region leads to complicated land-management issues that will likely become even more difficult as the city of Columbus continues its projected growth along the northern border of Fort Benning. To understand how anthropogenic developments affect the environment, we are developing a Regional Simulator (RSim) to project future developments and their impacts on environmental conditions. Using RSim, we can identify the potential effects of growth on noise and air pollution, water-borne nutrients, and habitats for focal species. Noise impacts are already large in the areas of current and projected urban growth for the region. This knowledge of potential futures allows options for environmental protection to be considered. A key lesson from this analysis is that regional simulation models are a cost-effective way to assess the long-term environmental implications of anthropogenic growth and development.

DTIC

*Cities; Computerized Simulation; Environmental Surveys; Land Management; Regional Planning; Simulation*



**20080022000** Cybernet Systems Corp., Ann Arbor, MI USA

**Unifying Systems Engineering Simulations**

Tang, Kevin; O'Grady, Ryan; Beach, Glenn; Patel, Rakesh; Ueda, Jason; Oct 22, 2007; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477924; TARDEC-TR-17956; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Department of Defense (DoD) relies on a multitude of fragmented simulations to assist in engineering new systems. The DoD has recognized the need for unified simulation environments to enhance the value of new models and help achieve its defense transformation goals; a major example of this is the U.S. Army's OneSAF program. However, no plan exists to leverage the thousands of simulation models that remain idle on shelves. Localized efforts by the government and its contractors to unify such models have been marginalized by a number of technical and nontechnical hurdles, some of which are not obvious. These include the availability of models, the usability of simulation construction tools, the creation of reference architecture, the complexity of simulation results, the automation of repetitive integration tasks, and the verification & validation of component models, among others. This paper discusses these hurdles in greater detail and provides context to DoD simulation efforts from the team developing the Virtual Systems Integration Lab (VSIL) for the U.S. Army TARDEC. We conclude with recommendations for establishing a unified approach to maximize simulation reuse across the DoD.

DTIC

*Computerized Simulation; Interoperability; Simulation; Software Development Tools; Systems Engineering*

**20080022035** Army Tank-Automotive and Armaments Command, Warren, MI USA

**Embedded Simulation for the Networked Unmanned Ground Air Systems Experiment**

Bunker, Paul; Jun 23, 2004; 16 pp.; In English

Report No.(s): AD-A478006; 14154; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In support of the Networked Unmanned Ground Air System (NUGAS) Experiment, and in support of evolving unmanned vehicles capabilities in general, the TARDEC Embedded Simulation System (ESS) has undergone significant modifications. These changes include updated hardware to support the latest off-the-shelf graphics products, a re-architecting of the ESS system software to support unmanned vehicle mission planning and crewstation independent modeless operation, the addition of Unmanned Air Vehicle (UAV) control, and database and Semi-Automated Forces (SAF) support specific for NUGAS. As the new ESS is still a work in progress, planned capabilities will be discussed as well as the differences from earlier versions of the ESS used in support of the Unmanned Combat Demonstration (UCD) and Crew integration and Automation Testbed (CAT) phase one activities.

DTIC

*Aircraft; Computer Programs; Embedding; Simulation*

**20080022053** Puget Sound Nearshore Partnership, Olympia, WA USA

**Conceptual Model for Assessing Restoration of Puget Sound Nearshore Ecosystems**

Simenstad, Charles; Logsdon, Miles; Fresh, Kurt; Shipman, Hugh; Dethier, Megan; Newton, Jan; Oct 2006; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478091; PSNP-TR-2006-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The PSNERP Nearshore Science Team has developed a Conceptual Model framework to aid in assessing restoration and preservation measures for nearshore ecosystems in Puget Sound. This model was designed primarily as a synthesis tool to better understand nearshore ecosystem processes and the response of nearshore ecosystems to different stressors or, alternatively, restoration actions. We have designed this model as a framework from which additional, more explicit 'submodels' can be consistently developed that relate to specific nearshore stressors, landscape segments, functions, or restoration designs.

DTIC

*Ecosystems; Planning; Restoration; Software Development Tools; Sounds (Topographic Features)*

**20080022063** Rhode Island Univ., Kingston, RI USA

**Expressing Quality of Service in Agent Communication**

DiPippo, Lisa C; Nair, Lekshmi; Jun 2001; 8 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0060

Report No.(s): AD-A478122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An agent communication language (ACL) provides a mechanism for agents to express their desires and intentions to other



agents in a content language independent manner. Agents can converse about what they know and what they want to know from other agents. This sharing of information allows multiple agents to work together to meet common goals as well as individual goals. However, in some applications, it is not enough for one agent to let another agent know that it wants some information. A requesting agent must also be able to express something about how it wants the information to be delivered. In general, it is important for an agent to be able to express a desired quality of service (QoS) as part of a communication with another agent. Further, it also is necessary for agents to be able to express the level of quality that it can provide to other agents in the services that it can offer. In this paper, the authors present a methodology for expressing QoS in the capabilities of agents and in the requirements of agents. Section 2 defines the semantics of QoS in agent communication by extending the semantics of a well-known communication language: Knowledge Query Manipulation Language (KQML). Section 3 presents extensions to KQML that allow for the expression of QoS in the language. Section 4 briefly describes a prototype that they have implemented to demonstrate the use of these language extensions. Section 5 concludes with a summary and discussion of the applicability of their work.

DTIC

*Knowledge Based Systems; Message Processing; Protocol (Computers); Quality; Semantics*

**20080022071** Office of the Under Secretary of Defense (Acquisitions, Technology and Logistics), Fort Belvoir, VA USA  
**Mission Impact of Foreign Influence on DoD Software**

Lucky, Robert; Sep 2007; 113 pp.; In English

Report No.(s): AD-A478166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Software has become the central ingredient of the information age, increasing productivity, facilitating the storage and transfer of information, and enabling functionality in almost every realm of human endeavor. However, as it improves the Department of Defense's (DoD) capability, it increases DoD's dependency. Each year the Department of Defense depends more on software for its administration and for the planning and execution of its missions. This growing dependency is a source of weakness exacerbated by the mounting size, complexity and interconnectedness of its software programs. It is only a matter of time before an adversary exploits this weakness at a critical moment in history. The software industry has become increasingly and irrevocably global. Much of the code is now written outside the USA (U.S.), some in countries that may have interests inimical to those of the USA. The combination of DoD's profound and growing dependence upon software and the expanding opportunity for adversaries to introduce malicious code into this software has led to a growing risk to the Nation's defense. A previous report of the Defense Science Board, 'High Performance Microchip Supply', discussed a parallel evolution of the microchip industry and its potential impact on U.S. defense capabilities. The parallel is not exact because the microchip fabrication business requires increasingly large capital formation - a considerable barrier to entry by a lesser nation-state. Software development and production, by contrast, has a low investment threshold. It requires only talented people, who increasingly are found outside the USA. The task force on microchip supply identified two areas of risk in the off-shoring of fabrication facilities - that the U.S. could be denied access to the supply of chips and that there could be malicious modifications in these chips. Because software is so easily reproduced, the former risk is small.

DTIC

*Computer Programs; Defense Program*

**20080022072** Rhode Island Univ., Kingston, RI USA

**A UML Package for Specifying Real-Time Objects**

DiPippo, Lisa C; Ma, Lynn; Nov 1999; 20 pp.; In English

Contract(s)/Grant(s): N00014-96-1-0401

Report No.(s): AD-A478169; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Unified Modeling language provides a robust set of tools for modeling software systems. However, these tools do not directly address the requirements of real-time systems. Many real-time systems require the specification of data that has strict timing constraints. This paper presents a UML package for specifying real-time objects called RT-Object. The constructs in the package are based on the objects of the RTSORAC 'Real-Time Semantic Objects Relationships And Constraints' model. The RT-Object package has been used to design real-time objects in a Real-Time Multi-User Virtual Environment in which widely distributed users collaborate in time-critical planning and decision making.

DTIC

*Computer Programs; Real Time Operation*

**20080022074** Naval Research Lab., Bay Saint Louis, MS USA

**MeshGUI: A Mesh Generation and Editing Toolset for the ADCIRC Model**

Blain, Cheryl A; Linzell, Robert S; Massey, T C; Feb 8, 2008; 54 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478174; NRL/MR/7322--08-9083; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The User's Manual for the Matlab-based MeshGUI Graphical User Interface (GUI) containing the software programs meshcreate.m and meshedit.m describes the software, including its functionality and usage. The meshcreate and meshedit tools provide a relatively automated and interactive means, respectively, for obtaining good quality finite element meshes that directly interface with the ADvanced CIRCulation Model (ADCIRC) through the fort.14 file. The resulting mesh, defined by a coastline boundary that inscribes connected linear triangles, discretizes a geographic region of interest for which the ADCIRC model is to be applied. The goals of the GUI-based meshcreate and meshedit tools are to provide some flexibility to the experienced user for designing or modifying a mesh while at the same time ensuring a quality mesh will result after only minimal input from the novice user.

DTIC

*Editing; Graphical User Interface; Grid Generation (Mathematics); Manuals; Software Development Tools*

**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.

**20080021358** NASA Langley Research Center, Hampton, VA, USA

**Plan for the Characterization of HIRF Effects on a Fault-Tolerant Computer Communication System**

Torres-Pomales, Wilfredo; Malekpour, Mahyar R.; Miner, Paul S.; Koppen, Sandra V.; May 2008; 43 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 645846.02.07.07.07

Report No.(s): NASA/TM-2008-215306; L-19453; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021358>

This report presents the plan for the characterization of the effects of high intensity radiated fields on a prototype implementation of a fault-tolerant data communication system. Various configurations of the communication system will be tested. The prototype system is implemented using off-the-shelf devices. The system will be tested in a closed-loop configuration with extensive real-time monitoring. This test is intended to generate data suitable for the design of avionics health management systems, as well as redundancy management mechanisms and policies for robust distributed processing architectures.

Author

*Computer Systems Performance; Radio Communication; Radiation; Electromagnetic Fields; Fault Tolerance; Data Transmission; Prototypes; Systems Health Monitoring; Avionics*

**20080021722** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Mission Operations of EO-1 with Onboard Autonomy**

Tran, Daniel Q.; July 17, 2006; 28 pp.; In English; IEEE International Conference on Space Mission Challenges for Information Technology, 17-20 Jul. 2006, Pasadena, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40773>

Space mission operations are extremely labor and knowledge-intensive and are driven by the ground and flight systems. Inclusion of an autonomy capability can have dramatic effects on mission operations. We describe the prior, labor and knowledge intensive mission operations flow for the Earth Observing-1 (EO-1) spacecraft as well as the new autonomous operations as part of the Autonomous Sciencecraft Experiment.

Author

*Autonomy; Space Missions; Computer Programs*

**20080021817** California Univ., Berkeley, CA USA

**Lambda Data Grid: Communications Architecture in Support of Grid Computing**

Lavian, Tal I; Dec 21, 2006; 198 pp.; In English

Contract(s)/Grant(s): F30602-98-2-0194

Report No.(s): AD-A477603; UCB/EECS-2006-190; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477603>

The practice of science experienced a number of paradigm shifts in the 20th century, including the growth of large geographically dispersed teams and the use of simulations and computational science as a third branch, complementing theory and laboratory experiments. The recent exponential growth in network capacity, brought about by the rapid development of agile optical transport, is resulting in another such shift as the 21st century progresses. Essential to this new branch of e-Science applications is the capability of transferring immense amounts of data: dozens and hundreds of TeraBytes and even PetaBytes. The invention of the transistor in 1947 at Bell Labs was the triggering event that led to the technology revolution of the 20th century. The completion of the Human Genome Project (HGP) in 2003 was the triggering event for the life science revolution of the 21st century. The understanding of the genome, DNA, proteins, and enzymes is prerequisite to modifying their properties and the advancement of systematic biology. Grid Computing has become the fundamental platform to conduct this e-Science research. Vast increases in data generation by e-Science applications, along with advances in computation, storage and communication, affect the nature of scientific research. During this decade, crossing the Peta line is expected: Petabyte in data size, Petaflop in CPU processing, and Petabit/s in network bandwidth.

DTIC

*Architecture (Computers); Communication Networks; Data Transmission; Grid Computing (Computer Networks)*

**20080021832** Department of Defense, Fort Meade, MD USA

**Department of Defense Trusted Computer System Evaluation Criteria**

Aug 15, 1983; 108 pp.; In English

Report No.(s): AD-A477648; CSC-STD-001-83; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477648>

In October 1967, a task force was assembled under the auspices of the Defense Science Board to address computer security safeguards that would protect classified information in remote-access, resource-sharing computer systems. The Task Force report, 'Security Controls for Computer Systems,' published in February, 1970, made a number of policy and technical recommendations on actions to be taken to reduce the threat of compromise of classified information processed on remote-access computer systems. Department of Defense Directive 5200.28 and its accompanying manual DoD 5200.28-M, published in 1972 and 1973 respectively, responded to one of these recommendations by establishing uniform DoD policy, security requirements, administrative controls, and technical measures to protect classified information processed by DoD computer systems. Research and development work undertaken by the Air Force, Advanced Research Projects Agency, and other defense agencies in the early and mid 70's developed and demonstrated solution approaches for the technical problems associated with controlling the flow of information in resource and information sharing computer systems. The DoD Computer Security Initiative was started in 1977 under the auspices of the Under Secretary of Defense for Research and Engineering to focus DoD efforts addressing computer security issues.

DTIC

*Computer Information Security; Computers; Data Processing; Defense Program; Protection; Systems Analysis*

**20080021833** National Computer Security Center, Fort Meade, MD USA

**Rating Maintenance Phase Program Document**

Jun 23, 1989; 92 pp.; In English

Report No.(s): AD-A477649; NCSC-TG-013-VER-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477649>

The National Computer Security Center has established an aggressive program to study and implement computer security technology, and to encourage the wide-spread availability of trusted computer products for use by any organization desiring better protection of their important data. The Trusted Product Evaluation Program, and the open and cooperative business relationship being forged with the computer and telecommunications industries, will result in the fulfillment of our country's computer security requirement. We are resolved to meet the challenge of identifying trusted computer products suitable for use in protecting information. 'Rating Maintenance Phase Program Document' is the latest in the series of technical guidelines published by the National Computer Security Center. The Rating Maintenance Phase (RAMP) of the Trusted Product Evaluation Program provides for the maintenance of computer security ratings across product revisions. This document

describes RAMP for current and prospective vendors of trusted systems. The primary objectives are to provide formal statements of program requirements and to provide guidance on addressing them.

DTIC

*Computer Information Security; Computers; Maintenance; Protection; Ratings*

**20080021834** National Computer Security Center, Fort Meade, MD USA

**Introduction to Certification and Accreditation**

Jan 1994; 75 pp.; In English

Report No.(s): AD-A477650; NCSC-TG-029-VER-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477650>

This document, which provides an introduction to certification and accreditation (C&A) concepts, provides an introductory discussion of some basic concepts related to C&A and sets the baseline for further documents. Its objectives are the following: (1) to provide an overview of C&A, its function and place within the risk management process; (2) to clarify the critical roles the Designated Approving Authority (DAA) and other key security officials must assume throughout the C&A process; (3) to identify some of the current security policies, emphasizing some key policy issue areas; and (4) to define C&A-related terms. The details of the actual C&A process are not included in this document, but will be provided in a follow-on document(s).

DTIC

*Certification; Information Systems; Security*

**20080021835** National Computer Security Center, Fort Meade, MD USA

**A Guide to Understanding Covert Channel Analysis of Trusted Systems**

Nov 1993; 124 pp.; In English

Report No.(s): AD-A477651; NCSC-TG-030-VER-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477651>

This document provides a set of good practices related to covert channel analysis of systems employed for processing classified and other sensitive information. It's written to help vendors and evaluators understand covert channel analysis requirements. It contains suggestions and recommendations derived from Trusted Computer System Evaluation Criteria (TCSEC) objectives but which aren't required by the TCSEC.

DTIC

*Computer Information Security; Computers; Security*

**20080021836** National Computer Security Center, Fort Meade, MD USA

**Trusted Product Evaluation Questionnaire**

Chokhani, Santosh; Goldman, Harriet; Gordon, James P; Toth, Patricia R; Oct 16, 1989; 59 pp.; In English

Report No.(s): AD-A477652; NCSC-TG-019-VER-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477652>

The questionnaire will address the TCSEC Criteria Classes C1 thru A1. In an effort to gather a better understanding of the system security, some questions in the questionnaire address information in addition to that required in the Department of Defense Trusted Computer Systems Evaluation Criteria. This document is organized by Criteria class subject area. The information provided in the questionnaire by the vendor is to assist the evaluator in obtaining an initial understanding of the system applying for evaluation and its security features of the respective Criteria class. The product questionnaire is not a statement of requirements, just an information gathering tool. This questionnaire should give the vendor an idea of the information required by the evaluator during the evaluation process and prepare the vendor for additional information necessary by the evaluation team later on in the evaluation process.

DTIC

*Access Control; Computer Information Security; Security*

**20080021844** California Univ., Berkeley, CA USA

**A General Framework for Flow Control in Wireless Networks**

Chen, Minghua; Dec 22, 2006; 162 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-00-1-0327

Report No.(s): AD-A477665; UCB/EECS-2006-194; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477665>

Flow control and rate control for multimedia streaming, is an important issue in information transmission. Although the

problem of flow control has been successfully addressed in wired networks, it is still open in wireless networks. Current widely accepted solutions assume that congestion is the only cause of packet loss and are not applicable to wireless networks in which the bulk of packet loss is due to errors at the physical layer. We show that this often results in bandwidth underutilization. In this thesis, we formulate flow control in wireless networks as a convex optimization problem. We then propose a new class of solutions that properly adjust the number of connections of a user, to fully utilize wireless bandwidth and minimize end-to-end packet loss. Our solution differs from existing schemes in the following ways: 1) It is theoretically guaranteed to be optimal, stable and scalable. In a network with arbitrary topology, arbitrary number of users, and arbitrary initial source rates, our proposed schemes guarantee all users' source rates to globally exponentially converge to an equilibrium. This convergence guarantees no congestion collapse in the network. 2) our proposed schemes are end-to-end and require modifications to neither infrastructure nor transport protocol stack. We have designed practical schemes for data transmission over wireless networks. Both users' rates and the number of connections they open are properly controlled to pursue equilibrium in the network. It is sufficient to control users' rates and their number of connections independently in two separate timescales to guarantee convergence to the desired equilibrium. This two timescale approach allows modification of the control law in one timescale without affecting the one in the other timescale, or the system's convergence.

DTIC

*Data Transmission; Wireless Communication*

**20080021912** Library of Congress, Washington, DC USA

**Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress**

O'Rourke, Ronald; May 30, 2003; 7 pp.; In English

Report No.(s): AD-A477857; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477857>

Network-centric warfare (NCW) is a key element of the Department of the Navy's effort to transform itself to meet 21st Century military challenges. NCW focuses on using information technology to link together Navy ships, aircraft, and shore installations into highly integrated networks. NCW could significantly improve U.S. naval capabilities and lead to substantial changes in naval tactics, doctrine, and organization. Key programs for implementing NCW include the Cooperative Engagement Capability (CEC), the Naval Fires Network (NFN), the IT-21 program, and ForceNet. A related program is the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some of these programs, particularly NMCI. This report may be updated if developments warrant.

DTIC

*Communication Networks; Information Systems; Military Operations; Navy; Warfare*

**20080021914** Defense Personnel Security Research Centre, Monterey, CA USA

**Privacy Concerns Related to the Collection of Personal Information Under the Personal Identify Verification (PIV) Program**

Helton-Fauth, Whitney B; Mar 2008; 67 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NBCHD-03-0003

Report No.(s): AD-A477862; PERS-TR-08-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477862>

In any system that requires the collection of personally identifying information, privacy concerns arise that must be addressed prior to the implementation of the system. Therefore, this report attempts to: (1) identify known privacy concerns related to the collection of personal information and the causes for concerns; (2) identify federal policy in place that may help mitigate these concerns; and (3) provide recommendations for alleviating privacy concerns that are not sufficiently addressed by existing policy or FIPS 201.

DTIC

*Computer Information Security; Particle Image Velocimetry; Privacy*

**20080022007** Library of Congress, Washington, DC USA

**Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress**

O'Rourke, Ronald; Mar 3, 2003; 7 pp.; In English

Report No.(s): AD-A477936; CRS-RS20557; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Network-centric warfare (NCW) is a key element of the Department of the Navy's effort to transform itself to meet 21st Century military challenges. NCW focuses on using information technology to link together Navy ships, aircraft, and shore



installations into highly integrated networks. NCW could significantly improve U.S. naval capabilities and lead to substantial changes in naval tactics, doctrine, and organization. Key programs for implementing NCW include the Cooperative Engagement Capability (CEC), the Naval Fires Network (NFN), the IT-21 program, and ForceNet. A related program is the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some of these programs, particularly NMCI.

DTIC

*Navy; Warfare*

**20080022008** Library of Congress, Washington, DC USA

**Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress**

O'Rourke, Ronald; Nov 25, 2002; 7 pp.; In English

Report No.(s): AD-A477937; CRS-RS20557; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Network-centric warfare (NCW) focuses on using information technology to link together Navy ships, aircraft, and shore installations into highly integrated networks. It could significantly improve U.S. naval capabilities and lead to substantial changes in naval tactics, doctrine, and organization. Key programs for implementing NCW include the Cooperative Engagement Capability (CEC), the Naval Fires Network (NFN), the IT-21 program, and ForceNet. A related program is the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some of these programs, particularly NMCI and ForceNet.

DTIC

*Navy; Warfare*

**20080022009** Library of Congress, Washington, DC USA

**Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress**

O'Rourke, Ronald; Aug 21, 2002; 7 pp.; In English

Report No.(s): AD-A477938; CRS-RS20557; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Network-centric warfare (NCW) is the Navy's central concept for organizing its efforts to transform itself for military operations in the 21st Century. NCW focuses on using information technology to link together Navy ships, aircraft, and shore installations into highly integrated networks. It could significantly improve U.S. naval capabilities and lead to substantial changes in naval tactics, doctrine, and organization. Key programs for implementing NCW include the Cooperative Engagement Capability (CEC), the Naval Fires Network (NFN), the IT-21 program. A related program is the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some of these programs, particularly NMCI.

DTIC

*Navy; Warfare*

**20080022011** Library of Congress, Washington, DC USA

**Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress**

O'Rourke, Ronald; Jun 3, 2002; 7 pp.; In English

Report No.(s): AD-A477940; CRS-RS20557; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Network-centric warfare (NCW) is the Navy's central concept for organizing its efforts to transform itself for military operations in the 21st Century. NCW focuses on using information technology to link together Navy ships, aircraft, and shore installations into highly integrated networks. It could significantly improve U.S. naval capabilities and lead to substantial changes in naval tactics, doctrine, and organization. Key programs for implementing NCW include the Cooperative Engagement Capability (CEC), the Naval Fires Network (NFN), the IT-21 program, and the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some NCW programs, particularly NMCI.

DTIC

*Navy; Warfare*

**20080022012** Library of Congress, Washington, DC USA

**Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress**

O'Rourke, Ronald; Jun 6, 2001; 7 pp.; In English

Report No.(s): AD-A477941; CRS-RS20557; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Network-centric warfare (NCW) is the Navy's central concept for organizing its efforts to transform itself for military operations in the 21st Century. NCW focuses on using information technology (IT) to link together Navy ships, aircraft, and

shore installations into highly integrated networks. It could significantly improve U.S. naval capabilities and lead to substantial changes in naval tactics, doctrine, and organization. Key programs for implementing NCW include the Cooperative Engagement Capability (CEC), the IT-21 program, and the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some of these programs. The Navy is working to resolve problems with the CEC system that were discovered in testing. The Navy recently awarded a multibillion-dollar NMCI contract and has begun to create the NMCI network.

DTIC

*Navy; Warfare*

**20080022077** Space and Naval Warfare Systems Center, San Diego, CA USA

**Adding QoS Dynamic Adaptation Services to TAO for Timeliness, High Availability, and Data Management**

Johnston, Russ; Morgan, Trudy; Wolfe, Victor F; DiPippo, Lisa; DiPalma, Lou; Kelly, Bob; Bagley, John; Kortmann, Peter; Watson, Ben; Aug 2001; 7 pp.; In English

Report No.(s): AD-A478201; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes a recently-initiated project to extend TAO to make it better capable of flexibly and effectively adapting to provide a sufficient level of timeliness and other quality of service (QoS) to dynamic environments that have varying workloads and dynamic real-time requirements. The project is a joint effort among The U.S. Navy SPAWAR Systems Center San Diego (SPAWAR), Tri-Pacific Software, Raytheon Electronic Systems (Raytheon), and the University of Rhode Island (URI).

DTIC

*Adaptation; Computer Networks; Computer Programs; Data Management; Real Time Operation; Scheduling*

**20080022078** Rhode Island Univ., Kingston, RI USA

**A Real-Time Multi-Agent System Architecture for E-Commerce Applications**

Cingiser DiPippo, Lisa; Fay-Wolfe, Victor; Nair, Lekshmi; Hodys, Ethan; Uvarov, Oleg; Dec 2000; 14 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0060

Report No.(s): AD-A478202; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes an architecture for real-time multi-agent systems (RTMAS) that builds upon an existing real-time CORBA architecture. The RTMAS architecture provides real-time agent services for real-time agent communication, real-time agent scheduling and real-time agent facilitation. These services work together to allow for the expression and enforcement of real-time agent interactions. The paper describes the design of these services, along with a prototype implementation of the RTMAS architecture that is based upon an existing agent communication implementation.

DTIC

*Architecture (Computers); Electronic Commerce; Interprocessor Communication; Real Time Operation*

**20080022084** Army War Coll., Carlisle Barracks, PA USA

**Recruiting and Retaining Cyberwarriors**

Westermeyer, Roger H; Feb 7, 2008; 43 pp.; In English

Report No.(s): AD-A478276; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In response to growing national reliance on cyberspace and the increasing vulnerability to it from state and non-state actors the USA Air Force stood up the Cyberspace Command on November 2nd, 2006. Establishment of this new command requires a highly-skilled Information Technology (IT) savvy workforce capable of controlling and dominating the cyber domain. Recruiting and retaining this highly skilled workforce is a significant challenge for the Air Force due to the high public and private sector demand for people with IT and related engineering skills and several other demographic and society factors. This recruitment and retention challenge is further exacerbated by a new generation, commonly referred to as Millennials, now coming into the workplace. The Millennials have different views, motivations, career goals, job and workplace expectations, demographics, and skill sets than previous generations. This paper examines these growing recruitment and retention challenges along with the many generational differences of the Millennials in an attempt to provide some insight and recommendations on how best to attract and retain the necessary talent for the new Cyberspace Command.

DTIC

*Information Systems; Personnel; Personnel Management*

## 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*.

**20080021820** CMC Electronics, Inc., Ottawa, Ontario Canada

### **Functional Modeling, Scenario Development, and Options Analysis to Support Optimized Crewing for Damage Control. Phase 2: Scenario Development**

Torenvliet, Gerard; Jamieson, Greg; Mar 31, 2007; 74 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W7711-05-7972/A

Report No.(s): AD-A477618; CMC-1000-1370-2; DRDC-T-CR-2007-061; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477618>

The Canadian Navy hopes to achieve significant lifetime cost reductions by implementing optimized crew levels across its next generation fleet. Defence Research and Development Canada has recognized that optimized crewing can only be achieved through a thorough Human Systems Integration effort, and that this effort will require systems modelling techniques to help the Navy predict the effectiveness of technologies and work strategies that aim to reduce operator workload and improve mission success. This report describes the second phase a project undertaken to provide Defence Research and Development Canada with such a technique, and details the development of two damage control scenarios. One additional phase of analysis is planned, to identify three different sets of damage control equipment and the crew level required to operate that equipment under the damage scenarios that have been defined. The outputs from this project will be used as inputs for a follow on project to develop a simulation of human and automated work in the damage control domain. The scenarios documented in this report coupled with the results of the first phase of work are a strong basis for the final phase of this project, and the follow on simulation development effort.

DTIC

*Damage*

**20080021892** Army Tank-Automotive Research and Development Command, Warren, MI USA

### **Ground Mobility Robotics Systems Integration Skunk Works**

Watts, Robert; Feb 3, 2006; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477803; TARDEC-BC-15451RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477803>

The objective of the Robotic Skunk Works program was to establish in-house quick reaction, ground mobility, robotics systems integration capability.

DTIC

*Mobility; Robotics; Systems Integration*

**20080022026** Army Tank-Automotive Research and Development Command, Warren, MI USA

### **In Search of Efficient Walking Robots**

Haueisen, Brooke; Muench, Paul; Hudas, Greg; Overholt, James; Adamczyk, Peter; Hulbert, Greg; Jan 10, 2005; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477969; TARDEC-14107; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With the recent conflicts in Afghanistan and Iraq, it is increasingly evident that the demands of warfare are changing and the need for innovative mobility systems is growing. In the rough, unstructured terrain that the soldiers encounter, they have reverted to using mules and donkeys to move stealthily and quickly. In light of the growing need for autonomous systems, the Army is looking at the possibility of legged mobility options such as gasoline powered quadrupeds to traverse the off-road terrain. As technology advances, the era of military bipeds may well be in sight. However, current bipedal robotic technology is far too inefficient for battlefield use. Much of this inefficiency stems from actuated control of each limb's motion throughout the entire gait cycle. An alternative approach is to exploit the passive pendular dynamics of legs and legged bodies for energy savings. This paper compares and contrasts fully-actuated walking with passive walking. Simulations of passive and quasi-passive walking are analyzed to evaluate their stability regions and their initial responses on uneven terrain functions are compared.

DTIC

*Robots; Walking*

**20080022183** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Visual End-Effector Position Error Compensation for Planetary Robotics**

Bajracharya, Max; DiCicco, Matthew; Backes, Paul; Nickels, Kevin; Journal of Field Robotics; January 29, 2007; Volume 24, No. 5, pp. 399-420; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources  
ONLINE: <http://dx.doi.org/10.1002/rob.20186>; <http://hdl.handle.net/2014/40812>

This paper describes a vision-guided manipulation algorithm that improves arm end-effector positioning to subpixel accuracy and meets the highly restrictive imaging and computational constraints of a planetary robotic flight system. Analytical, simulation-based, and experimental analyses of the algorithm's effectiveness and sensitivity to camera and arm model error is presented along with results on several prototype research systems and 'ground-in-the-loop' technology experiments on the Mars Exploration Rover (MER) vehicles. A computationally efficient and robust subpixel end-effector fiducial detector that is instrumental to the algorithm's ability to achieve high accuracy is also described along with its validation results on MER data.

Author

*Mars Exploration; Computer Vision; End Effectors; Simulation; Robotics; Position Errors; Imaging Techniques*

**20080022198** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Biomimetics as a Model for Inspiring Human Innovation**

Bar-Cohen, Yoseph; October 12, 2006; 49 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40775>

Electroactive polymers (EAP) are human made actuators that are the closest to mimic biological muscles. Technology was advanced to the level that biologically inspired robots are taking increasing roles in the world around us and making science fiction ideas a closer engineering reality. Artificial technologies (AI, AM, and others) are increasingly becoming practical tools for making biologically inspired devices and instruments with enormous potential for space applications. Polymer materials are used to produce figures that resemble human and animals. These materials are widely employed by the movie industry for making acting figures and by the orthopedic industry to construct cyborg components. There are still many challenges ahead that are critical to making such possibilities practical. The annual armwrestling contest is providing an exciting measure of how well advances in EAP are implemented to address the field challenges. There is a need to document nature's inventions in an engineering form to possibly inspire new capabilities.

Author

*Electroactive Polymers; Robots; Artificial Intelligence; Orthopedics; Biomimetics; Actuators; Muscles*

**20080022199** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**JPL Robotics**

Younse, Paulo J.; July 20, 2006; 26 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources  
ONLINE: <http://hdl.handle.net/2014/40776>

Goal: Develop new robotic technologies Groups: a) Robotic Hardware Systems; b) Robotic Software Systems; c) Mobility and Manipulation; d) Computer Vision; e) Advanced Robotic Controls

Derived from text

*Robotics; Software Engineering; Computer Vision; Robots*

**20080022200** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Experimental Results for Titan Aerobot Thermo-Mechanical Subsystem Development**

Pauken, Michael T.; Hall, Jeffery L.; June 29, 2006; 15 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40777>

This paper presents experimental results on a set of 4 thermo-mechanical research tasks aimed at Titan and Venus aerobots: 1. A cryogenic balloon materials development program culminating in the fabrication and testing of a 4.6 m long blimp prototype at 93K. 2. A combined computational and experimental thermal analysis of the effect of radioisotope power system (RPS) waste heat on the behavior of a helium filled blimp hull. 3. Aerial deployment and inflation testing using a blimp 4. A proof of concept experiment with an aerobot-mounted steerable high gain antenna These tasks were supported with JPL

internal R&D funds and executed by JPL engineers with substantial industry collaboration for Task #1, the cryogenic balloon materials

Author

*Thermal Analysis; Cryogenics; Thermodynamics; Analysis (Mathematics); Steerable Antennas*

**20080022249** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Considerations for Isochronous Data Services over the Proximity-1 Space Link**

Gao, Jay L.; June 19, 2006; 13 pp.; In English; SpaceOps, Earth, Moon, Mars and Beyond, 19-23 Jun. 2006, Rome, Italy; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40786>

Future mission concepts for robotic and human explorations will involve a high level of real time control/monitoring operations such as tele-operation for spacecraft rendezvous and surface mobile platforms carrying life-support equipments. The timely dissemination of voice, command, and real-time telemetry for monitoring and coordination purposes is critical for mission success. It is envisioned that future missions will require a network infrastructure capable of supporting isochronous data services. The CCSDS Proximity-1 Space Link Protocol1 could be used to carry isochronous traffic. This paper we will focus on the data link layer portion of the Proximity-1 protocol specification and analyze its jitter and performance for supporting isochronous applications. In particular we will focus on constrained scenarios where the protocol operates in full-duplex mode, carrying isochronous traffic in one direction and error-controlled traffic in the other direction. We analyze the impact of the strict priority scheme in Proximity-1 used to arbitrate channel access on the latency jitter of the isochronous traffic and the efficiency of the reliable data transfer. In general, jitter performance is driven by the loading of the acknowledgement traffic on the forward link. Under light loading condition, the upper-bound of the delay jitter is the transmission duration of an acknowledgement frame on the forward link; for higher loading scenarios, the maximum jitter is scaled up by the inverse of the residual bandwidth, i.e., the spare capacity available in the forward link after accounting for the acknowledgement traffic. We derive analytical expression on the maximum jitter and discuss its performance.

Author

*Robotics; Telemetry; Real Time Operation; Mission Planning; Space Rendezvous; Space Missions*

## 64

### NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

**20080021508** North Carolina Univ., Chapel Hill, NC USA

**3D Spatial Modeling Plan for Biospice**

Adalsteinsson, David; Colella, Phil; Jan 2008; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-1-0118; Proj-BIOC

Report No.(s): AD-A477420; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This effort developed the spatial modeling component of the Defense Advanced Research Projects Agency (DARPA) BioSpice project. The principal accomplishments include the development of a new class of methods for simulating reaction-diffusion processes in cells, and of an end-to-end methodology for obtaining discretization data from image data via level sets. These methods were tested on several model problems in systems biology.

DTIC

*Computer Programs; Diffusion; Partial Differential Equations*

**20080021548** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Numerical Study of Active Flow Control for a Transitional Highly-Loaded Low-Pressure Turbine**

Rizzetta, Donald P; Visbal, Miguel R; Feb 2008; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-A04Y

Report No.(s): AD-A477077; AFRL-RB-WP-TR-2008-3055; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477077>

Active control was simulated numerically for subsonic flow through a highly-loaded low-pressure turbine. At a nominal Reynolds number of 25,000 based upon axial chord and inlet conditions, massive separation occurred on the suction surface of each blade. Vortex generating jets were then used to help mitigate separation, thereby reducing wake losses. Computations



were performed using both steady blowing and pulsed mass injections. The numerical method utilized a centered compact finite-difference scheme to represent spatial derivatives in conjunction with a low-pass Pade-type non-dispersive filter operator to maintain stability. Calculations were carried out on a massively parallel computing platform, using domain decomposition and a high-order overset grid approach. Features of the flow fields are described, and simulations are compared with each other, with available experimental data, and with a previously obtained baseline case for the non-controlled flow. Active flow control resulted in a reduction of the wake total pressure loss coefficient of 53-56%.

DTIC

*Active Control; Flow Distribution; Low Pressure; Simulation; Subsonic Flow; Turbines; Turbulence*

**20080021823** Naval Postgraduate School, Monterey, CA USA

**Fractional Factorial Controlled Sequential Bifurcation: Efficient Factor Screening Through Divide and Discard**

Oh, Regine P; Dec 2007; 112 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477623; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477623>

On any given day, organizations use software simulations to make better decisions. Software simulations of real world systems are often large and rich with many parameters potentially affecting outcomes. Faced with a multitude of parameters, decision makers may not know or may lose sight of the few truly critical factors. Thus, screening algorithms are essential in order to identify the factors that most impact outcome measures. This enables experimenters to better utilize their resources by focusing on truly important factors. Fractional Factorial Controlled Sequential Bifurcation (FFCSB) is a newly proposed two-phase screening procedure for large-scale simulation experiments. This thesis evaluates the performance of FFCSB from accuracy and efficiency perspectives. FFCSB is also compared to existing algorithms, Controlled Sequential Bifurcation (CSB) and Fractional Factorial (FF), in order to understand the relative merits and weaknesses of each algorithm. FFCSB delivers consistent accuracy guarantees across more factor patterns and offers efficiency savings over CSB. FFCSB and FF are equally matched in accuracy; however, FFCSB is more robust to non-ideal settings of control parameters and scales better with increasing response model size; conversely FFCSB can be less efficient than FF. A first-case application of FFCSB on the Hierarchy organizational model yields results in agreement with prior research, as well as providing interesting hypotheses for further exploration. The Hierarchy model serves as a benchmark to compare innovative Command and Control structures for enabling more effective warfare.

DTIC

*Algorithms; Command and Control; Computer Programs; Computerized Simulation; Factorials*

**20080021880** Bio-Behavior Analysis Systems, LLC, Saint Louis, MO USA

**Real-Time Detector of Human Fatigue: Detecting Lapses in Alertness**

Stern, John; Feb 15, 2008; 134 pp.; In English

Contract(s)/Grant(s): FA9550-06-C-0008

Report No.(s): AD-A477767; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477767>

This project seeks to develop superior new methods to monitor human alertness and fatigue in real time, using a suite of unobtrusive sensors and algorithms to assess and predict human behavioral capabilities.

DTIC

*Alertness; Detection; Detectors; Real Time Operation*

**20080022061** Virginia Univ., Charlottesville, VA USA

**Effective and Efficient Automatic Database Selection**

French, James C; Powell, Allison L; Callan, Jamie; Jan 1999; 13 pp.; In English

Contract(s)/Grant(s): N66001-97-C-8542; F19628-95-C-0235

Report No.(s): AD-A478116; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We examine a class of database selection algorithms that require only document frequency information. The CORI algorithm is an instance of this class of algorithms. In previous work, we showed that CORI is more effective than (g)GLOSS when evaluated against a relevance-based standard. In this paper, we introduce a family of other algorithms in this class and examine components of these algorithms and of the CORI algorithm to begin identifying the factors responsible for their

performance. We establish that the class of algorithms studied here is more effective and efficient than (g)GLOSS and is applicable to a wider variety of operational environments. In particular, this methodology is completely decoupled from the database indexing technology so is as useful in heterogeneous environments as in homogeneous environments.

DTIC

*Data Bases; Ranking*

**20080022075** Rhode Island Univ., Kingston, RI USA

**A Replication Strategy for Distributed Real-Time Object-Oriented Databases**

Peddi, Praveen; DiPippo, Lisa C; Apr 2002; 9 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0060

Report No.(s): AD-A478185; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes a replication algorithm for distributed real-time object-oriented databases in a static environment. All data requirements are specified a priori, and the algorithm creates replication transactions that copy remote data to a local site in order to guarantee that every data request reads temporally valid data. The algorithm conditions are proven to be necessary and sufficient for providing this guarantee. Test results indicate that under most conditions, this replication strategy is better than total replication, which is a typical strategy used in distributed databases.

DTIC

*Algorithms; Data Bases; Object-Oriented Programming; Real Time Operation*

**20080022076** Rhode Island Univ., Narragansett, RI USA

**Numerical Modeling of Wave Breaking Induced by Fixed or Moving Boundaries**

Grilli, Stephan T; Subramanya, Ravishankar; Jan 1996; 39 pp.; In English

Contract(s)/Grant(s): N0001-94-1-G607

Report No.(s): AD-A478189; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, several numerical aspects of an existing model for fully nonlinear waves are improved and validated to study wave breaking due to shoaling over a gentle plane slope and wave breaking induced by a moving lateral boundary. The model is based on fully nonlinear potential flow theory and combines a higher-order Boundary Element Method (BEM) for solving Laplace's equation at a given time and Lagrangian Taylor expansions for the time updating of the free surface position and potential. An improved numerical treatment of the boundary conditions at the intersection between moving lateral boundaries and the free surface (corner) is implemented and tested in the model, and the free surface interpolation method is also improved to better model highly curved regions of the free surface that occur in breaking waves. Finally, a node regridding technique is introduced to improve the resolution of the solution close to moving boundaries and in breaker jets. Examples are presented for solitary wave propagation, shoaling, and breaking over a 1:35 slope and for wave breaking induced by a moving vertical boundary. Using the new methods, both resolution and extent of computations are significantly improved compared to the earlier model, for similar computational efforts. In all cases computations can be carried out up to impact of the breaker jets on the free surface.

DTIC

*Boundary Element Method; Mathematical Models; Wave Propagation*

**20080022083** Columbia Univ., New York, NY USA

**A Line Search Multigrid Method for Large-Scale Convex Optimization**

Wen, Zaiwen; Goldfarb, Donald; Jul 3, 2007; 30 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0514

Report No.(s): AD-A478260; CORC-RPT-2007-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a line search multigrid method based on Nash's MG/OPT multilevel optimization approach for solving discretized versions of convex infinite dimensional optimization problems. Global convergence is proved under fairly minimal requirements on the minimization method used at all grid levels. In particular, our convergence proof does not require that these minimization, or so-called (smoothing) steps, which we interpret in the context of optimization, be taken at each grid level in contrast with multigrid algorithms for PDEs, which fail to converge without such steps. Preliminary numerical experiments show that our method is promising.

DTIC

*Convexity*

**20080022254** Air Force Research Lab., Edwards AFB, CA USA

**Analysis of Different Approaches to Modeling of the Nozzle Flows in the Near Continuum Regime (Preprint)**

Titov, E V; Levin, D A; Gimelshein, N E; Gimelshein, S F; Dec 21, 2007; 25 pp.; In English

Report No.(s): AD-A477895; AFRL-RZ-ED-TP-2008-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A conical nozzle flow is studied for Reynolds numbers 1,230 and 12,300 using different numerical techniques: the direct simulation Monte Carlo method, the solution of Navier-Stokes equations that accounts for wall temperature jump and velocity slip, and statistical and deterministic approaches for the BGK equation. Detailed comparison of the efficiency, stability, accuracy, and convergence of the employed numerical techniques provides better understanding of their benefits and deficiencies, and assists in selecting the most appropriate technique for a particular nozzle and flow application. The deterministic solution of the BGK equation was found to be in good agreement with the benchmark DSMC results, while there were some differences observed between the statistical BGK and DSMC. The Navier-Stokes solution differs from DSMC in the boundary layer. The DSMC was shown to be the more computationally efficient than the solution of the BGK equation, both statistical and deterministic.

DTIC

*Conical Nozzles; Continuums; Flow; Nozzle Flow; Numerical Analysis*

**65**

**STATISTICS AND PROBABILITY**

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

**20080021174** NASA Langley Research Center, Hampton, VA, USA

**Statistical Methodologies to Integrate Experimental and Computational Research**

Parker, P. A.; Johnson, R. T.; Montgomery, D. C.; May 12, 2008; 9 pp.; In English; 55th JANNAF Propulsion Meeting/42nd Combustion/30th Airbreathing Propulsion/30th Exhaust Plume Technology/24th Propulsion Systems Hazards/12th SPIRITS User Group Joint Subcommittee Meeting, 12-16 May 2008, Newton, MA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.03.02.01; Copyright; Avail.: CASI: A02, Hardcopy

Development of advanced algorithms for simulating engine flow paths requires the integration of fundamental experiments with the validation of enhanced mathematical models. In this paper, we provide an overview of statistical methods to strategically and efficiently conduct experiments and computational model refinement. Moreover, the integration of experimental and computational research efforts is emphasized. With a statistical engineering perspective, scientific and engineering expertise is combined with statistical sciences to gain deeper insights into experimental phenomenon and code development performance; supporting the overall research objectives. The particular statistical methods discussed are design of experiments, response surface methodology, and uncertainty analysis and planning. Their application is illustrated with a coaxial free jet experiment and a turbulence model refinement investigation. Our goal is to provide an overview, focusing on concepts rather than practice, to demonstrate the benefits of using statistical methods in research and development, thereby encouraging their broader and more systematic application.

Author

*Statistical Analysis; Mathematical Models; Free Jets; Algorithms; Simulation*

**66**

**SYSTEMS ANALYSIS AND OPERATIONS RESEARCH**

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

**20080021407** Air Univ., Maxwell AFB, AL USA

**Elegant Coercion and Iran: Beyond the Unitary Actor Model**

Moss, J C; May 2005; 111 pp.; In English

Report No.(s): AD-A477003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477003>

Coercion involves the use, or threatened use, of force to influence an adversary's choices. At its core, then, coercion is about state decision-making. Most theories of coercion describe states as if they were unitary actors whose decision-making

results from purely rational cost-benefit calculations. However, models that are more robust portray state decision-making as the result of complex interactions among important sub-state actors. This thesis presents a framework of coercion based on state decision-making involving multiple actors. The thesis uses the framework to answer the question: how can the USA persuade Iran to abandon its pursuit of nuclear weapons? The framework identifies four key actors in Iranian decision-making regarding nuclear weapons: the Supreme Leader Ayatollah Khamenei, President Mohammad Khatami, Head of the Expediency Council Hojjatoleslam Ali Akbar Hashemi Rafsanjani, and the Islamic Revolutionary Guard Corps (IRGC). These actors operate in a complex and delicate balance of constitutional processes and clerical authoritarianism that characterizes Iranian decision-making. The framework articulates a strategy of coercion to guide the employment of instruments to affect things these actors value and thereby their cost-benefit calculus. If properly developed, the framework predicts that the key actors in Iranian decision-making, and thus Iran itself may be persuaded to abandon their pursuit of nuclear weapons.

DTIC

*Decision Making; Iran; Nuclear Weapons*

**20080021537** Columbia Univ., New York, NY USA

### **The Structure of Complex Problems**

Lee, John B; Watts, Duncan J; Jan 2008; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-1-0180; Proj-AC52

Report No.(s): AD-A477494; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The design of collective problem solving experiments requires that experimenters be able to control for task difficulty and problem structure across a variety of potential experimental tasks. Controlling for these factors allows experimenters to isolate the effects of organizational and communication structure from the nature of the task, and allows for comparison between experimental results and real-world problem solving efforts. This report develops a model of problems that accounts for the major features of 'complex problems' and shows that the model is capable of generating 'hard' problems.

DTIC

*Problem Solving; Task Complexity; Control Systems Design; Controllers*

**20080021555** Air Univ., Maxwell AFB, AL USA

### **Capturing Non-Linear Battlefield Operations: Conventional Air Forces' Interdependence with Special Operations Forces**

Cihak, II, Anton W; Jun 2005; 55 pp.; In English

Report No.(s): AD-A477181; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477181>

As the USA Military transforms from an industrial age organization into an information age institution, doctrine and strategy should be evaluated and adjusted if necessary to match information age resources, capabilities and mindset. This thesis uses historical analysis to answer the question: How can the environment be cultivated to foster the next generation of maneuver warfare in the information age? The framework of this analysis is focused on Conventional Air Force/Special Operations Force integration and interdependent operations. The analysis of these operations placed special emphasis on the training relationships developed between these two communities to determine if there are mission enhancement qualities found in integrated, interdependent and habitual relationships. Understanding there are valuable capabilities derived from these relationships, the focus shifts to the post-mission segregation of the two communities that repeatedly demonstrates a misunderstanding of the importance found in long-term habitual training relationships and ultimately hinders non-linear battlefield operations. Recent combat operations indicate the USA' military may no longer be bound by the limitations of linear warfare but it is now capable of conducting operational level non-linear battlefield operations. Non-linear battlefield operations are becoming the maneuver warfare standard bearer for the information age military. The Conventional air Force (CAF) and Special Operations Force (SOF) relationship and interdependent operations demonstrated during OEF and subsequently refined during OIF serve as a model for future joint operations. Service parochialisms should be set aside and CAF-SOF interdependence maintained through strategic level staff and leadership integration.

DTIC

*Military Operations; Military Personnel; Nonlinearity*

**20080021809** Defence Research and Development Canada, Toronto, Ontario Canada

**Toward a Concept of Risk for Effective Military Decision Making**

Mandel, David R; Dec 2007; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477582; DRDC-T-TR-2007-124; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477582>

This report critically examines existing concepts of risk and offers recommendations for improving the definition of risk and other risk-related terms. The author highlights the fact that the concept of risk is problematic because it is ambiguous and vague. In the vernacular, risk has multiple meanings including (a) risk as potential loss, (b) risk as a probability of a negative event occurring, and (c) risk as variability, volatility, or uncertainty regarding events in the future. In addition, many organizational definitions of risk define the concept in terms of an integration of the probability of a threat and the severity of its potential consequences. The author examines the definition of risk promulgated by (a) the Government of Canada through the Treasury Board Secretariat in its 2001 Integrated Risk Management Framework, (b) the Department of National Defense and Canadian Forces (DND/CF) through the 2002 Joint Doctrine on Risk Management for CF Operations and the 2005 Integrated Risk Management Guideline and Policy documents, and (c) the Canadian Standards Association (CSA) and the International Organization for Standardization and International Electrotechnical Commission (ISO/IEC). The report concludes with recommendations for the definition of risk, expected utility, and uncertainty, which the author proposes form a set of concepts that can contribute to effective decision making in defense and security contexts.

DTIC

*Canada; Decision Making; Risk; Risk Management*

**20080022082** Columbia Univ., New York, NY USA

**Optimal Procurement Mechanisms for Divisible Goods with Capacitated Suppliers**

Iyengar, Garud; Kumar, Anuj; Aug 31, 2007; 24 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0514

Report No.(s): AD-A478259; CORC-TR-2006-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The literature on procurement auctions typically assumes that the suppliers are uncapacitated (see, e.g. Dasgupta and Spulber, 1990; Che, 1993). Consequently, these auction mechanisms award the contract to a single supplier. We study mechanism design in a model where suppliers have limited production capacity, and both the marginal costs and the production capacities are private information. We provide a closed form solution for the revenue maximizing direct mechanism when the distribution of the cost and production capacities satisfies a modified regularity condition (Myerson, 1981). We also present a sealed low bid implementation of the optimal direct mechanism for the special case of identical suppliers, i.e. symmetric environment. The results in this paper extend to other principle-agent mechanism design problems where the agents have a privately known upper bound on allocation. Examples of such problems include monopoly pricing with adverse selection and forward auctions.

DTIC

*Procurement; Supplying*

**20080022251** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**A Perspective on DSN System Performance Analysis**

Pham, Timothy T.; June 19, 2006; 13 pp.; In English; SpaceOps, Earth, Moon, Mars and Beyond, 19-23 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40788>

This paper discusses the performance analysis effort being carried out in the NASA Deep Space Network. The activity involves root cause analysis of failures and assessment of key performance metrics. The root cause analysis helps pinpoint the true cause of observed problems so that proper correction can be effected. The assessment currently focuses on three aspects: (1) data delivery metrics such as Quantity, Quality, Continuity, and Latency; (2) link-performance metrics such as antenna pointing, system noise temperature, Doppler noise, frequency and time synchronization, wide-area-network loading, link-configuration setup time; and (3) reliability, maintainability, availability metrics. The analysis establishes whether the current system is meeting its specifications and if so, how much margin is available. The findings help identify the weak points in the system and direct attention of programmatic investment for performance improvement.

Author

*Deep Space Network; Frequency Synchronization; Wide Area Networks; Time Synchronization; Reliability Analysis*



**20080022253** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**A Roadmap for using Agile Development in a Traditional System**

Streiffert, Barbara; Starbird, Thomas; June 19, 2006; 15 pp.; In English; SpaceOps 2006 Rome, 19-21 Jun. 2006, Rome, Italy; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40795>

I. Ensemble Development Group: a) Produces activity planning software for in spacecraft; b) Built on Eclipse Rich Client Platform (open source development and runtime software); c) Funded by multiple sources including the Mars Technology Program; d) Incorporated the use of Agile Development. II. Next Generation Uplink Planning System: a) Researches the Activity Planning and Sequencing Subsystem for Mars Science Laboratory (APSS); b) APSS includes Ensemble, Activity Modeling, Constraint Checking, Command Editing and Sequencing tools plus other uplink generation utilities; c) Funded by the Mars Technology Program; d) Integrates all of the tools for APSS.

Derived from text

*Uplinking; Sequencing; Run Time (Computers); Eclipses*

67

**THEORETICAL MATHEMATICS**

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

**20080021412** Hunter Coll., New York, NY USA

**Signal and Image Processing in Different Representations**

Cohen, Leon; Jan 2008; 98 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-1-0590; Proj-558B

Report No.(s): AD-A477410; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One of the fundamental and powerful ideas of signal processing is that of a system function and input-output relations. Traditionally input-output relations are formulated in the time domain or, equivalently, in the spectral domain. However, over the last sixty years it has been found that many natural and man made signals are nonstationary, and the standard formulation does not fully describe what is happening, and therefore is not effective. We have shown that an immense simplification occurs, both conceptually and technically, when input-output relations are formulated in the combined time-frequency plane. We have developed an approach for formulating time-frequency/input-output systems for both the deterministic and random case. Using our approach we have solved a number of hitherto unsolved problems. In particular, we have been able to obtain the exact time-dependent solution of the Wiener process, the exact solution to the gliding tone problem, and the full exact solution to the RC circuit driven by white noise, among other problems. In addition, using our formulation we have clarified the issues with the ABC algorithm proposed by A. Noga, and we have also been able to formulate nonstationary noise so that it produces images that are similar to real clouds.

DTIC

*Image Processing; Signal Processing*

**20080022255** Air Force Research Lab., Edwards AFB, CA USA

**Preliminary Results on Coaxial Jets Spread Angles and the Effects of Variable Phase Transverse Acoustic Fields (Preprint)**

Leyva, Ivett A; Talley, Douglas; Rodriguez, Juan I; Chehroudi, Bruce; Aug 21, 2007; 15 pp.; In English

Report No.(s): AD-A477896; AFRL-RZ-ED-TP-2007-528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experimental study on the jet spreading angle of N<sub>2</sub> shear coaxial jets at sub-, near-, and supercritical pressures is presented. The jet spreading angle is an important parameter which characterizes the mixing between two flows forming a shear layer. The present results are compared with previous experimental data, CFD results, and theoretical predictions. The angle measurements are made directly from at least 20 backlit images. The shear coaxial injector used here is similar to those used in cryogenic liquid rockets. The chamber pressure ranges from 1.5 to 5.0 MPa to span subcritical to supercritical pressures. The chamber to outer jet density ratio varies from 0.17-4.8 and the momentum flux ratio between the outer and the inner jet varies from 0.37 to 30. These ratios are mainly varied by changing the temperature and flow rates of the outer jet. For the ranges of conditions studied it is found that the tangent of the jet spreading angle is roughly constant and approximately 0.19 with std. dev. of 0.02. The value is lower than those predicted by different theories for planar mixing layers of variable density for gaseous flows. The second part of the paper focuses on the initial results obtained by combining two piezo-sirens

which generate a transverse acoustic field to excite the coaxial jet. The resonant frequency studied is ~3kHz and delta-P/P varies from 1-1.6%. These two acoustic sources can have an arbitrary phase between them so the position of the jet with respect to the pressure and velocity field can be adjusted. The main parameter investigated is the length of the dark inner jet core. The initial results indicate an effect of the phase angle on the dark core length but the differences are statistically significant only in the extreme cases.

DTIC

*Acoustics; Fluid Jets; Liquid Rocket Propellants*

## 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*.

**20080021243** Naval Research Lab., Washington, DC, USA

#### **Modeling of Sporadic-E Structures from Wind-Driven Kelvin-Helmholtz Turbulence**

Bernhardt, Paul A.; Werne, Joseph; Larsen, Miguel F.; Characterising the Ionosphere; June 2006, pp. 34-1 - 34-14; In English; See also [20080021218](#); Original contains color and black and white illustrations

Report No.(s): Paper 34; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Atmospheric wind shears control the irregularity structure in the E-region. Near 100 km altitude, where the ion collision frequency is much larger than the ion cyclotron frequency, the degree of shear turning and the direction of maximum shear gradient determine the location of the E-layer peak. The effects of speed shears on the three-dimensional structure of the E-layer are modeled using a system of coupled equations for continuity and momentum that describes both the neutrals and plasma. In the coupled model, the large amplitude components of the neutral wind shear drive the neutral atmosphere unstable and produce Kelvin-Helmholtz (K-H) billows. At the same time, the three-dimensional structure of the same wind shear compresses the ions vertical profile that is not necessarily centered on the node of the wind shear. The shear component is the source of Kelvin-Helmholtz turbulence and it produces quasi-periodic (Q-P) irregularities in the layer along the horizontal direction of the shear. The location of the turbulence in the ions is dependent on the offset lifting or lowering by the turning component of the neutral wind shear. The numerical results of the model study are consistent with the radar and optical observations.

Author

*Atmospheric Circulation; Wind Shear; Kelvin-Helmholtz Instability; E Region; Ion Cyclotron Radiation; Collision Rates; Cyclotron Frequency; Radar Tracking*

**20080021441** Lawrence Livermore National Lab., Livermore, CA USA

#### **Prominent Soft X-ray Lines of SR-like Au<sub>41+</sub> in Low-energy EBIT Spectrum**

Vilkas, M. J.; Ishikawa, Y.; Traebert, E.; Mar. 30, 2007; 6 pp.; In English

Report No.(s): DE2007-908138; UCRL-CONF-229575; No Copyright; Avail.: National Technical Information Service (NTIS)

Relativistic multireference Moller-Plesset perturbation theory has been employed to calculate with high accuracy the energy levels and transition probabilities of Cu- to Sr-like gold ions. The many-body calculations were carried out to identify the unassigned blended lines in the 3540 DGA region of the low-energy EBIT spectrum of the gold ions (Traebert et al 2001 Can. J. Phys. 79 153). Most of the prominent lines in the 3540 DGA region were identified as the emission lines in Sr-like gold.

NTIS

*Electron Beams; Ions; Spectra; X Rays*

**20080021766** Istituto Nazionale di Fisica Nucleare, Pisa, Italy; Fermi National Accelerator Lab., Batavia, IL, USA

#### **Review of Recent Results from the Tevatron**

Chiarelli, G.; January 2007; 11 pp.; In English

Report No.(s): DE2007-909169; FERMILAB-CONF-07-216-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The D0 and CDF experiments have been taking data at the Run 2 of the Tevatron Collider since 2001. We present a

selection of recent results, most of them obtained with an integrated luminosity. I will describe the most important facets of the physics programme and detail some results. Recent direct limits on standard model Higgs obtained at the Tevatron, and their prospects will be also reviewed.

NTIS

*Particle Accelerators; Standard Model (Particle Physics)*

**20080021767** Stanford Linear Accelerator Center, CA, USA; Wroclaw Univ., Poland; Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

**Baseline Configuration of the Cryogenic System for the International Linear Collider**

Casas-Cubillos, J.; Chorowski, M.; Claudet, S.; Ganni, R.; Klebaner, A.; Jun. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-908997; SLAC-PUB-12560; No Copyright; Avail.: National Technical Information Service (NTIS)

The paper discusses the main constraints and boundary conditions and describes the baseline configuration of the International Linear Collider (ILC) cryogenic system. The cryogenic layout, architecture and the cooling principle are presented. The paper addresses a plan for study and development required to demonstrate and improve the performance, to reduce cost and to attain the desired reliability.

NTIS

*Cryogenics; Linear Systems; Electrons; Particle Theory*

**20080021768** Stanford Linear Accelerator Center, CA, USA

**Observation of the Long-Range Beam-Beam Effect in RHIC and Plans for Compensation (June 2007)**

Fischer, W.; Jun. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-908996; SLAC-12581; No Copyright; Avail.: National Technical Information Service (NTIS)

At large distances the electromagnetic field of a wire is the same as the field produced by a bunch. Such a long-range beam-beam wire compensator was proposed for the LHC, and single beam tests with wire compensators were successfully done in the SPS. RHIC offers the possibility to test the compensation scheme with colliding beams. We report on measurements of beam losses as a function of transverse separation in RHIC at 100GeV, and comparisons with simulations. We present a design for a long-range wire compensator in RHIC.

NTIS

*Beam Interactions; Electromagnetic Fields*

**20080021770** Stanford Linear Accelerator Center, CA, USA

**Fast SCR Thyatron Driver**

Nguyen, M. N.; January 2006; 3 pp.; In English

Report No.(s): DE2007-908993; SLAC-PUB-12590; No Copyright; Avail.: Department of Energy Information Bridge

As part of an improvement project on the linear accelerator at SLAC, it was necessary to replace the original thyatron trigger generator, which consisted of two chassis, two vacuum tubes, and a small thyatron. All solid-state, fast rise, and high voltage thyatron drivers, therefore, have been developed and built for the 244 klystron modulators. The rack mounted, single chassis driver employs a unique way to control and generate pulses through the use of an asymmetric SCR, a PFN, a fast pulse transformer, and a saturable reactor. The resulting output pulse is 2 kV peak into 50 W load with pulse duration of 1.5 ms FWHM at 180 Hz. The pulse risetime is less than 40 ns with less than 1 ns jitter. Various techniques are used to protect the SCR from being damaged by high voltage and current transients due to thyatron breakdowns. The end-of-line clipper (EOLC) detection circuit is also integrated into this chassis to interrupt the modulator triggering in the event a high percentage of line reflections occurred.

NTIS

*Linear Accelerators; Thyatrons; Klystrons*

**20080021771** Weizmann Inst. of Science, Rehovot, Israel; Stanford Univ., CA, USA; California Univ., Santa Barbara, CA, USA

**Phase Transition in Commuting Gaussian Multi-matrix Models**

Aharony, O.; Hartnoll, S. A.; Jul. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-908992; WIS/08/07-JUNE-DPP; SLAC/PUB-12570; No Copyright; Avail.: Department of Energy Information Bridge

We analyze in detail a second order phase transition that occurs in large N Gaussian multi-matrix models in which the matrices are constrained to be commuting. The phase transition occurs as the relative masses of the matrices are varied, assuming that there are at least four matrices in the lowest mass level. We also discuss the phase structure of weakly coupled large N 3+1 dimensional gauge theories compactified on an  $S^3$  of radius R.

NTIS

*Numerical Analysis; Phase Transformations; Quadratures*

**20080021772** Fermi National Accelerator Lab., Batavia, IL, USA

**Microsecond Delays on Non-Real Time Operating Systems**

Angstadt, R.; Estrada, J.; Diehl, H. T.; Flaughner, B.; Johnson, M.; January 2007; 4 pp.; In English

Report No.(s): DE2007-908839; FERMILAB-CONF-07-115-E; No Copyright; Avail.: Department of Energy Information Bridge

We have developed microsecond timing and profiling software that runs on standard Windows(1) and Linux based operating systems. This software is orders of magnitudes better than most of the standard native functions in wide use. Our software libraries calibrate RDTSC in microseconds or seconds to provide two different types of delays: a Guaranteed Minimum and a precision Long Delay, which releases to the kernel. Both return profiling information of the actual delay.

NTIS

*Operating Systems (Computers); Windows (Computer Programs); Time Lag*

**20080021774** Fermi National Accelerator Lab., Batavia, IL, USA

**Assessment of the Radiological Releases from the NuMI Facility during MINOS and NOvA Operations**

Martens, M.; Feb. 20, 2007; 18 pp.; In English

Report No.(s): DE2007-908838; FERMILAB-TM-2375-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

This report makes projections of the radiological releases from the NuMI facility during operations for the MINOS and NOvA experiments. It includes an estimate of the radionuclide levels released into the atmosphere and the estimated tritium and sodium-22 concentrations in the NuMI sump water and Fermilab pond system. The analysis was performed for NuMI operations with a beam power on target increased from the present 400 kW design up to a possible 1500 kW with future upgrades.

NTIS

*Dosage; Exposure; Radiology; Radioactive Isotopes*

**20080021780** Chevron Texaco Corp., San Ramon, CA, USA

**Preparation of Molecular Sieves Involving Spray Drying**

Miller, S. J., Inventor; Allen, D., Inventor; Wooltermann, G. M., Inventor; Cormier, W. E., Inventor; 14 Apr 05; 10 pp.; In English

Contract(s)/Grant(s): NIST-70NANB7H3014

Patent Info.: Filed Filed 14 Apr 05; US-Patent-Appl-SN-11-107-496

Report No.(s): PB2007-109273; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Molecular sieves are prepared by forming a reaction mixture slurry, spray drying the reaction mixture slurry to form particles, and heating the spray dried reaction mixture at a temperature and pressure sufficient to cause crystallization of the molecular sieve. The reaction mixture contains an organic templating agent capable of forming the molecular sieve. The template may be added to the reaction mixture either by adding all of the template prior to spray drying, or by adding a portion of the template prior to spray drying with the remainder being added after spray drying.

NTIS

*Absorbents; Drying; Sprayers*

**20080021781** Stanford Linear Accelerator Center, CA, USA

**RF Waveguide Distribution System for the ILC Test Accelerator at Fermilab's NLM**

Nantista, C.; Adolphsen, C.; Bowden, G.; Swent, R.; McKee, B.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909296; SLAC-PUB-12626; No Copyright; Avail.: National Technical Information Service (NTIS)

An ILC R&D facility is being constructed in the NML building at Fermilab which, in addition to an injector and beam dump with spectrometer, will contain up to three cryomodules of ILC-type superconducting 9-cell cavities. This linac will be powered by a single klystron. As part of SLAC's contribution to this project, we will provide a distribution network in WR650 waveguide to the various cavity couplers. In addition to commercial waveguide components and circulators and loads, this system will include adjustable tap-offs, and customized hybrids. In one configuration, the circulators will be removed to test pair-wise cancellation of cavity reflections through hybrids. The system will be pressurized with nitrogen to 3 bar absolute to avoid the need for SF<sub>6</sub>. The full distribution system for the first cryomodule will be delivered and installed later this year. We describe the design of the system and completed RF testing.

NTIS

*Particle Accelerators; Radio Frequencies; Waveguides*

**20080021782** Stanford Linear Accelerator Center, CA, USA

**Emittance Measurements of Trapped Electrons from a Plasma Wakefield Accelerator**

Kirby, N.; Berry, M.; Blumenfeld, I.; Decker, F. J.; Hogan, M. J.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909294; SLAC-PUB-12616; No Copyright; Avail.: National Technical Information Service (NTIS)

Recent electron beam driven plasma wakefield accelerator experiments carried out at SLAC showed trapping of plasma electrons. These trapped electrons appeared on an energy spectrometer with smaller transverse size than the beam driving the wake. A connection is made between transverse size and emittance; due to the spectrometer's resolution, this connection allows for placing an upper limit on the trapped electron emittance. The upper limit for the lowest normalized emittance measured in the experiment is 1 mm-mrad.

NTIS

*Electron Beams; Electrons; Emittance; Plasma Accelerators; Plasma Waves*

**20080021783** Stanford Linear Accelerator Center, CA, USA

**Wakefield Effects in the Beam Delivery System of the ILC**

Bane, K. L. F.; Seryi, A.; Jun. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909295; SLAC-PUB-12627; No Copyright; Avail.: National Technical Information Service (NTIS)

The main linac of the International Linear Collider (ILC) accelerates short, high peak current bunches into the Beam Delivery System (BDS) on the way to the interaction point. In the BDS wakefields, excited by the resistance of the beam pipe walls and by beam pipe transitions, will tend to degrade the emittance of the beam bunches. In this report we calculate the effect on single bunch emittance of incoming jitter or drift, and of misalignments of the beam pipes with respect to the beam axis, both analytically and through multi-particle tracking. As we want to keep emittance growth due to this effect small, we consider also mitigation measures of changing the metallic surface material and/or the beam pipe aperture. The wake effects are studied in that part of the BDS which includes the collimation and final focus systems.

NTIS

*Beam Currents; Bunching; Linear Accelerators*

**20080022185** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Finite-Size Effects on the Behavior of the Susceptibility in van der Waals Films Bounded by Strongly Absorbing Substrates**

Dantchev, Daniel; Rudnick, Joseph; Barnatz, M.; Physical Review E 75; January 23, 2007; Volume 75; 15 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): F-1402; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1103/PhysRevE.75.011121>; <http://hdl.handle.net/2014/40816>

We study critical point finite-size effects in the case of the susceptibility of a film in which interactions are characterized by a van der Waals-type power law tail. The geometry is appropriate to a slab-like system with two bounding surfaces.



Boundary conditions are consistent with surfaces that both prefer the same phase in the low temperature, or broken symmetry, state. We take into account both interactions within the system and interactions between the constituents of the system and the material surrounding it. Specific predictions are made with respect to the behavior of  $^3\text{He}$  and  $^4\text{He}$  films in the vicinity of their respective liquid-vapor critical points.

Author

*Boundary Conditions; Broken Symmetry; Critical Point; Low Temperature*

**20080022189** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Multi-Band and Broad-Band Infrared Detectors Based on III-V Materials for Spectral Imaging Instruments**

Bandara, S. V.; Gunapala, S. D.; Liu, J. K.; Rafol, S. B.; Hill, C. J.; Ting, D. Z.; Mumolo, J. M.; Trinh, T. Q.; Infrared Physics and Technology; October 2005; Volume 47, Issues 1-2, pp. 15-21; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40814>; <http://dx.doi.org/10.1016/j.infrared.2005.02.006>

Quantum well infrared photodetector technology has shown remarkable success by realizing large-format focal plane arrays in both broad-bands and in multi-bands. The spectral response of these detectors based on the III-V material system are tailorable within the mid and long wavelength IR bands (similar to 3-25  $\mu\text{m}$ ) and possibly beyond. Multi-band and broad-band detector arrays have been developed by vertically integrating stacks of multi quantum wells tailored for response in different wavelengths bands. Each detector stack absorbs photons within the specified wavelength band while allowing the transmission other photons, thus efficiently permitting multiband detection. Flexibility in many design parameters of these detectors allows for tuning and tailoring the spectral shape according to application requirements, specifically for spectral imaging instruments.

Author

*Quantum Wells; Infrared Detectors; Design Analysis; Focal Plane Devices; Imaging Techniques; Photometers*

**20080022239** Stanford Linear Accelerator Center, Menlo Park, CA, USA

**Material Effects and Detector Response Corrections for Bunch Length Measurements**

Zacherl, W.; Blumenfeld, I.; Berry, M.; Decker, F. J.; Hogan, M. J.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909293; SLAC-PUB-12618; No Copyright; Avail.: National Technical Information Service (NTIS)

A typical diagnostic used to determine the bunch length of ultra-short electron bunches is the auto-correlation of coherent transition radiation. This technique can produce artificially short bunch length results due to the attenuation of low frequency radiation if corrections for the material properties of the Michelson interferometer and detector response are not made. Measurements were taken using FTIR spectroscopy to determine the absorption spectrum of various materials and the response of a Molelectron P1-45 pyroelectric detector. The material absorption data will be presented and limitations on the detector calibration discussed.

NTIS

*Bunching; Correction; Length; Mechanical Properties*

**20080022241** Stanford Linear Accelerator Center, Menlo Park, CA, USA

**Validation of PEP-II Resonantly Excited Turn-by-Turn BPM Data**

Yan, Y. T.; Cai, Y.; Colocho, W.; Decker, F. J.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909292; SLAC-PUB-12621; No Copyright; Avail.: National Technical Information Service (NTIS)

For optics measurement and modeling of the PEP-II electron (HER) and positron (LER) storage rings, we have been doing well with MIA which requires analyzing turn-by-turn Beam Position Monitor (BPM) data that are resonantly excited at the horizontal, vertical, and longitudinal tunes. However, in anticipation that certain BPM buttons and even pins in the PEP-II IR region would be missing for the run starting in January 2007, we had been developing a data validation process to reduce the effect due to the reduced BPM data accuracy on PEP-II optics measurement and modeling. Besides the routine process for ranking BPM noise level through data correlation among BPMs with a singular-value decomposition (SVD), we could also check BPM data symplecticity by comparing the invariant ratios. Results from PEP-II measurement will be presented.

NTIS

*Beams (Radiation); Monitors; Storage Rings (Particle Accelerators)*

**20080022243** Stanford Linear Accelerator Center, Menlo Park, CA, USA

**RF Distribution Optimization in the Main Linacs of the ILC**

Bane, K. L. F.; Adolphsen, C.; Nantista, C.; Jun. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909291; SLAC-PUB-12628; No Copyright; Avail.: National Technical Information Service (NTIS)

The nominal design gradient in the main linacs of the International Linear Collider (ILC) is 31.5 MV/m for a beam current of 9.0 mA. However, the superconducting cavities built to date have demonstrated a range in sustainable gradient extending well below this goal, being limited by Q drop-off and quenching. Thus, an economically feasible cavity acceptance rate will include a certain percentage of sub-performing cavities. An important question that needs to be addressed is, For a string of cavities rated to various levels of gradient and powered from a common source how can we optimize the overall gradient. Along with adjustable cavity coupling--or loaded Q factor--we assume adjustable RF power so that gradient can be leveled in nonnominal cavities, to avoid quench-inducing overshoots. In the ILC an RF unit comprises three cryomodules containing a total of 26 nine-cell cavities, which are fed by one klystron that nominally feeds equal power to all cavities. One simple way of running such a unit is to set RF power, beam arrival time, and all loaded Qs so that the power is matched and the gradient in all cavities equals the gradient limit in the poorest performing cavity.

NTIS

*Linear Accelerators; Radio Frequencies*

**20080022244** Stanford Linear Accelerator Center, Menlo Park, CA, USA

**Geometric Transitions, Topological Strings, and Generalized Complex Geometry**

Chang, W. Y.; January 2006; 97 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909289; SLAC-R-873; No Copyright; Avail.: National Technical Information Service (NTIS)

Mirror symmetry is one of the most beautiful symmetries in string theory. It helps us very effectively gain insights into non-perturbative worldsheet instanton effects. It was also shown that the study of mirror symmetry for Calabi-Yau flux compactification leads us to the territory of 'Non-Kahlerity.' In this thesis we demonstrate how to construct a new class of symplectic non-Kahler and complex non-Kahler string theory vacua via generalized geometric transitions. The class admits a mirror pairing by construction. From a variety of sources, including super-gravity analysis and KK reduction on SU(3) structure manifolds, we conclude that string theory connects Calabi-Yau spaces to both complex non-Kahler and symplectic non-Kahler manifolds and the resulting manifolds lie in generalized complex geometry. We go on to study the topological twisted models on a class of generalized complex geometry, bi-Hermitian geometry, which is the most general target space for worldsheet theory with non-trivial H flux turned on. We show that the usual Kahler A and B models are generalized in a natural way. Since the gauged supergravity is the low energy effective theory for the compactifications on generalized geometries, we study the fate of flux-induced isometry gauging in  $N = 2$  IIA and heterotic strings under non-perturbative instanton effects.

NTIS

*Strings; Topology; Geometry*

**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*.

**20080020584** Naval Research Lab., Bay Saint Louis, MS USA; Army Medical Research and Materiel Command, Fort Detrick, MD, USA

**FeyRay Evaluation: 2007**

Fulford, James K; Feb 8, 2008; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N68948-07-WX-7M013

Report No.(s): AD-A477291; NRL/MR/5580--08-9089; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The capabilities of the FeyRay acoustic prediction model (version 1.12 Foreman 2007) are analyzed through comparison with the Navy Standard Parabolic Equation Model (NSPE), and the GRAB (Gaussian Ray Bundle eigenray propagation model) in a limited number of environments. Measurements of the relationship between GRAB and NSPE are designed to

quantify the meaning of our FeyRay measurements in terms of another commonly used OAML model for Gaussian Beam propagation. The measurements reported here indicated that the accuracy and execution speed of FeyRay are sufficient to justify its use in high-fidelity training systems.

DTIC

*Audio Equipment; Wave Propagation*

**20080021553** California Univ., Los Angeles, CA USA

**Generation of High Frequency P and S Wave Energy by Rock Fracture During a Buried Explosion**

Sammis, Charles G; Nov 10, 2007; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-04-C-0012; Proj-1010

Report No.(s): AD-A477146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477146>

The micromechanical damage mechanics developed by Ashby and Sammis (1990) was used to explore the effects of rock fracture on the seismic coupling of explosions. An important focus was the effect of ice in the fractures. The main effect of ice in the cracks of crystalline rock is to bridge the existing cracks forming a larger number of smaller cracks. Ice also increases the coefficient of friction on the cracks resulting in a significant increase in both elastic stiffness and fracture strength, both of which are temperature and strain-rate dependent. The damage mechanics model was used to interpret laboratory data on frozen rock and a field experiment in which chemical explosions were detonated above and below the permafrost layer in Alaska to directly observe the effect of ice in rock on the seismic coupling. Finally, we used the equivalent elastic medium model for an explosive source developed by Johnson and Sammis (2001) to explore the effect of an increase in both elastic stiffness and compressive strength on the amplitude of far-field seismic radiation. Our conclusion is that an explosion in frozen rock should have a smaller apparent yield than the same explosion in rock at temperatures above the freezing point and that the effect should be larger in limestone than in granite.

DTIC

*Crystallinity; Explosions; Fracturing; High Frequencies; Micromechanics; P Waves; Rocks; S Waves; Underground Explosions*

**20080021852** Library of Congress, Washington, DC USA

**Environmental Exemptions for the Navy's Mid-Frequency Active Sonar Training Program**

Alexander, Kristina; Mar 4, 2008; 19 pp.; In English

Report No.(s): AD-A477692; CRS-RL34403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477692>

Mid-frequency active (MFA) sonar emits pulses of sound from an underwater transmitter to help determine the size, distance, and speed of objects. The sound waves bounce off objects and reflect back to underwater acoustic receivers as an echo. MFA sonar has been used since World War II, and the Navy finds it the only reliable way to track submarines, especially more recently designed submarines that operate more quietly, making them more difficult to detect. Scientists have found that sonar may harm certain marine mammals under certain conditions, especially beaked whales. Depending on the exposure, the sonar may damage the ears of the mammals, causing hemorrhaging and/or disorientation. The Navy agrees that the sonar may harm some marine mammals, but says it has taken protective measures so that animals are not harmed. MFA testing must comply with a variety of environmental laws, unless an exemption is granted by the appropriate authority. Marine mammals are protected under the Marine Mammal Protection Act (MMPA) and some under the Endangered Species Act (ESA). The training program must also comply with the National Environmental Policy Act (NEPA), and in some cases the Coastal Zone Management Act (CZMA). Each of these laws has provisions where a federal action may be exempted from compliance. The Navy has invoked all of the exemptions to continue its sonar training exercises.

DTIC

*Acoustics; Animals; Education; Frequencies; Marine Biology; Signal Detectors; Sonar*

**20080022043** Rhode Island Univ., Narragansett, RI USA

**Inverted Echo Sounder Data Processing Manual**

Kennelly, Maureen; Tracey, Karen; Watts, D R; Jun 2007; 89 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0271; OCE00-95572

Report No.(s): AD-A478039; GSO-TR-2007-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Inverted Echo Sounder (IES) is an ocean bottom-moored instrument that measures the vertical acoustic travel time

(VATT) round-trip from the sea floor to the sea surface and back. The VATT varies principally due to changes in the temperature profile of the water column, making the IES well-suited for monitoring changes in temperature structure and dynamic height (baroclinic signal). Currently, the Model 6.2, a combined IES, data-logger, and acoustic release, with optional measurements of bottom pressure, temperature and current speed and direction (with attached Aanderaa™ Doppler current sensor) is produced at URI/GSO. Data are processed in situ and are available (optional) remotely by an acoustic telemetry link or expendable, satellite-link data shuttle. In addition to the IES-measured baroclinic signals, barotropic near-bottom pressure variations may be measured with the optional pressure sensor. A report was written in 1991 describing IES data processing (Fields et al., 1991). Since that report, significant improvements have been made to both IES hardware and software, warranting an update of the IES data processing. This report will document standard processing steps currently carried out for IES Models 6.1 and 6.2 at URI/GSO. A separate document, Inverted Echo Sounder User's Manual, IES Model 6.2, describes the IES hardware and instrument configuration.

DTIC

*Data Processing; Rangefinding; Sounding*

## 72

### ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 *Nuclear Physics*.

**20080021997** Nebraska Univ., Lincoln, NE USA

#### **Cation-Cation pi-pi Stacking in Small Ionic Clusters of 1,2,4-Triazolium (Preprint)**

Li, Hui; Boatz, Jerry A; Gordon, Mark S; Jul 12, 2007; 4 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-23030423

Report No.(s): AD-A477920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Aromatic cations such as imidazolium and its derivatives have delocalized charges and, therefore, are often used to synthesize functional nanomaterials, low-melting salts and ionic liquids. Recently, energetic low-melting salts and ionic liquids based on triazolium and its derivatives have received considerable attention. A characteristic property of aromatic compounds is their ability to form pi-pi stacking structures, which can have significant influence on properties. Cation-cation pi-pi stacking structures are less common, but have been observed in organometallic crystals and imidazolium salts. Cation-cation pi-pi stacking dimers can be formed in a dielectric solvent due to significant screening of the charge-charge repulsion forces. However, such species in small clusters have not been reported. Calculations reported in this work suggest that cation-cation pi-pi stacking structures can be formed between two 1,2,4-triazolium cations in small clusters of the two cations and two anions.

DTIC

*Cations; Clusters; Hydrogen Bonds; Ions*

## 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*.

**20080021776** North Carolina State Univ., Raleigh, NC, USA

#### **Nonlinear Projective-Iteration Methods for Solving Transport Problems on Regular and Unstructured Grids**

Anistratov, D. Y.; Constantinescu, A.; Roberts, L.; Wiselquist, W.; Apr. 2007; 91 pp.; In English

Contract(s)/Grant(s): DE-FG07-03ID14496

Report No.(s): DE2007-909188; No Copyright; Avail.: National Technical Information Service (NTIS)

This is a project in the field of fundamental research on numerical methods for solving the particle transport equation. Numerous practical problems require to use unstructured meshes, for example, detailed nuclear reactor assembly-level calculations, large-scale reactor core calculations, radiative hydrodynamics problems, where the mesh is determined by hydrodynamic processes, and well-logging problems in which the media structure has very complicated geometry. Currently this is an area of very active research in numerical transport theory. Main issues in developing numerical methods for solving the transport equation are the accuracy of the numerical solution and effectiveness of iteration procedure. The problem in case

of unstructured grids is that it is very difficult to derive an iteration algorithm that will be unconditionally stable. It is vital to develop novel computational transport methods that will be able to fit accurately asymptotics of the transport equation, mimic various important features of the transport solution, adapt to significantly different behavior of the solution without loss of accuracy, and converge fast. The project focuses on development of unconditionally stable methods for solving the multidimensional transport equation on unstructured grids and new nonlinear methods with advanced properties for regular meshes, based on nonlinear projective-iterative methods, namely, the Quasidiffusion and Flux methods.

NTIS

*Iteration; Nonlinearity; Transport Theory; Unstructured Grids (Mathematics)*

**20080021791** Government Accountability Office, Washington, DC, USA

**Nuclear Safety: Construction of the Protective Shelter for the Chernobyl Nuclear Reactor Faces Schedule Delays, Potential Cost Increases, and Technical Uncertainties**

Jul. 2007; 72 pp.; In English

Report No.(s): PB2007-113035; GAO-07-923; No Copyright; Avail.: CASI: [A04](#), Hardcopy

In 1986, an explosion at the Chernobyl nuclear power plant in Ukraine destroyed the reactor building and released massive amounts of radioactive contamination. A temporary shelter was built over the damaged reactor to prevent further contamination. The USA is a major donor to an international project to build a new shelter to replace the existing one, which is badly deteriorating. GAO was asked to (1) assess the progress toward completing the new shelter, (2) review the cost estimates to complete the project, and (3) assess the U.S. role in overseeing and funding the project. To carry out its work, GAO analyzed program documents, interviewed U.S. and international program officials, and visited the Chernobyl nuclear power plant. Although two of three construction components--site preparation and stabilization of the existing shelter--are nearly finished, construction of the new shelter has fallen about 7 years behind schedule. Over the past couple of years, the main reason for schedule slippage has been the failure to award a construction contract. The lack of a contract is partly the result of a lengthy disagreement between Ukraine and the European Bank for Reconstruction and Development (EBRD). In late 2006, the Chernobyl nuclear power plant director told GAO that the donors should not make any additional contributions to the project until contracting issues were resolved.

NTIS

*Construction; Costs; Nuclear Reactors; Reactor Safety; Schedules; Shelters*

**20080021854** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Feb 9, 2007; 7 pp.; In English

Report No.(s): AD-A477710; CRS-RS21592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477710>

International Atomic Energy Agency (IAEA) inspections since 2003 have revealed two decades' worth of undeclared nuclear activities in Iran, including uranium enrichment and plutonium separation efforts. Iran agreed in 2003 to suspend sensitive activities in negotiations with Germany, France, and the UK (EU-3), which broke down in August 2005. On September 24, 2005, the IAEA Board of Governors found Iran to be in noncompliance with its Nuclear Nonproliferation Treaty (NPT) safeguards agreement and reported Iran's case to the United Nations Security Council in February 2006. The Security Council called upon Iran to resuspend enrichment and reprocessing, reconsider construction of its heavy water reactor, ratify and implement the Additional Protocol, and implement transparency measures. Iran has continued its enrichment activities, failing to meet deadline after deadline. The Security Council passed UNSCR 1696 on July 31, 2006, and on December 23, 2006, the Security Council adopted limited sanctions under UNSCR 1737. The next deadline is February 23, 2007. This report will be updated as needed.

DTIC

*Enrichment; Inspection; International Relations; Iran; Nuclear Fuels; Nuclear Weapons; Technology Transfer*

**20080021855** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Jul 20, 2006; 7 pp.; In English

Report No.(s): AD-A477711; CRS-RS21592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477711>

International Atomic Energy Agency (IAEA) inspections since 2003 have revealed almost two decades' worth of



undeclared nuclear activities in Iran, including uranium enrichment and plutonium separation efforts. Iran agreed in 2003 to suspend sensitive activities in exchange for promises of assistance from Germany, France, and the UK (EU-3), but negotiations broke down in August 2005. On September 24, 2005, the IAEA Board of Governors found Iran to be in noncompliance with its Nuclear Nonproliferation Treaty (NPT) safeguards agreement (GOV/2005/77) and voted (GOV/2006/14) on February 4, 2006, to report Iran to the United Nations Security Council. The Security Council called upon Iran to take steps requested of it by the IAEA Board in February: reinstate its suspension of enrichment and reprocessing, reconsider construction of its heavy water reactor, ratify and implement the Additional Protocol, and implement transparency measures. Iran has continued enrichment activities and has failed to meet the Security Council's request. The IAEA reported little progress at the end of April (GOV/2006/27). While the permanent members of the Security Council plus Germany (P-5 +1) wait for positive Iranian action on their June 6th proposal, they continue efforts to craft a tough United Nations resolution. This report will be updated as needed.

DTIC

*Enrichment; Inspection; International Relations; Iran; Nuclear Fuels; Nuclear Weapons; Technology Transfer*

**20080021899** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Mar 4, 2004; 7 pp.; In English

Report No.(s): AD-A477826; CRS-RS21592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477826>

Inspections in 2003 of Iran's nuclear program revealed significant undeclared activities with potential application for nuclear weapons. The most recent report by the International Atomic Energy Agency (IAEA) details detail two uranium enrichment programs (centrifuges and lasers) and the separation of plutonium, another fissile material, in small quantities. Although the IAEA has stated previously that Iran has not met all of its NPT obligations, it has not yet declared Iran in violation of the NPT. Iran declared in November 2003 that it would halt all enrichment and reprocessing-related activities and would sign an Additional Protocol, which contains provisions for enhanced inspection. Although it signed an additional protocol on December 18, 2003, Iran continued to assemble centrifuge components. In late February 2004, it halted this activity also. The IAEA Board of Governors meets again in March to consider Iran's compliance. This report, which will be updated as needed, analyzes the significance of the IAEA's findings for a possible Iranian nuclear weapons program. See also CRS Report RL30551, Iran: Arms and Weapons of Mass Destruction Suppliers.

DTIC

*Atomic Energy Levels; Destruction; Iran; Nuclear Weapons*

**20080021906** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Jan 14, 2005; 7 pp.; In English

Report No.(s): AD-A477834; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477834>

Inspections in 2003 and 2004 of Iran's nuclear program revealed significant undeclared activities with potential application for nuclear weapons. The International Atomic Energy Agency (IAEA) uncovered two uranium enrichment programs (centrifuges and lasers) and plutonium separation efforts. Iran has been pressured to give up its enrichment and reprocessing activities and has declared twice (November 2003 and November 2004) that it would halt all such activities in exchange for technical cooperation with Germany, France, and the UK. It is not clear whether Iran is buying time for a clandestine program or effectively using its program as a bargaining chip for wider economic gain. Iran signed an Additional Protocol to its safeguards agreement in December 2003, but has not yet ratified it. Ever on the brink of being declared in violation of the NPT, Iran has allowed IAEA inspectors access only when pressed. After several months, Iran recently agreed to let inspectors visit a military site: Parchin. This report, which is updated as needed, analyzes the significance of the IAEA's findings for a possible Iranian nuclear weapons program.

DTIC

*Atomic Energy Levels; International Relations; Iran; Nuclear Weapons*

**20080021907** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Aug 2, 2005; 7 pp.; In English

Report No.(s): AD-A477835; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477835>

International Atomic Energy Agency (IAEA) inspections of Iran's nuclear program since 2003 have revealed significant undeclared activities with potential application for nuclear weapons, including uranium enrichment facilities and plutonium separation efforts. Ever on the brink of being declared in violation of the Nuclear Nonproliferation Treaty (NPT), Iran has allowed IAEA inspectors access only when pressed. Iran agreed to suspend its enrichment and reprocessing activities in exchange for promises of assistance from Germany, France, and the UK (EU-3). Negotiations with the EU-3 are ongoing, although on August 1, 2005, Iran told the IAEA of its plans to resume uranium conversion, regardless of what the EU-3 offer. This report will be updated as needed.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security*

**20080021908** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; May 18, 2005; 7 pp.; In English

Report No.(s): AD-A477836; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477836>

Since 2003, International Atomic Energy Agency (IAEA) inspections of Iran's nuclear program have revealed significant undeclared activities with potential application for nuclear weapons, including uranium enrichment facilities and plutonium separation efforts. Also since 2003, Iran has been negotiating with Germany, France, and the UK (EU-3) for a wide range of assistance in exchange for a halt to such activities. Yet, most evidence indicates that Iran has never completely suspended its enrichment activities, raising the question of whether Iran is buying time to build nuclear weapons. Although the EU-3 are seeking a permanent suspension, Iran insists its suspension is temporary. Ever on the brink of being declared in violation of the Nonproliferation Treaty (NPT), Iran has allowed IAEA inspectors access only when pressed. This report, which is updated as needed, analyzes the significance of the IAEA's findings for a possible Iranian nuclear weapons program.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security*

**20080021910** Library of Congress, Washington, DC USA

**Iran's Nuclear Program: Recent Developments**

Squassoni, Sharon; Nov 12, 2003; 7 pp.; In English

Report No.(s): AD-A477843; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477843>

Revelations about Iran's capability to produce enriched uranium - the fissile material for a nuclear weapon prompted a flurry of inspections, diplomatic missions and rhetoric in mid-2003 regarding Iran's compliance with the Nuclear Nonproliferation Treaty (NPT). The International Atomic Energy Agency's (IAEA) most recent findings reportedly detail two enrichment programs (centrifuges and lasers) and the separation of plutonium, another fissile material, in small quantities. Although the IAEA has stated previously that Iran has not met all of its NPT obligations, it has not yet declared Iran in violation of the NPT. On November 20-21, 2003, the IAEA Board of Governors will meet to discuss Iran. Meanwhile, Iran agreed on November 10 to sign the Additional Protocol, which contains provisions for enhanced inspections. This report, which will be updated as needed, analyzes the significance of the IAEA's findings for a possible Iranian nuclear weapons program. See also CRS Report RL30551, Iran: Arms and Weapons of Mass Destruction Suppliers.

DTIC

*Command and Control; Nuclear Weapons; Russian Federation; Safety; Security*

**20080022005** Library of Congress, Washington, DC USA

**North Korea's Nuclear Weapons: How Soon an Arsenal?**

Squassoni, Sharon A; May 12, 2005; 7 pp.; In English

Report No.(s): AD-A477931; CRS-RS21391; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In December 2002, North Korea ended the 8-year freeze on its nuclear program by expelling international inspectors and

restarting plutonium production facilities. In 2005, North Korea announced that it had nuclear weapons and that it would withdraw from the Six Party talks. It then shut down its small reactor and made preparations that some observers believe may be for a nuclear test. Before 2002, the CIA estimated that North Korea might have enough plutonium (Pu) for 1 or 2 weapons. Now, many assume that North Korea has successfully reprocessed the 8000 spent fuel rods at Yongbyon, which had previously been under seal, yielding enough Pu for 6 or 8 weapons. The Yongbyon reactor is estimated to produce plutonium for one weapon per year. Two unknown factors are the status of North Korea's uranium enrichment efforts and whether Pakistani scientist A. Q. Khan gave North Korea a weapons design, as he did to Libya. This report will be updated as needed.

DTIC

*Fissionable Materials; North Korea; Nuclear Fuels; Nuclear Weapons; Plutonium; Uranium*

## 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*.

**20080021264** NASA Langley Research Center, Hampton, VA, USA

### **In Search of Multi-Peaked Reflective Spectrum with Optic Fiber Bragg Grating Sensor for Dynamic Strain Measurement**

Tai, Hsiang; January 2006; 11 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 524238.08.02.04.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021264>

In a typical optic fiber Bragg grating (FBG) strain measurement, unless in an ideal static laboratory environment, the presence of vibration or often disturbance always exists, which often creates spurious multiple peaks in the reflected spectrum, resulting in a non-unique determination of strain value. In this report we attempt to investigate the origin of this phenomenon by physical arguments and simple numerical simulation. We postulate that the fiber gratings execute small amplitude transverse vibrations changing the optical path in which the reflected light traverses slightly and non-uniformly. Ultimately, this causes the multi-peak reflected spectrum.

Author

*Bragg Gratings; Optical Paths; Strain Measurement; Transverse Oscillation*

**20080021488** Cobrin and Gittes, New York, NY, USA

### **Laser Burn Through Sensor**

Arenberg, J. W., Inventor; Sun, A. S., Inventor; Komine, H., Inventor; Soule, M. W., Inventor; 17 Jun 04; 9 pp.; In English

Contract(s)/Grant(s): AF-F29601-03-C-0061

Patent Info.: Filed Filed 17 Jun 04; US-Patent-Appl-SN-10-872-028

Report No.(s): PB2007-110135; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An optical sensor for detecting the presence of laser radiation in locations outside an intended optical path in a high energy laser device. An optical sensor, such as a photodiode, is positioned to receive light through an optical component when it fails to operate properly and laser light burns through the component. The optical sensor preferably includes a diffuser, an optical filter, and electrical circuitry to compare the signal generated by the photodiode with a selected reference signal, and to use the photodiode signal to actuate an alarm indicator and to disable power to the laser source. A thermal detector may be employed as a backup detection device.

NTIS

*Lasers; Optical Measuring Instruments; Patent Applications*

**20080021797** Thomas, Kayden, Horstemeyer and Risley, LLP, Atlanta, GA, USA

### **Systems and Methods for Three-Dimensional Lithography and Nano-Indentation**

Mule, T., Inventor; Kohl, P., Inventor; Bakir, M., Inventor; Martin, K. P., Inventor; Meindl, J. D., Inventor; 24 Nov 05; 18 pp.; In English

Contract(s)/Grant(s): DARPA-MDA972-99-1-0002

Patent Info.: Filed Filed 24 Nov 05; US-Patent-Appl-SN-10-699-287

Report No.(s): PB2007-109177; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Systems and methods for three dimensional lithography, nano-indentation, and combinations thereof are disclosed. One

exemplary three dimensional lithography method, among others, includes: providing a substrate having at least one optical element, wherein the optical element is selected from a refractive element and a diffractive element; disposing a polymer layer on the substrate and at least one optical element, wherein the polymer layer includes a polymer material selected from a positive-tone polymer material and a negative-tone polymer material; positioning a mask adjacent to the polymer layer, wherein the mask does not cover at least one directly exposed portion of the polymer material directly overlaying at least one element; and exposing at least one directly exposed portion of the polymer material to optical energy, wherein the optical energy passes through at least one directly exposed portion of the polymer material and interacts with the element, and the element redirects the optical energy through the polymer material forming at least one area of indirectly exposed polymer material.

NTIS

*Lithography; Nanoindentation; Polymers*

**20080022034** Rochester Univ., NY USA

**Enhancing the Spectral Sensitivity of Interferometers using Slow-Light Media**

Shi, Zhimin; Boyd, Robert W; Gauthier, Daniel J; Dudley, C C; Jan 2007; 4 pp.; In English

Report No.(s): AD-A478005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We demonstrate experimentally that the spectral sensitivity of an interferometer can be greatly enhanced by introducing a slow-light medium into it. The experimental results agree very well with theoretical predictions that the enhancement factor of the spectral sensitivity is equal to the group index  $n_{\text{sub } g}$  of the slow-light medium.

DTIC

*Interferometers; Sensitivity; Spectral Sensitivity; Spectroscopy*

**20080022045** Rochester Univ., NY USA

**Applications of Slow Light in Telecommunications**

Boyd, Robert W; Gauthier, Daniel J; Gaeta, Alexander L; Apr 2006; 7 pp.; In English

Report No.(s): AD-A478047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over the past several years, researchers have been intrigued by the possibility of using nonlinear optical methods to exercise unprecedented control over the propagation velocity of light pulses through material systems. Exotic effects such as slow light, fast light and even stored light have been observed in the laboratory. Now, optical scientists are turning their attention toward developing useful applications of slow light, including controllable optical delay lines, optical buffers and true time delay methods for synthetic aperture radar. This article reviews recent progress in developing slow-light methods for these applications.

DTIC

*Nonlinear Optics; Telecommunication*

**20080022237** Connecticut Univ., Storrs, CT USA

**Laser-Based 3D Data Acquisition System for the Analysis of Pavement Distress and Roughness**

Javidi, B.; Kim, D.; Kishk, S.; Dec. 2004; 33 pp.; In English

Report No.(s): PB2007-112741; JHR-04-300; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report we deal with the detection and classification of pavement cracks. Currently, ConnDOT is using Wisecrux which is a commercial product supplied by Roadware. We develop a 3D laser based technique to detect the cracks in a certain pavement sector. We use phase shifting interferometer to store the 3D information of the pavement. Regular imaging systems are not able to estimate the crack depth. The proposed technique has the advantage of estimating the crack depth. The proposed laser based system can be used in conjunction with the Wisecrux to improve its performance or as stand alone system. We used an improved multi scale wavelet algorithm to reduce the effect of the speckle noise.

NTIS

*Cracks; Data Acquisition; Detection; Interferometers; Lasers; Pavements; Surface Roughness; Systems Analysis*

**20080022247** California Univ., Berkeley, CA, USA

**Fiber Optic Gap Gauge**

Wood, B. E., Inventor; Groves, S. E., Inventor; Larsen, G. J., Inventor; Sanchez, R. J., Inventor; 18 May 05; 7 pp.; In English  
Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed Filed 18 May 05; US-Patent-Appl-SN-11-132-976

Report No.(s): PB2007-109173; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A lightweight, small size, high sensitivity gauge for indirectly measuring displacement or absolute gap width by measuring axial strain in an orthogonal direction to the displacement/gap width. The gap gauge includes a preferably titanium base having a central tension bar with springs connecting opposite ends of the tension bar to a pair of end connector bars, and an elongated bow spring connected to the end connector bars with a middle section bowed away from the base to define a gap. The bow spring is capable of producing an axial strain in the base proportional to a displacement of the middle section in a direction orthogonal to the base. And a strain sensor, such as a Fabry-Perot interferometer strain sensor, is connected to measure the axial strain in the base, so that the displacement of the middle section may be indirectly determined from the measurement of the axial strain in the base.

NTIS

*Fiber Optics; Measuring Instruments; Patent Applications*

**20080022256** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Laser Metrology Sensing and Control for Large Segmented-Mirror Telescopes**

Zhao, Feng; Rao, Shanti; Ksendzov, Alex; Kadogawa, Hiroshi; May 30, 2006; 20 pp.; In English; Original contains color illustrations

Report No.(s): SPIE 6267-81; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40796>

Described an optical hexapod metrology concept: a) Can work together with edge sensors; b) Can measure M1 - M2 distance and M1 global curvature. Swept-frequency laser metrology system: a) Absolute optical path length measurement (approx.1 micron); b) Relative optical path length measurement (approx.nm) Air turbulence is a concern for ground-based telescopes and needs further study.

Derived from text

*Lasers; Metrology; Segmented Mirrors; Telescopes; Optical Paths*

## 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*.

**20080021217** National Inst. of Aerospace, Hampton, VA, USA; NASA Langley Research Center, Hampton, VA, USA

**Experimental Validation of the Piezoelectric Triple Hybrid Actuation System (TriHYBAS)**

Xu, Tian-Bing; Jiang, Xiaoning; Su, Ji; May 14, 2008; 4 pp.; In English; U.S. Navy Workshop on Acoustic Transduction Materials and Devices, 13-15 May 2008, State College, PA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.07.07; Copyright; Avail.: CASI: [A01](#), Hardcopy

A piezoelectric triple hybrid actuation system (TriHYBAS) has been developed. In this brief presentation of the validation process the displacement profile of TriHYBAS and findings regarding displacement versus applied voltage are highlighted.

Derived from text

*Piezoelectricity; Displacement; Electric Potential*

**20080021760** Lathrop and Gage, LC, Boulder, CO, USA

**Thin-Film Electrochemical Devices on Fibrous or Ribbon-Like Substrates and Method for Their Manufacture and Design**

Neudecker, B. J., Inventor; Lanning, B., Inventor; Armstrong, J. H., Inventor; Benson, M. H., Inventor; Emerson, B. K., Inventor; 16 Jul 04; 28 pp.; In English

Contract(s)/Grant(s): ONR-N00014-00-C-0479

Patent Info.: Filed Filed 16 Jul 04; US-Patent-Appl-SN-10-893-664

Report No.(s): PB2007-109287; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The fabrication of functional thin-film patterns, such as solid-state thin-film batteries on substrates having fibrous, or



ribbon-like or strip-like geometry is disclosed. The present invention relates additionally to the design and manufacture of multiple-layer and multi-function thin films.

NTIS

*Thin Films; Fabrication; Electrochemical Capacitors; Substrates*

**20080021784** Fish and Neave IP Group, Ropes, Boston, MA, USA

**Growth of Boron Nanostructures with Controlled Diameter**

Pfefferle, L., Inventor; Ciuparu, D., Inventor; 13 Dec 04; 12 pp.; In English

Contract(s)/Grant(s): CHE-0335218

Patent Info.: Filed 13 Dec 04; US-Patent-Appl-SN-11 011 504

Report No.(s): PB2007-109155; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A process for growth of boron-based nanostructures, such as nanotubes and nanowires, with a controlled diameter and with controlled chemical (such as composition, doping) as well as physical (such as electrical and superconducting) properties is described. The boron nanostructures are grown on a metal-substituted MCM-41 template with pores having a uniform pore diameter of less than approximately 4 nm, and can be doped with a Group Ia or Group IIa electron donor element during or after growth of the nanostructure. Preliminary data based on magnetic susceptibility measurements suggest that Mg-doped boron nanotubes have a superconducting transition temperature on the order of 100 K.

NTIS

*Boron; Diameters; Nanostructures (Devices); Nanotubes*

**20080021985** Air Force Research Lab., Edwards AFB, CA USA

**First High Pressure Crystallization and Study of Disorder Modes in Isostructural Dihaloperfluoroethanes (Preprint)**

Olejniczak, Anna; Katrusiak, Andrzej; Vij, Ashwani; May 25, 2007; 19 pp.; In English

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

Report No.(s): AD-A477883; AFRL-PR-ED-JA-2007-289; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A group of isostructural crystals has been identified for a series of 1,2-dihalotetrafluoroethanes  $X(CF_2)_2Y$  ( $X = Br, I; Y = Br, I$ ). 1,2-Dibromotetrafluoroethane ( $BrCF_2CF_2Br$ ), 1,2-diiidotetrafluoroethane ( $ICF_2CF_2I$ ) and 1-bromo-2-iodotetrafluoroethane ( $BrCF_2CF_2I$ ), have been in-situ pressure crystallized in a diamond-anvil cell and their structures determined by X-ray diffraction. All the crystals are monoclinic, space group  $P2_1/n$ , with the midpoint of the C-C bond located at the centre of inversion. The freezing pressures of these compounds have been determined to be 0.80(5) GPa, 0.30(5) GPa and 0.10(5) GPa for  $BrCF_2CF_2Br$ ,  $BrCF_2CF_2I$  and  $ICF_2CF_2I$ , respectively. In the structure of  $ICF_2CF_2I$ , the  $-CF_2-CF_2-$  moiety is orientationally disordered about the intramolecular  $I-I$  axis at 0.16(5) GPa, but it becomes ordered at 0.86(5) GPa. The  $BrCF_2CF_2I$  crystal structure is disordered in a different way: the  $-CF_2-CF_2-$  is ordered but the Br and I atoms are substitutionally disordered with equal occupancies. The  $CF_2BrCF_2Br$  structure is completely ordered. The formation of isostructural crystals by these compounds and different types of molecular disorder can be rationalized by the intermolecular interactions at varied thermodynamical conditions. The cohesion forces in these structures are dominated by  $I-I$ ,  $Br-Br$  and  $(Br/I)-(Br/I)$  contacts, but  $(Br/I)-F$  contacts are considerably shorter in  $BrCF_2CF_2I$  than in  $ICF_2CF_2I$  and  $BrCF_2CF_2Br$ .

DTIC

*Crystallization; High Pressure; Molecular Interactions; Order-Disorder Transformations; X Ray Diffraction*

**20080021999** Adam Mickiewicz Univ., Poznan, Poland

**Halogen Oxygen Interactions and Disorder Modes in Pressure Frozen Complexes of 1,2-Dihaloperfluoroethanes with 1,4-Dioxane (Preprint)**

Olejniczak, Anna; Katrusiak, Andrzej; May 17, 2007; 17 pp.; In English

Contract(s)/Grant(s): FA8655-06-1-3039; Proj-2303

Report No.(s): AD-A477923; AFRL-PR-ED-JA-2007-288; No Copyright; Avail.: Defense Technical Information Center (DTIC)

1,2-Diiodo-, 1,2-dibromo- and 1-bromo-2-iodoperfluoroethanes in 1:1 mixtures with 1,4-dioxane were pressure frozen in a diamond-anvil cell. Structures of cocrystal of 1,2-diiodoperfluoroethane: 1,4-dioxane at 0.30(5) GPa/296(2) K and of 1-bromo-2-iodoperfluoroethane: 1,4-dioxane at 0.62(5) GPa/296 K were determined by single-crystal X-ray diffraction. Also the single-crystal of 1,4-dioxane separated from 1,2-dibromoperfluoroethane, which remained liquid, was investigated at 0.42

GPa/296 K. The cocrystal of ICF<sub>2</sub>CF<sub>2</sub>I:C<sub>4</sub>H<sub>8</sub>O<sub>2</sub> and the 1,4-dioxane crystals are isostructural with their phases frozen by cooling; the BrCF<sub>2</sub>CF<sub>2</sub>I:C<sub>4</sub>H<sub>8</sub>O<sub>2</sub> cocrystal has not been reported earlier. In the structure of ICF<sub>2</sub>CF<sub>2</sub>I:C<sub>4</sub>H<sub>8</sub>O<sub>2</sub> the -CF<sub>2</sub>-CF<sub>2</sub>-moiety is disordered about the I...I molecular axis and the C<sub>4</sub>H<sub>8</sub>O<sub>2</sub> molecule rotates about the O...O molecular axis too; and in BrCF<sub>2</sub>CF<sub>2</sub>I:C<sub>4</sub>H<sub>8</sub>O<sub>2</sub> the Br and I atoms are disordered in this way and they possess the same position with half occupancy, but the molecule of C<sub>4</sub>H<sub>8</sub>O<sub>2</sub> is ordered in this complex, and it is also ordered in the structure of the single crystal obtained from the BrCF<sub>2</sub>CF<sub>2</sub>Br:C<sub>4</sub>H<sub>8</sub>O<sub>2</sub> mixture.

DTIC

*Crystallization; Halogens; Molecular Dynamics; Oxygen*

## 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*.

**20080021749** Fermi National Accelerator Lab., Batavia, IL, USA

**Exclusive e+e-, Di-photon and Di-jet Production at the Tevatron**

Terashi, K.; January 2006; 4 pp.; In English

Report No.(s): DE2007-908686; FERMILAB-CONF-07-148-E; No Copyright; Avail.: Department of Energy Information Bridge

Results from studies on exclusive production of electron-positron pair, di-photon, and di-jet production at CDF in proton-antiproton collisions at the Fermilab Tevatron are presented. The first observation and cross section measurements of exclusive e<sup>(sup +)</sup>e<sup>(sup -)</sup> and di-jet production in hadron-hadron collisions are emphasized.

NTIS

*Photons; Particle Accelerators; Electrons; Positrons; Particle Collisions; Proton-Antiproton Interactions*

## 81

### ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**20080021182** NASA Glenn Research Center, Cleveland, OH, USA

**Seven Key Principles of Program and Project Success: A Best Practices Survey**

Bilardo, Vincent J.; Korte, John J.; Dankhoff, Walter; Langan, Kevin; Branscome, Darrell R.; Fragola, Joseph R.; Dugal, Dale J.; Gormley, Thomas J.; Hammond, Walter E.; Holloper, James J.; Sweet, Randall E.; April 2008; 39 pp.; In English; NASA APPEL Project Management Challenge Conference, 6-7 Feb. 2007, Galveston, TX, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 136905.10.10.80.20.10

Report No.(s): NASA/TM-2008-214692; E-15880; Copyright; Avail.: CASI: [A03](#), Hardcopy

The National Aeronautics and Space Administration (NASA) Organization Design Team (ODT), consisting of 20 seasoned program and project managers and systems engineers from a broad spectrum of the aerospace industry, academia, and government, was formed to support the Next Generation Launch Technology (NGLT) Program and the Constellation Systems Program. The purpose of the ODT was to investigate organizational factors that can lead to success or failure of complex government programs, and to identify tools and methods for the design, modeling, and analysis of new and more-efficient program and project organizations. The ODT conducted a series of workshops featuring invited lectures from seasoned program and project managers representing 25 significant technical programs spanning 50 years of experience. The result was the identification of seven key principles of program success that can be used to help design and operate future program organizations. This paper presents the success principles and examples of best practices that can significantly improve the design of program, project, and performing technical line organizations, the assessment of workforce needs and organization performance, and the execution of programs and projects.

Author

*NASA Programs; Constellation Program; Design Analysis; Range (Extremes); Launching*

**20080021368** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

**Analysing Operational Effects**

Duistermaat, M.; Vink, N.; Smeenk, B. J. E.; Cleophas, P. L. H.; Barbier, R. R.; Gouweleeuw, R. G. W.; September 2007; 55 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): V215; 032.10177

Report No.(s): TNO-DV 2007 A200; TD2007-0103; Copyright; Avail.: Other Sources

Because the effects of the current missions are not easy to define and measure, there is a need for guidelines on how to determine if, and how own operations contribute to the desired effects. To offer these guidelines, a framework has been set up in order to support the analyst in determining the operational effectiveness of military units. The framework helps the analyst in answering the following questions. What effects are meant to be achieved in the area of operation? Which tasks will be performed in order to achieve these effects? How can be measured if the desired effects are actually achieved? How can be measured if, and how the own operations have contributed to the achieved effect? Besides the set up of the framework, a case has been worked out to test the usefulness of the framework in a realistic scenario. The experiences that have been gained with the use of the framework in practice, on staff level in theatre), are also described. And finally, the level in the organisation (from staff level to the level of small units) on which this effects based thinking (in which the desired effect is the key issue) can be applied is discussed.

Author

*System Effectiveness; Military Operations; Procedures*

**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*.

**20080020583** National Archives and Records Service, Washington, DC USA

**Improving Declassification**

Dec 2007; 49 pp.; In English

Report No.(s): AD-A477270; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Understanding history is essential in a democracy. Without such an understanding, the public cannot know which candidates to vote for or which policies to support. They cannot judge the best course for the country. Without historic understanding, the mistakes of the past are destined to be repeated; the triumphs, unappreciated. Yet, the public cannot always be told all that its Government is doing. To do so would reveal information that might harm the country's interests. Diplomatic problems might be created, military capabilities could be undermined, or the ability to gather information about threats to security might be damaged. To protect sensitive information, the U.S. Government, like other democratic Governments, has established a classification system whereby such information is identified, marked, handled, and stored in a manner designed to prevent its unauthorized disclosure. For the most part, the public has accepted, and continues to accept, the need for such controls on information. At the same time, the public believes its Government often keeps information classified longer than it needs to be. Eventually, all classified information will lose its potential to cause serious and demonstrable harm to U.S. security interests should it be disclosed. It might take 100 days for this to happen, or it might take 100 years, but eventually events, circumstances, and the passage of time will erode the reason for restricting access to the information. The public expects the Government to make its best effort to ascertain the point when this occurs and to make historically significant information available. Declassified information, whenever made available, is often important essential, in fact to understanding the decisions and actions taken at crucial junctures in the country's history. History, after all, is cumulative: it has no finality.

DTIC

*Classifications; Histories; Governments; Voting*

**20080021405** Air Univ., Maxwell AFB, AL USA

**It's Mine! Why the US Intelligence Community Does Not Share Information**

Green, Andrew W; Jul 2005; 77 pp.; In English

Report No.(s): AD-A477000; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477000>

No abstract available

*Intelligence; Information Systems*

**20080021455** National Archives and Records Service, Washington, DC, USA  
**FRC (Federal Records Centers) Toolkit: Your Guide to Federal Records Center Services**  
January 2007; 28 pp.; In English  
Report No.(s): PB2007-112483; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This FRC Toolkit is intended to serve as a resource for Federal employees with records management responsibilities. It provides step-by-step instructions for transferring, retrieving, and returning records to a Federal Records Center as well as information on records disposition and accession of records into the National Archives at the end of their retention schedule. It also provides definitions of key terms, which are highlighted throughout the document.

NTIS

*Management Planning; Records Management*

**20080021538** North Carolina Agricultural and Technical State Univ., Greensboro, NC USA  
**Developing a Taxonomy of Characteristics and Features of Collaboration Tools for Teams in Distributed Environments**  
Xu, Jinsheng; Sep 2007; 106 pp.; In English  
Contract(s)/Grant(s): FA8650-06-1-6741; Proj-1123  
Report No.(s): AD-A477518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Collaboration refers to all processes where people work together to achieve results. With the advent of computers and the Internet, many collaboration tools have emerged. Synchronous collaboration tools require a team to work at the same time. Asynchronous tools allow a team to work at different times. This final report investigates the available features of these tools, the meanings of these features, identifies common and key features, and develops a taxonomy based on these features. The PI and the team did an extensive market survey of collaboration tools. To gain first hand experience, the PI and team installed and tested nine synchronous collaboration tools and nine asynchronous collaboration tools. This final report consists of three parts: surveying synchronous collaboration tools, surveying asynchronous collaboration tools, and developing a working taxonomy of collaboration tools.

DTIC

*Software Development Tools; Taxonomy*

**20080021556** Yale Univ., New Haven, CT USA  
**Development of a Test Battery to Assess Mental Flexibility Based on Sternberg's Theory of Successful Intelligence**  
Matthew, Cynthia T; Beckman, Jens F; Sternberg, Robert J; Jan 2008; 110 pp.; In English  
Contract(s)/Grant(s): DASW01-03-K-0001; Proj-B74F  
Report No.(s): AD-A477193; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA477193>

A test battery to assess mental flexibility was developed based on Sternberg's theory successful intelligence (1985). New mental flexibility assessment instruments were developed and underwent formative and summative evaluation. The newly developed mental flexibility tests showed adequate reliability, and preliminary evidence of construct- and criterion-related validity. One mental flexibility factor explained 70% of variance in the test battery and was differentiated from the latent factor underlying divergent and convergent measures of fluid intelligence. Preliminary evidence of incremental criterion-related validity was found, suggesting that the mental flexibility test battery explains variance above and beyond divergent and convergent measures of fluid intelligence in criterion measures.

DTIC

*Electric Batteries; Flexibility; Intelligence*

**20080021734** Massachusetts Inst. of Tech., Cambridge, MA, USA; National Marine Fisheries Service, Woods Hole, MA, USA  
**Geographic Information Systems and Ocean Mapping in Support of Fisheries Management. Poster Abstract From the Conference on April 11, 2006**  
Adams, C.; Apr. 11, 2006; 148 pp.; In English  
Contract(s)/Grant(s): NOAA-NA86RG0074  
Report No.(s): PB2007-109579; MITSG-07-6; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The importance of ocean mapping to support the management of living marine resources, conserve habitats, and protect biodiversity has been thoroughly reviewed and promoted by government organizations and independent commissions (e.g. U.S. Commission on Ocean Policy, NOAA Fisheries Service, and Pew Oceans Commission). The need to coordinate mapping

initiatives has motivated the Massachusetts Institute of Technology Sea Grant College Program and the NOAA/NMFS Northeast Fisheries Science Center to convene this conference. In recent years, advances in collecting oceanographic data, new applications of ocean mapping, and expanding digital communication technologies have provided many new opportunities to integrate vast amounts of information in managing natural resources. This conference will focus attention on the areas where communication can facilitate data integration, so that marine resource scientists and managers can better utilize emerging technologies to make accurate, informed decisions.

NTIS

*Data Integration; Fisheries; Geographic Information Systems; Ocean Bottom; Oceans*

**20080021790** Government Accountability Office, Washington, DC, USA

**Information Technology: FBI Following a Number of Key Acquisition Practices on New Case Management System, but Improvements Still Needed**

Jul. 2007; 61 pp.; In English

Report No.(s): PB2007-113042; GAO-07-912; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The Sentinel program is intended to replace and expand on the Federal Bureau of Investigation's (FBI) failed Virtual Case File (VCF) project and thereby meet the bureau's pressing need for a modern, automated capability to support its field agents and intelligence analysts' investigative case management and information sharing requirements. Because of the FBI's experience with VCF and the importance of Sentinel to the bureau's mission operations, GAO was asked to conduct a series of reviews on the FBI's management of Sentinel. This review focuses on the FBI's (1) use of effective practices for acquiring Sentinel and (2) basis for reliably estimating Sentinel's schedule and costs. To address its objectives, GAO researched relevant best practices, reviewed FBI policies and procedures, program plans and other program documents, and interviewed appropriate program officials. The FBI is managing its Sentinel program according to a number of key systems acquisition best practices. For example, the FBI has followed best practices when soliciting offers from contractors to lead the development of Sentinel; it has also followed the practices in evaluating the offers and making a contract award decision.

NTIS

*Information Systems; Management Systems; Procedures*

**20080021794** Government Accountability Office, Washington, DC, USA

**Information Management: The National Archives and Records Administration's Fiscal Year 2007 Expenditure Plan**

Jul. 2007; 46 pp.; In English

Report No.(s): PB2007-113030; GAO-07-987; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Since 2001, the National Archives and Records Administration (NARA) has been working to acquire the Electronic Records Archives (ERA) system. As required by law, the agency submitted its fiscal year 2007 expenditure plan to congressional appropriations committees, seeking the release of \$23.4 million for the development of the system. GAO's objectives in reviewing the expenditure plan were to (1) determine the extent to which the expenditure plan satisfied the legislative conditions specified in the appropriations act; (2) determine the extent to which NARA has implemented GAO's prior recommendations; and (3) provide any other observations about the expenditure plan and the ERA acquisition. GAO reviewed the expenditure plan and analyzed it against the legislative conditions and assessed NARA's progress in addressing prior recommendations. In May 2007, GAO briefed staff of the Senate subcommittee and sent a copy of the briefing to the House and Senate subcommittee staffs.

NTIS

*Documents; Information Management; Management; Records Management*

**20080021802** New York Univ., New York, NY USA

**Improving Information Extraction and Translation Using Component Interactions**

Ji, Heng; Jan 2008; 163 pp.; In English

Contract(s)/Grant(s): HR0011-06-C-0023; NSF-IIS- 00325657

Report No.(s): AD-A477326; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477326>

The traditional natural language processing (NLP) pipeline incorporates multiple stages of linguistic analysis. Although errors are typically compounded through the pipeline, it is possible to reduce the errors in one stage by harnessing the results of the other stages. This thesis presents a new framework based on component interactions to approach this goal. The new framework applies all stages in a suitable order, with each stage generating multiple hypotheses and propagating them through



the whole pipeline. The feedback from subsequent stages is then used to enhance the target stage by re-ranking these hypotheses and producing the best analysis. The effectiveness of this framework has been demonstrated by substantially improving the performance of Chinese and English entity extraction and Chinese-to-English entity translation. The inference knowledge includes monolingual interactions among information extraction stages such as name tagging, coreference resolution, relation extraction, and event extraction, as well as cross-lingual interaction between information extraction and machine translation. Such symbiosis of analysis components allows the author to incorporate information from a much wider context, spanning the entire document and even going across documents, and to utilize deeper semantic analysis. It will therefore be essential for the creation of a high-performance NLP pipeline.

DTIC

*Data Processing; Extraction; Machine Translation; Natural Language (Computers); Natural Language Processing; Translating*

**20080021806** Naval Health Research Center, San Diego, CA USA

**Tactical Medical Coordination System (TacMedCS)**

Williams, Diane; Nov 6, 2007; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-9162

Report No.(s): AD-A477535; NHRC-07-91; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477535>

The Tactical Medical Coordination System (TacMedCS) provides rapid casualty identification under adverse conditions, enables visibility of casualty status from the point of injury through medical treatment in higher echelons of care, maintains an electronic treatment record for the patient, utilizes non-physical-contact data transmission and storage media, and uplinks casualty information to a theater information network. Additionally, the current version of TacMedCS provides information to the corpsman in the field about patient location and status using a stand-alone handheld device. This mature prototype (DoD Technology Readiness Level 7) was tested at Fleet Hospital 3 during Operation Iraqi Freedom in 2003, shipboard in the Health Services Support Exercise in 2004, in Coalition Warrior Interoperability Demonstration 2005 where it was determined to be a top performer, and during several Limited Technology Assessments conducted at the Marine Corps Warfighting Laboratory. Near real-time awareness of casualty status and location will allow medical personnel to respond with needed evacuation resources and will facilitate planning for the treatment of incoming casualties by more quickly identifying the resources required to treat specific injury types and severity, while providing medical managers with advanced situational awareness.

DTIC

*Biomedical Data; Casualties; Coordination; Information Systems; Injuries; Medical Services; Patients; Radio Frequencies*

**20080021839** Naval Research Lab., Washington, DC USA

**1980 Naval Research Laboratory Review**

Henifin, E E; Jul 1, 1981; 233 pp.; In English

Report No.(s): AD-A477655; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477655>

This NRL Review is a review of the major unclassified research and development efforts and accomplishments of the Naval Research Laboratory (NRL) during 1980. As such, it is an important source document for other Navy and DoD organizations, academia, and industry, and has been since its inception in 1967. NRL's principal task is the development and orderly flow of research results for Navy applications and technology transfer. The Laboratory interacts strongly with science and technology performers and users both in and outside of the Navy and the Department of Defense. Readership response indicates that the Review plays a significant role in the success of this information exchange. The Review also provides part of the comprehensive record of Laboratory accomplishments for archival purposes. It has been nearly six decades since the Naval Research Laboratory opened its doors of science for the Navy and the nation. In the past 57 years, NRL has grown from a handful of small buildings to a complex of specialized laboratories housed in some 150 buildings along the banks of the Potomac River in Washington, D.C. with field stations located in Maryland, Florida, Virginia, and West Virginia.

DTIC

*Data Processing; Laboratories*

**20080021881** Massachusetts Univ., Amherst, MA USA

**Extraction of Key Words from News Stories**

Nallapati, Ramesh; Allan, James; Mahadevan, Sridhar; Jan 2004; 7 pp.; In English

Contract(s)/Grant(s): N66001-99-1-8912; N66001-02-1-8903

Report No.(s): AD-A477769; CIIR-TR-IR-345; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477769>

In this work, we consider the task of extracting key-words such as key-players, key-locations, key-nouns and key-verbs from news stories. We cast this problem as a classification problem wherein we assign appropriate labels to each word in a news story. We considered statistical models such as naive Bayes model, hidden Markov model and maximum entropy model in our work. We have also experimented with various features. Our results indicate that a maximum entropy model that ignores contextual features and considers only word-based features combined with stopping and stemming yields the best performance. We found that extraction of keyverbs and key-nouns is a much harder problem than extracting keyplayers and key-locations.

DTIC

*Extraction; Indexes (Documentation); Information Retrieval; Subjects*

**20080021911** Library of Congress, Washington, DC USA

**Defense Research: A Primer on the Department of Defense's Research, Development, Test and Evaluation (RDT&E) Program**

Moteff, John D; Jul 14, 1999; 18 pp.; In English

Report No.(s): AD-A477855; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477855>

This report describes the basic elements and issues of the Department of Defense's (DOD) Research, Development, Test and Evaluation (RDT&E) Program. It defines basic activities supported by the program, presents budget trends, discusses the management of program, and describes the infrastructure in which the program is implemented. This report is for staff new to the area of defense research and for senior staff interested in historical trends. This report will be updated periodically. For tracking congressional action on the current year's budget, the reader is referred to the Issue Brief entitled Defense Research: DOD's Research, Development, Test and Evaluation (RDT&E) Program, by the same author.

DTIC

*Evaluation; System Effectiveness*

**20080021986** Massachusetts Univ., Amherst, MA USA

**Studies in the Use of Color for Image Indexing and Retrieval in Specialized Databases**

Das, Madirakshi; Sep 2001; 166 pp.; In English

Contract(s)/Grant(s): F19628-95-C-0235; ARPA ORDER-D468

Report No.(s): AD-A477886; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The content of an image is often associated with the main object(s) present in an image. Therefore, for effective content-based retrieval, the database images need to be indexed by features extracted from the object of interest, ignoring any irrelevant image background. In this work, we propose content-based retrieval strategies focusing on the use of color-based features for specialized image domains where the performance of general-purpose color image retrieval techniques is poor. The retrieval performance is improved by taking the special characteristics of the domain into account to extract the object of interest when possible, or capture the properties of the important objects present in an image when it is not possible to extract an object of interest a priori. Three test domains are selected which have very different characteristics requiring different retrieval strategies.

DTIC

*Color; Data Bases; Data Retrieval; Images; Information Retrieval*

**20080021995** Massachusetts Univ., Amherst, MA USA

**Retrieving Historical Manuscripts Using Shape**

Rath, Toni M; Lavrenko, Victor; Manmatha, R; Jan 2003; 10 pp.; In English

Contract(s)/Grant(s): N66001-02-1-8903

Report No.(s): AD-A477913; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Convenient access to handwritten historical document collections in libraries generally requires an index, which allows

one to locate individual text units (pages, sentences, lines) that are relevant to a given query (usually provided as text). Currently, extensive manual labor is used to annotate and organize such collections, because handwriting recognition approaches provide only poor results on old documents. In this work, we present a novel retrieval approach for historical document collections, which does not require recognition. We assume that word images can be described using a vocabulary of discretized word features. From a training set of labeled word images, we extract discrete feature vectors, and estimate the joint probability distribution of features and word labels. For a given feature vector (i.e. a word image), we can then calculate conditional probabilities for all labels in the training vocabulary. Experiments show that this relevance-based language model works very well with a mean average precision of 89% for 4-word queries on a subset of George Washington's manuscripts. We also show that this approach may be extended to general shapes by using the same model and a similar feature set to retrieve general shapes in two different shape datasets.

DTIC

*Handwriting; Histories; Information Retrieval; Models; Probability Theory; Shapes; Words (Language)*

**20080022015** Defense Personnel Security Research Centre, Monterey, CA USA

**New Resources for Collecting Psychological Conditions Information**

Lang, Eric L; Nelson, Leissa C; Hayes, Alissa J; Dec 2007; 67 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A477943; PERS-TR-07-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The report summarizes information about procedures personnel security investigators uses to collect relevant mental health information, outlines current laws and professional guidelines related to the release of such information, and describes difficulties faced by personnel security investigators when collecting this information. Research staff worked with the American Psychiatric Association to develop a resource document that should be useful for mental health care providers for understanding and cooperating with investigators' interview requests. The resource document is available on the Internet at [http://www.psych.org/edu/other\\_res/lib\\_archives/200602.pdf](http://www.psych.org/edu/other_res/lib_archives/200602.pdf) and could be a useful addition to investigators' resource materials.

DTIC

*Collection; Psychological Tests; Resources; Security*

**20080022029** Massachusetts Univ., Amherst, MA USA

**A Probabilistic Approach to Crosslingual Information Retrieval**

Groeting, Philip; Jun 2001; 11 pp.; In English  
Contract(s)/Grant(s): N66001-99-1-8912

Report No.(s): AD-A477981; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a method to translate queries from an arbitrary source language to retrieve documents in a destination language merely with easily obtainable instruments such as a machine readable dictionary and monolingual corpora in both languages. The key is to infer probabilistical information about the query and structuring the destination language terms accordingly. Though the results compare unfavourably with those obtained with more sophisticated but difficult to obtain IR-methods using Part-of-Speech-Tagging and/or Phrase dictionaries, our work shows the successful deployment and combination of related work to crosslingual Information Retrieval.

DTIC

*Algorithms; Information Retrieval; Machine Translation*

**20080022038** Massachusetts Univ., Amherst, MA USA

**A Language Modeling Framework for Selective Query Expansion**

Cronen-Townsend, Steve; Zhou, Yun; Croft, W B; Jan 2004; 10 pp.; In English  
Contract(s)/Grant(s): N66001-02-1-8903

Report No.(s): AD-A478016; UMA-CIIR-IR-338; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Query expansion is a well-known technique that has been shown to improve average retrieval performance. This technique has not been used in many operational systems because of the fact that it can greatly degrade the performance of some individual queries. We show how comparison between language models of the unexpanded and expanded retrieval results can be used to predict when the expanded retrieval has strayed from the original sense of the query. In these cases, the unexpanded results are used while the expanded results are used in the remaining cases (where such straying is not detected). We evaluate this method and others on a wide variety of TREC collections and show how to automatically compute a decision

threshold for a collection. We demonstrate the ability of the method to enhance the effectiveness and reliability of the query expansion technique in information retrieval.

DTIC

*Information Retrieval; Probability Density Functions*

**20080022051** Massachusetts Univ., Amherst, MA USA

**Incorporating Syntactic Information in Question Answering**

Li, Xiaoyan; Croft, W B; Jan 2001; 13 pp.; In English

Contract(s)/Grant(s): N66001-99-1-8912

Report No.(s): AD-A478081; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Syntactic information potentially plays a much more important role in question answering than it does in information retrieval. The aim of the experiment described in this paper is to study the impact of a particular approach for using syntactic information on question answering effectiveness. The TREC-9 QA track data are used in the evaluation. Our results indicate that a combination of syntactic information with heuristics for ranking potential answers can perform about 10% better than the ranking heuristics on their own.

DTIC

*Heuristic Methods; Information Retrieval; Syntax*

**20080022054** Massachusetts Univ., Amherst, MA USA

**Localized Smoothing for Multinomial Language Models**

Lavrenko, Victor; May 2000; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N66001-99-1-8912

Report No.(s): AD-A478094; UMA-CIIR-IR-222; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We explore a formal approach to dealing with the zero frequency problem that arises in applications of probabilistic models to language. In this report we introduce the zero frequency problem in the context of probabilistic language models, describe several popular solutions, and introduce localized smoothing, a potentially better alternative. We formulate localized smoothing as a two-step maximization process, outline the estimation details for both steps and present the experiments which show the technique to have potential for improving performance.

DTIC

*Data Processing; Smoothing; Texts*

**20080022055** Massachusetts Univ., Amherst, MA USA

**Evaluating a Visual Presentation of Retrieved Documents**

Leuski, Anton; Jan 1999; 10 pp.; In English

Contract(s)/Grant(s): F19628-95-C-0235; ARPA ORDER-D468

Report No.(s): AD-A478099; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we study a visualization system for the purpose of helping the user to locate interesting material in the retrieved data. The system works by placing the documents into 1-, 2-, and 3-dimensional space and positioning them according to the inter-document similarity. We compute the quality of the visualization by simulating a user searching for the relevant material and calculating average precision of that search. We compare the numbers for the visualization with the same measure taken for traditional ranked list. We show that the visualization performs - on average - significantly better than ranked list. We show a significant advantage of multidimensional visualizations over the 1 dimensional one. We also show that the difference between 2 and 3 dimensional visualizations is very small.

DTIC

*Display Devices; Information Retrieval*

**20080022057** Massachusetts Univ., Amherst, MA USA

**Probing a Collection to Discover Its Language Model**

Du, Aiqun; Callan, Jamie; Jan 1998; 21 pp.; In English

Contract(s)/Grant(s): F19628-95-C-0235; ARPA ORDER-D468

Report No.(s): AD-A478103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Most solutions to distributed IR rely on access to a language model for each text collection, but it has been unclear how

the model can be obtained reliably in real-world distributed environments. This paper proposes a solution based upon probing the collection and demonstrates its effectiveness on four databases.

DTIC

*Data Bases; Information Retrieval; Information Systems*

**20080022058** Massachusetts Univ., Amherst, MA USA

**Learning Threshold Parameters for Event Classification in Broadcast News**

Papka, Ron; Jan 1999; 8 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0138; EEC-9209623

Report No.(s): AD-A478104; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we present two methods for automatic threshold parameter estimation for an event tracking algorithm. We view the threshold as a statistic of the incoming data stream, which is assumed to contain broadcast news stories from radio, television, and newswire sources. Query bias defined in terms of threshold estimators can be identified when a word co-occurrence representation for text is used. Our results suggest that both approaches learn bias from training corpora, leading to improved classification accuracy for event tracking applications.

DTIC

*Algorithms; Broadcasting; Classifications; Data Processing; Information Retrieval*

**20080022062** Massachusetts Univ., Amherst, MA USA

**A Fast, Background-Independent Retrieval Strategy for Color Image Databases**

Das, M; Draper, B A; Lim, W J; Manmatha, R; Riseman, E M; Nov 1996; 36 pp.; In English

Contract(s)/Grant(s): F19628-95-C-0235; F30602-94-C-0042

Report No.(s): AD-A478119; CMPSCI-TR-96-79; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe an interactive, multi-phase color-based image retrieval system which is capable of identifying query objects specified by the user in an image in the presence of significant, interfering backgrounds. The system uses a split and merge histogram peak detection technique, efficient indexing and a color neighborhood graph-based refinement phase for removing false matches. The method is fast and has low storage overhead. Good retrieval results are obtained with multi-colored query objects even when they occur in arbitrary sizes, rotations and locations in the database images. The overall scheme is flexible so that one or more phases could be used for retrieval depending on the precision desired. The experimental results on a database of advertisement images highlights the capabilities of the system.

DTIC

*Color; Data Bases; Data Retrieval; Histograms; Image Processing; Information Retrieval*

**20080022064** Massachusetts Univ., Amherst, MA USA

**Comparing Effectiveness in TDT and IR**

Allan, James; Lavrenko, Victor; Jin, Hubert; Jan 2000; 14 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0138

Report No.(s): AD-A478126; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many of the research tasks in Topic Detection and Tracking have counterparts in Information Retrieval research. However, the two research communities evaluate their tasks differently, which makes it very difficult to determine the extent to which they can help each other. In this study, we compare the performance of TDT tracking task to the IR filtering task, and show that they have nearly identical effectiveness. We also show a method for using tracking to predict error rates for the TDT First Story Detection (FSD) task. We then show that FSD performance is what tracking predicts. More importantly, we show that with current approaches, FSD performance has probably reached the limits of effectiveness.

DTIC

*Detection; Information Retrieval; Tracking (Position)*

**20080022065** Massachusetts Univ., Amherst, MA USA

**Improving Efficiency of Indexing by Using a Hierarchical Merge Approach**

Du, Aiqun; Callan, Jamie; Jan 1998; 10 pp.; In English

Contract(s)/Grant(s): F19628-95-C-0235; ARPA ORDER-D468

Report No.(s): AD-A478134; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As electronic collections become larger and more numerous, systems capable of working with very large collections will



be more and more in demand. On the other hand, computer main memory is relatively limited and constrained compared to the amount of data in a large collection. The requirement for larger memory while building big databases can sometimes make this resource a bottleneck for an information indexing system. INQUERY is a state-of-the-art, widely used, full-text information retrieval system. The INQUERY document indexing system consists of two main operations: parsing and merging. The subsystem responsible for parsing is called the Parser. It creates partial inverted lists by scanning, lexically analyzing, and inverting documents. A partial inverted list contains document entries for a subset of the documents in the collection. It must be combined with other partial inverted lists for the same term to create a final inverted list for the document collection. The Parser buffers partial inverted lists in main memory and flushes them to intermediate files when the buffer is full. The subsystem responsible for merging is called the Merger. After all of the documents have been parsed, the Merger combines the intermediate files to produce the final inverted lists for the collection. The aim of this project is to solve the efficiency and scalability problem of the Merger for the INQUERY indexing system. The speed performance of the old Merger (merge\_btl) degrades significantly when used in building big databases under tight memory space limitations. The authors have found a better solution by using a hierarchical merge approach. Timing tests on the new Merger indicates that merge time can be significantly reduced. Hierarchical merge nicely solves the problem of scalability and greatly improves the efficiency of building very large databases for information retrieval systems.

DTIC

*Data Bases; Expert Systems; Indexing (Information Science); Information Retrieval; Texts*

**20080022068** Space and Naval Warfare Systems Center, San Diego, CA USA

**A Statistical Approach to Retrieving Historical Manuscript Images without Recognition**

Rath, Toni M; Lavrenko, Victor; Manmatha, R; Jan 2003; 10 pp.; In English

Contract(s)/Grant(s): N66001-99-1-8912; N66001-02-1-8903

Report No.(s): AD-A478157; CIIR-MM-42; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Handwritten historical document collections in libraries and other areas are often of interest to researchers, students, or the general public. Convenient access to such corpora generally requires an index, which allows one to locate individual text units (pages, sentences, lines) that are relevant to a given query (usually provided as text). Several solutions are possible: manual annotation (very expensive), handwriting recognition (poor results), and word spotting -- an image matching approach (computationally expensive). In this work, the authors present a novel retrieval approach for historical document collections that does not require recognition. They assume that word images can be described using a vocabulary of discretized word features. From a training set of labeled word images, they extract discrete feature vectors, and estimate the joint probability distribution of features and word labels. For a given feature vector (i.e., a word image), they can then calculate conditional probabilities for all labels in the training vocabulary. Experiments show that this relevance-based language model works very well with a mean average precision of 89% for 4-word queries on a subset of George Washington's manuscripts.

DTIC

*Handwriting; Histories; Images; Information Retrieval; Statistical Analysis; Words (Language)*

**20080022079** Massachusetts Univ., Amherst, MA USA

**On-Line New Event Detection, Clustering, and Tracking**

Papka, Ron; Sep 1999; 170 pp.; In English

Report No.(s): AD-A478204; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this work, we discuss and evaluate solutions to text classification problems associated with the events that are reported in on-line source of news. We present solutions to three related classification problems: new event detection, event clustering, and event tracking. The primary focus of this thesis is new event detection, where the goal is to identify news stories that have not previously reported, in a stream of broadcast news comprising radio, television, and newswire. We present an algorithm for new event detection, and analyze the effects of incorporating domain properties into the classification algorithm. We explore a solution that models the temporal relationship between news stories, and investigate the use of proper noun phrase extraction to capture the who, what, when, and where contained in news. Our results for new event detection suggest that previous approaches to document clustering provide a good basis for an approach to new event detection, and that further improvements to classification accuracy are obtained when the domain properties of broadcast news are modeled. New event detection is related to the problem of event clustering, where the goal is to group stories that discuss the same event. We investigate on-line clustering as an approach to new event detection, and re-evaluate existing cluster comparison strategies previously used for document retrieval. Our results suggest that these strategies produce different groupings of events, and that the on-line single-link strategy extended with a model for domain properties is faster and more effective than other approaches. In this dissertation, we explore several test representation issues in the context of event tracking, where a classifier for an event

is formulated from one or more sample stories. The classifier is used to monitor the subsequent news stream for documents related to the event.

DTIC

*Data Processing; Detection; On-Line Systems; Texts; Tracking (Position)*

**20080022133** Department of the Army, Washington, DC USA

**External Storage Structure**

Hansen, David M, Inventor; May 26, 2004; 8 pp.; In English

Report No.(s): AD-D020324; PATENT-7 225 958 B2; No Copyright; Avail.: US Patent and Trademark Office

A storage container system for mounting a storage box on the exterior of a vehicle has trapezoidal members attached to the vehicle that mate with and hold U-shaped members mounted on the container to be carried. The system has a handle mounted on the box which holds the U-shaped member in contact with the trapezoidal member when the box is in a locked position for vehicle movement and a tab that will partially separate the U-shaped member from the trapezoidal member when the handle is rotated.

DTIC

*External Stores; Patents*

**20080022261** Defence Science and Technology Organisation, Edinburgh, Australia

**The Use of Metadata Visualisation Assist Information Retrieval**

McCormac, Agata; Parsons, Kathryn; Butavicius, Marcus; Oct 2007; 34 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478112; DSTO-TR-2057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Metadata is descriptive information about data, which can be used to manage locate or retrieve information. Although tabular presentations of metadata can be extremely useful, the exploitation of such information may be improved by visualisation. There are a number of information visualisation interfaces available, and many of these utilise metadata. However, on the whole, these approaches have not been objectively evaluated, and there is little information about their validity and reliability. This study analyses some of these techniques, highlighting their strengths and weaknesses, and the areas where further research is required. A study is proposed, in which a simple interface will empirically assess the efficacy of a metadata visualisation technique.

DTIC

*Information Retrieval; Metadata*

**83**

**ECONOMICS AND COST ANALYSIS**

Includes cost effectiveness studies.

**20080021425** Forest Products Lab., Madison, WI USA

**Charge Out: Determining Machine and Capital Equipment Charge-Out Rates Using Discounted Cash-Flow Analysis**

Bilek, T.; May 2007; 35 pp.; In English

Report No.(s): PB2007-112268; FSGTR-FPL-171; No Copyright; Avail.: National Technical Information Service (NTIS)

The model ChargeOut was developed to determine charge-out rates or rates of return for machines and capital equipment. This paper introduces a costing methodology and applies it to a piece of capital equipment. Although designed for the forest industry, the methodology is readily transferable to other sectors. Based on discounted cash-flow analysis, ChargeOut provides more accurate financial outputs than traditional single-period models. ChargeOut produces a break-even charge-out rate that will return any specified after-tax real rate of return over the economic life of the capital equipment. Alternatively, given a negotiated charge-out rate, the model produces net present values and real and nominal rates of return before tax and financing, before tax, and after tax. It also compares the negotiated charge-out rate with the calculated break-even rate, incorporates inflation, accounts for depreciation, and automatically conducts a sensitivity analysis. Graphs illustrate the major cost centers and cash flows. The model is both automated and flexible. Interpretation of ChargeOuts results requires some knowledge of discounted cash-flow analysis. The target audience is financial professionals in the logging industry or equipment owners who have some background in engineering economics. ChargeOut is illustrated using representative data from a logging skidder; however, the methodology could be adapted to find charge-out rates or rates of return for any piece of capital equipment.

NTIS

*Costs; Industries; Equipment*

## SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

**20080021357** NASA Dryden Flight Research Center, Edwards, CA, USA

**Suborbital Science Program: Dryden Flight Research Center**

Vachon, Jacques; May 20, 2008; 10 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080021357>

Dryden Capabilities include: a) Aeronautics history of aircraft developments and milestones; b) Extensive history and experience in instrument integration; c) Extensive history and experience in aircraft modifications; d) Strong background in international deployments; e) Long history of reliable and dependable execution of projects; f) Varied aircraft types providing different capabilities, performance and duration. Program Objectives: Satellite Calibration and Validation. Provide methods to perform the cal/val requirements for Earth Observing System satellites. New Sensor Development: Provide methods to reduce risk for new sensor concepts and algorithm development prior to committing sensors to operations. Process Studies: Facilitate the acquisition of high spatial/temporal resolution focused measurements that are required to understand small atmospheric and surface structures which generate powerful Earth system effects. Airborne Networking: Develop disruption-tolerant networking to enable integrated multiple scale measurements of critical environment features.

Derived from text

*Earth Observing System (EOS); Calibrating; Deployment; Algorithms; High Resolution*

**20080021989** Naval Observatory, Washington, DC USA

**Long-Term Evolution of Orbits About a Precessing Oblate Planet: 3. A Semianalytical and a Purely Numerical Approach**

Gurfil, Pini; Lainey, Valery; Efroimsky, Michael; Nov 2007; 33 pp.; In English

Report No.(s): AD-A477899; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Construction of an accurate theory of orbits about a precessing and nutating oblate planet, in terms of osculating elements defined in a frame associated with the equator of date, was started in Efroimsky and Goldreich (2004) and Efroimsky (2004, 2005, 2006a, b). Here we continue this line of research by combining that analytical machinery with numerical tools. Our model includes three factors: the  $J_2$  of the planet, its nonuniform equinoctial precession described by the Colombo formalism, and the gravitational pull of the Sun. This semianalytical and seminumerical theory, based on the Lagrange planetary equations for the Keplerian elements, is then applied to Deimos on very long time scales (up to 1 billion years). In parallel with the said semianalytical theory for the Keplerian elements defined in the co-precessing equatorial frame, we have also carried out a completely independent, purely numerical, integration in a quasi-inertial Cartesian frame. The results agree to within fractions of a percent, thus demonstrating the applicability of our semianalytical model over long timescales.

DTIC

*Equatorial Orbits; Planets; Precession; Stellar Evolution*

**20080021996** Naval Observatory, Washington, DC USA

**Physics of Bodily Tides in Terrestrial Planets and the Appropriate Scales of Dynamical Evolution**

Efroimsky, Michael; Lainey, Valery; Dec 29, 2007; 12 pp.; In English

Report No.(s): AD-A477918; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Any model of tides is based on a specific hypothesis of how lagging depends on the tidal-flexure frequency  $X$ . For example, Gerstenkorn (1955), MacDonald (1964), and Kaula (1964) assumed constancy of the geometric lag angle  $\delta$ , while Singer (1968) and Mignard (1979, 1980) asserted constancy of the time lag  $\Delta t$ . Thus each of these two models was based on a certain law of scaling of the geometric lag: the Gerstenkorn-MacDonald-Kaula theory implied that  $\delta \sim X(0)$ , while the Singer-Mignard theory postulated  $\delta \sim X(1)$ . The actual dependence of the geometric lag on the frequency is more complicated and is determined by the rheology of the planet. Besides, each particular functional form of this dependence will unambiguously fix the appropriate form of the frequency dependence of the tidal quality factor,  $Q(X)$ . Since at present we know the shape of the function  $Q(X)$ , we can reverse our line of reasoning and single out the appropriate actual frequency dependence of the lag,  $\delta(X)$ : as within the frequency range of our concern  $Q \sim X(\alpha)$ ,  $\alpha = 0.2 - 0.4$ , then  $\delta \sim$

X(-alpha). This dependence turns out to be different from those employed hitherto, and it entails considerable alterations in the timescales of the tide-generated dynamical evolution. Phobos's fall on Mars is an example we consider.

DTIC

*Gravitational Fields; Natural Satellites; Terrestrial Planets; Tides*

**20080022117** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Asynchronous Message Service for Deep Space Mission Operations**

Burleigh, Scott C.; June 22, 2006; 12 pp.; In English; 9th International Conference on Space Operations (SpaceOps, 19-24 Jun. 2006, Rome, Italy; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40802>

AMS is in early stages of standardization. a) CCSDS 'white book' (Proposed Standard) has been published. b) A single implementation has been developed and is being tested. No major obstacles encountered so far. a) Protocol has changed since original concept paper, but not radically. b) Design concepts seem to be sound. AMS capabilities seem to be broadly applicable. a) On-board, proximity, and deep-space communications for spacecraft. b) Suitable underlying messaging protocol for proposed CCSDS Spacecraft Monitor and Control protocols. c) Terrestrial applications designed for operation over a message bus. AMS Working Group within CCSDS is on schedule, so far.

Derived from text

*Deep Space; Messages; Protocol (Computers); Space Missions; Spacecraft Control*

**20080022162** STERIS Corp., Mentor, OH, USA

**Vapor Hydrogen Peroxide as Alternative to Dry Heat Microbial Reduction**

Cash, Howard A.; Kern, Roger G.; Chung, Shirley Y.; Koukol, Robert C.; Barengoltz, Jack B.; July 16, 2006; 20 pp.; In English; 36th Committee on Space Research (COSPAR) Scientific Assembly, 16-23 Jul. 2006, Beijing, China; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40807>

The Jet Propulsion Laboratory, in conjunction with the NASA Planetary Protection Officer, has selected vapor phase hydrogen peroxide (VHP) sterilization process for continued development as a NASA approved sterilization technique for spacecraft subsystems and systems. The goal is to include this technique, with appropriate specification, in NPG8020.12C as a low temperature complementary technique to the dry heat sterilization process. A series of experiments were conducted in vacuum to determine VHP process parameters that provided significant reductions in spore viability while allowing survival of sufficient spores for statistically significant enumeration. With this knowledge of D values, sensible margins can be applied in a planetary protection specification. The outcome of this study provided an optimization of test sterilizer process conditions: VHP concentration, process duration, a process temperature range for which the worst case D value may be imposed, a process humidity range for which the worst case D value may be imposed, and robustness to selected spacecraft material substrates.

Author

*Vapor Phases; Hydrogen Peroxide; Sterilization; Dry Heat; Low Temperature; Planetary Protection; Spores; Humidity; Enumeration*

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

**20080021658** National Optical Astronomy Observatories, Tucson, AZ, USA; National Solar Observatory, Tucson, AZ, USA  
**NOAO/NSO Newsletter: Issue 94**

June 2008; 42 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Science articles in this issue are: 'The Tilted Solar Magnetic Dipole,' 'Watching the Production of Elements in Evolved Stars,' 'The Magellanic Bridge: Tidal Debris in our Backyard,' and 'The NEWFIRM Medium-Band Survey.'

CASI

*Solar Magnetic Field; Stellar Activity; Stellar Winds*

**20080021808** Aerospace Corp., El Segundo, CA USA

**Micrometeoroid and Orbital Debris Environments for the International Space Station**

Gallini, T E; Hackwell, J A; Marin, D C; Zambran, Michael; Peterson, Glenn E; Lynch, David K; Dec 15, 2007; 12 pp.; In English

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A477576; AEROSPACE-TR-2008(8570)-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477576>

Baseline micrometeoroid and orbital debris fluence estimates for spacecraft in low Earth orbit (LEO) are provided. For these calculations, an orbit similar to that of the International Space Station (ISS) is used.

DTIC

*Debris; Earth Orbits; International Space Station; Meteoroids; Micrometeoroids; Space Debris; Space Stations*

**20080021867** Naval Observatory, Washington, DC USA

**CTIO 0.9m Observations of ICRF Optical Counterparts**

Zacharias, Marion I; Zacharias, Norbert; Jan 2007; 3 pp.; In English

Report No.(s): AD-A477733; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477733>

We present astrometric results from 7 observing runs at the Cerro Tololo Interamerican Observatory (CTIO) 0.9m telescope of 197 extragalactic reference frame sources, selected from the original International Celestial Reference Frame (ICRF) catalog. This is part of the U.S. Naval Observatory (USNO) reference frame link program. Contemporaneous to the CTIO deep imaging, wide-field CCD data were taken with the USNO Twin Astrograph to provide accurate secondary reference stars in the 13 to 16 mag range. The optical positions are on the Hipparcos system (via Tycho-2 stars). The unweighted, mean RMS position difference optical-radio for a single source is 28 and 25 mas for RA and Dec, respectively.

DTIC

*Astrometry; Astronomy; Ion Cyclotron Radiation; Plasma Heating; Radio Frequency Heating; Spectral Counterparts (Astronomy)*

**20080022123** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Adaptive Nulling for the Terrestrial Planet Finder Interferometer**

Jeganathan, Muthu; Hirai, Akiko; Lay, Oliver P; Peters, Robert D.; May 24, 2006; 7 pp.; In English; SPIE Astronomical Telescopes and Instrumentation, Advances in Stellar Interferometry, 24 -31 May 2006, Orlando, Florida, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40803>

Deep, stable starlight nulls are needed for the direct detection of Earth-like planets and require careful control of the intensity and phases of the beams that are being combined. We are testing a novel compensator based on a deformable mirror to correct the intensity and phase at each wavelength and polarization across the nulling bandwidth. We have successfully demonstrated intensity and phase control using a deformable mirror across a 100nm wide band in the near-IR, and are in the process of conducting experiments in the mid-IR wavelengths. This paper covers the current results and in the mid-IR.

Author

*Terrestrial Planets; Near Infrared Radiation; Infrared Radiation; Deformable Mirrors; Bandwidth; Broadband; Interferometers*

**20080022165** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Cassini Thermal Observations of Saturn's Main Rings: Implications for Particle Rotation and Vertical Mixing**

Spilker, Linda J.; Pilorz, Stuart H.; Wallis, Brad D.; Pearl, John C.; Cuzzi, Jeffrey N.; Brooks, Shawn M.; Altobelli, Nicolas; Edgington, Scott G.; Showalter, Mark; Flasar, F. Michael; Ferrari, Cecile; July 26, 2006; 10 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40810>; <http://dx.doi.org/10.1016/j.pss.2006.05.033>

In late 2004 and 2005 the Cassini composite infrared spectrometer (CIRS) obtained spatially resolved thermal infrared radial scans of Saturn's main rings (A, B and C, and Cassini Division) that show ring temperatures decreasing with increasing solar phase angle, ( $\alpha$ ), on both the lit and unlit faces of the ring plane. These temperature differences suggest that Saturn's main rings include a population of ring particles that spin slowly, with a spin period greater than 3.6 h, given their low thermal



inertia. The A ring shows the smallest temperature variation with ( $\alpha$ ), and this variation decreases with distance from the planet. This suggests an increasing number of smaller, and/or more rapidly rotating ring particles with more uniform temperatures, resulting perhaps from stirring by the density waves in the outer A ring and/or self-gravity wakes. The temperatures of the A and B rings are correlated with their optical depth, ( $\tau$ ), when viewed from the lit face, and anti-correlated when viewed from the unlit face. On the unlit face of the B ring, not only do the lowest temperatures correlate with the largest ( $\tau$ ), these temperatures are also the same at both low and high  $a$ , suggesting that little sunlight is penetrating these regions. The temperature differential from the lit to the unlit side of the rings is a strong, nearly linear, function of optical depth. This is consistent with the expectation that little sunlight penetrates to the dark side of the densest rings, but also suggests that little vertical mixing of ring particles is taking place in the A and B rings.

Author

*Saturn Rings; Thermal Emission; Cassini Mission; Infrared Spectrometers; Phase Shift; Optical Thickness*

**20080022188** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

### **Terrestrial Planet Finder Coronagraph Optical Modeling**

Basinger, Scott A.; Redding, David C.; Proceedings of SPIE. Space Systems Engineering and Optical Alignment Mechanisms; August 2004; ISSN 0277-786X/04; Volume 5528; 9 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40813>; <http://dx.doi.org/10.1117/12.560507>

The Terrestrial Planet Finder Coronagraph will rely heavily on modeling and analysis throughout its mission lifecycle. Optical modeling is especially important, since the tolerances on the optics as well as scattered light suppression are critical for the mission's success. The high contrast imaging necessary to observe a planet orbiting a distant star requires new and innovative technologies to be developed and tested, and detailed optical modeling provides predictions for evaluating design decisions. It also provides a means to develop and test algorithms designed to actively suppress scattered light via deformable mirrors and other techniques. The optical models are used in conjunction with structural and thermal models to create fully integrated optical/structural/thermal models that are used to evaluate dynamic effects of disturbances on the overall performance of the coronagraph. The optical models we have developed have been verified on the High Contrast Imaging Testbed. Results of the optical modeling verification and the methods used to perform full three-dimensional near-field diffraction analysis are presented.

Author

*Terrestrial Planets; Coronagraphs; Near Fields; Imaging Techniques; Temperature Distribution; Proving*

**20080022192** Massachusetts Inst. of Tech., Cambridge, MA, USA

### **The Sloan Lens ACS Survey. I. A Large Spectroscopically Selected Sample of Massive Early-Type Lens Galaxies**

Bolton, Adam S.; Burles, Scott; Koopmans, Leon V. E.; Treu, Tommaso; Moustakas, Leonidas A.; Astrophysical Journal; February 20, 2006; Volume 638, pp. 703-724; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS5-26555; Program 10174; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40818>; <http://dx.doi.org/10.1086/498884>

The Sloan Lens ACS (SLACS) Survey is an efficient Hubble Space Telescope (HST) Snapshot imaging survey for new galaxy-scale strong gravitational lenses. The targeted lens candidates are selected spectroscopically from the Sloan Digital Sky Survey (SDSS) database of galaxy spectra for having multiple nebular emission lines at a redshift significantly higher than that of the SDSS target galaxy. The SLACS survey is optimized to detect bright early-type lens galaxies with faint lensed sources in order to increase the sample of known gravitational lenses suitable for detailed lensing, photometric, and dynamical modeling. In this paper, the first in a series on the current results of our HST Cycle 13 imaging survey, we present a catalog of 19 newly discovered gravitational lenses, along with nine other observed candidate systems that are either possible lenses, nonlenses, or nondetections. The survey efficiency is thus  $\geq 68\%$ . We also present Gemini 8 m and Magellan 6.5 m integral-field spectroscopic data for nine of the SLACS targets, which further support the lensing interpretation. A new method for the effective subtraction of foreground galaxy images to reveal faint background features is presented. We show that the SLACS lens galaxies have colors and ellipticities typical of the spectroscopic parent sample from which they are drawn (SDSS luminous red galaxies and quiescent MAIN sample galaxies), but are somewhat brighter and more centrally concentrated. Several explanations for the latter bias are suggested. The SLACS survey provides the first statistically significant and

homogeneously selected sample of bright early-type lens galaxies, furnishing a powerful probe of the structure of early-type galaxies within the half-light radius. The high confirmation rate of lenses in the SLACS survey suggests consideration of spectroscopic lens discovery as an explicit science goal of future spectroscopic galaxy surveys.

Author

*Lenses; Photometry; Hubble Space Telescope; Gravitational Lenses; Sky Surveys (Astronomy); Emission Spectra; Image Processing; Imaging Techniques*

**20080022194** California Inst. of Tech., Pasadena, CA, USA

#### **A New Look at Stellar Outflows: Spitzer Observations of the HH 46/47 System**

Noriega-Crespo, Alberto; Morris, Patrick; Marleau, Francine R.; Carey, Sean; Boogert, Adwin; van Dishoeck, Ewine; Evans, Neal J., II; Keene, Jocelyn; Muzerolle, James; Stapelfeldt, Karl; Pontoppidan, Klaus; Lowrance, Patrick; Allen, Lori; Bourke, Tyler L.; *The Astrophysical Journal Supplement Series*; September 2004; Volume 154, pp. 352-358; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 1407; 1224608; NRA0001-ADP-096; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40820>; <http://dx.doi.org/10.1086/422819>

We present the Early Release Observations of the HH 46/47 system and HH 46 IRS 1 source, taken with the three instruments aboard the Spitzer Space Telescope. The optically invisible southwest lobe, driven by the HH 47C bow shock, is revealed in full detail by the Infrared Array Camera (IRAC) images and displays a 'loop'-like morphology. Both of the mid-infrared outflow lobes are narrower than those of CO flow. We believe that the combination of emission by H<sub>2</sub> rotational lines [S(11)-S(4)] and some atomic lines, which fall within the IRAC passbands, are responsible for the bulk of the observed emission, although contributions from the 3.3, 6.2, and 7.7 micron polycyclic aromatic hydrocarbon emission bands cannot be ruled out. Weak spectral features corresponding to these emitters are present in the Infrared Spectrograph spectrum of the HH 47A bow shock. The spectrum of HH 46 IRS 1 shows remarkable similarities to those of high-mass protostars, which include the presence of H<sub>2</sub>O, CO<sub>2</sub>, CH<sub>4</sub>, and possibly NH<sub>3</sub>, CH<sub>3</sub>OH, and ices. The high ice abundances and the lack of signs of thermal processing indicate that these ices in the envelope are well shielded from the powerful outflow and its cavity. Emission from the Bok globule at 24 micron is detected and displays a similar structure to that observed at 8 micron.

Author

*Space Infrared Telescope Facility; Emission Spectra; Infrared Spectra; Infrared Imagery; Protostars; Polycyclic Aromatic Hydrocarbons; Display Devices; Carbon Dioxide; Atomic Spectra*

**20080022195** La Sapienza Univ., Rome, Italy; NASA Goddard Space Flight Center, Greenbelt, MD, USA

#### **Radar Soundings of the Subsurface of Mars**

Picardi, Giovanni; Plaut, Jeffrey J.; Biccari, Daniela; Bombaci, Ornella; Calabrese, Diego; Cartacci, Marco; Cicchetti, Andrea; Clifford, Stephen M.; Edenhofer, Peter; Farrell, William M.; Federico, Costanzo; Frigeri, Alessandro; Gurnett, Donald A.; Hagfors, Tor; Heggy, Essam; Herique, Alain; Huff, Richard L.; Ivanov, Anton B.; Johnson, William T. K.; Jordan, Rolando L.; Kirchner, Donald L.; Kofman, Wlodek; Leuschen, Carlton J.; Nielsen, Erling; Orosei, Roberto, et al.; *Science*; December 23, 2005; Volume 310, No. 5756, pp. 1925-1928; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40823>; <http://dx.doi.org/10.1126/science.1122165>

The martian subsurface has been probed to kilometer depths by the Mars Advanced Radar for Subsurface and Ionospheric Sounding instrument aboard the Mars Express orbiter. Signals penetrate the polar layered deposits, probably imaging the base of the deposits. Data from the northern lowlands of Chryse Planitia have revealed a shallowly buried quasi-circular structure about 250 kilometers in diameter that is interpreted to be an impact basin. In addition, a planar reflector associated with the basin structure may indicate the presence of a low-loss deposit that is more than 1 kilometer thick.

Author

*Mars Atmosphere; Planetary Ionospheres; Ionospheric Sounding; Mars Surface; Mars Express*

90  
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

**20080021304** NASA Langley Research Center, Hampton, VA, USA

**Tropospheric Carbon Monoxide (CO) over Tropical Southeast Asia: Tropospheric Emission Spectrometer (TES) and Atmospheric Chemistry Experiment (ACE) Fourier Transform Spectrometer Measurements: Impact of Fires due to a Moderate El Niño in 2006**

Rinsland, Curtis P.; Luo, Ming; Shephard, Mark; Clerbaux, Cathy; Boone, Chris; Bernath, Peter; Chiou, Linda S.; Coheur, P. F.; January 2007; 22 pp.; In English; Original contains poor quality, truncated or crooked pages

Contract(s)/Grant(s): WBS 281945.02.44.01.04; Copyright; Avail.: Other Sources

High spectral resolution Fourier transform spectrometer measurements of tropospheric carbon monoxide (CO) distributions by the Tropospheric Emission Spectrometer (TES) and the Atmospheric Chemistry Experiment (ACE) show higher mixing ratios over tropical southeast Asia during northern hemisphere autumn 2006 than in the same area and during the same time period in 2005. Both instruments measure 2006 mixing ratios of approx. 200 ppbv (10(exp -9) per unit volume) in the middle troposphere during October 2006 near the time of maximum emissions. The elevated emissions were caused by intense and widespread Indonesian peat and forest fire emissions elevated compared to other years by the impact of a moderate El Niño/Southern Oscillation (ENSO) event, which delayed that year's monsoon season and produced very dry conditions. Moderate Resolution Imaging Spectrometer (MODIS) fire counts covering the region for the two time periods provide evidence that the higher northern hemisphere autumn 2006 tropical CO mixing ratios resulted from fire emissions.

Author

*Atmospheric Chemistry; Carbon Monoxide; Troposphere; Mixing Ratios; MODIS (Radiometry); High Resolution; Spectral Resolution; Fourier Transformation*

**20080021390** Stanford Linear Accelerator Center, Menlo Park, CA, USA; Nicolaus Copernicus Univ., Bartycka, Poland

**Learning about Jets from Observations of Blazars**

Sikora, M.; Madejski, G. M.; May 30, 2007; 4 pp.; In English

Report No.(s): DE2007-908219; SLAC-PUB-12537; No Copyright; Avail.: Department of Energy Information Bridge

Jets, paving their way outward through the inner regions of active nuclei, Compton-interact with the UV radiation from an accretion disc and broad emission line region. We calculate the predicted properties of the resulting spectral signatures of this bulk-Compton process, noting that they are independent on the fractional proton content or kinetic power of the jet, and use the presence or absence of such signatures to put constraints on the structure of jets near their bases.

NTIS

*Blazars; Ultraviolet Radiation; Spectral Signatures; Emission*

**20080021773** Stanford Univ., CA, USA; California Univ., Santa Cruz, CA, USA

**Hadronic Gamma Rays from Supernova Remnants**

Moskalenko, I. V.; Porter, T. A.; Malkov, M. A.; Diamond, P. H.; Jun. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-908759; No Copyright; Avail.: Department of Energy Information Bridge

A gas cloud near a supernova remnant (SNR) provides a target for pp-collisions leading to subsequent x-ray emission through hadronic-decay. The assumption of a power-law ambient spectrum of accelerated particles with index near 2 is usually built into models predicting the spectra of very-high energy (VHE) x-ray emission from SNRs. However, if the gas cloud is located at some distance from the SNR shock, this assumption is not necessarily correct. In this case, the particles which interact with the cloud are those leaking from the shock and their spectrum is approximately monoenergetic with the injection energy gradually decreasing as the SNR ages. The x-ray spectrum resulting from particle interactions with the gas cloud will be flatter than expected, with the cutoff defined by the pion momentum distribution in the laboratory frame. We evaluate the flux of particles escaping from a SNR shock and apply the results to the VHE diffuse emission detected by the HESS at the Galactic centre.

NTIS

*Gamma Rays; Hadrons; Supernova Remnants; High Energy Interactions*

**20080021775** Stanford Univ., CA, USA; California Univ., Santa Cruz, CA, USA

**Gamma-ray Albedo of the Moon**

Moskalenko, I. V.; Porter, T. A.; Jun. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-908753; SLAC-PUB-12565; No Copyright; Avail.: National Technical Information Service (NTIS)

We use the GEANT4 Monte Carlo framework to calculate the x-ray albedo of the Moon due to interactions of cosmic ray (CR) nuclei with moon rock. Our calculation of the albedo spectrum agrees with the EGRET data. We show that the spectrum of x-rays from the Moon is very steep with an effective cutoff around 3 GeV (600 MeV for the inner part of the Moon disc). Since it is the only (almost) black spot in the x-ray sky, it provides a unique opportunity for calibration of x-ray telescopes, such as the forthcoming Gamma Ray Large Area Space Telescope (GLAST). The albedo flux depends on the incident CR spectrum which changes over the solar cycle. Therefore, it is possible to monitor the CR spectrum using the albedo x-ray flux. Simultaneous measurements of CR proton and helium spectra by the Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics (PAMELA), and observations of the albedo x-rays by the GLAST Large Area Telescope (LAT), can be used to test the model predictions and will enable the GLAST LAT to monitor the CR spectrum near the Earth beyond the lifetime of PAMELA.

NTIS

*Albedo; Gamma Rays; Moon; Astrophysics*

**20080021871** Maryland Univ., College Park, MD USA

**An Astrometric Analysis of eta Carinae's Eruptive History Using HST WF/PC2 and ACS Observations**

Dorland, Bryan N; Jul 11, 2007; 270 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477746; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477746>

eta Carinae, estimated to be well over a hundred times more massive and millions of times brighter than our sun, is shrouded in an expanding cloud of gas and debris that was ejected around 1843 during its so-called 'Great Eruption' and surrounded by what appear to be fields of debris from previous eruptions. The fundamental nature of the star is not well understood. Quite basic questions remain, such as is the star a binary? In this dissertation, Hubble Space Telescope (HST) observations spanning nearly a decade and utilizing both the Wide Field/Planetary Camera 2 (WFPC2) and the Advanced Camera for Surveys (ACS) instruments - the most accurate visible imaging data yet taken of eta Carinae - are used to address many fundamental issues. In the first section, HST/ACS data taken during 2003-2005 is used to address the question of binarity. Based on an astrometric analysis of the data, binary reflex motion is detected in the primary and, by combining these results with those of other authors, allows us to derive the physical parameters of the resultant system. In the second section, 1995 WFPC2 and 2003 ACS data are used to make the most precise measurements yet of the debris around the central star. A date of origin is derived for the Homunculus, and a new, much shorter interval for the duration of the Great Eruption. Certain equatorial features, previously associated with an 1890 eruptive event are instead shown to be coeval with the Homunculus features and are thus associated with the Great Eruption. New debris associations outside the Homunculus are identified and their dates of origin are determined, implying eruptive events that preceded the Great Eruption. These results add both significant new insight into our understanding of eta Carinae and its history and introduce important new constraints for any theoretician who seeks to model the star, the Great Eruption, or earlier events.

DTIC

*Astrometry; Stellar Evolution; Variable Stars*

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*.

**20080021392** Lawrence Livermore National Lab., Livermore, CA USA

**Hydrodynamic and Spectral Simulations of HMXB Winds**

Mauche, C. W.; Liedahl, D. A.; Akiyama, S.; Plewa, T.; Apr. 02, 2007; 6 pp.; In English

Report No.(s): DE2007-908113; UCRL-CONF-229626; No Copyright; Avail.: National Technical Information Service (NTIS)

We describe preliminary results of a global model of the radiatively-driven photoionized wind and accretion flow of the

high-mass X-ray binary Vela X-1. The full model combines FLASH hydrodynamic calculations, XSTAR photoionization calculations, HULLAC atomic data, and Monte Carlo radiation transport. We present maps of the density, temperature, velocity, and ionization parameter from a FLASH two-dimensional time-dependent simulation of Vela X-1, as well as maps of the emissivity distributions of the X-ray emission lines.

NTIS

*Hydrodynamics; Simulation; Spectra; X Ray Binaries*

**20080022240** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

### **The Juno Mission to Jupiter**

Grammier, Richard S.; June 7, 2006; 13 pp.; In English; 25th International Symposium on Space Technology and Science, 7 Jun. 2006, Kanazawa, Japan; Original contains color illustrations

Report No.(s): ISTS 2006-o-2-06V; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40780>

Origin: Determine O/H ratio (water abundance) and constrain core mass to decide among alternative theories of origin. Interior: Understand Jupiter's interior structure and dynamical properties by mapping its gravitational and magnetic fields. Atmosphere: Map variations in atmospheric composition, temperature, cloud opacity and dynamics to depths greater than 100 bars at all latitudes. Magnetosphere: Characterize and explore the three-dimensional structure of Jupiter's polar magnetosphere and auroras.

Author

*Space Missions; Jupiter (Planet); Magnetic Fields; Atmospheric Composition; Auroras; Gravitational Fields*

**20080022242** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

### **Trajectory Design of the Lunar Impactor Mission Concept**

Chung, Min-Kun J.; McElrath, Timothy P.; Roncoli, Ralph B.; August 21, 2006; 9 pp.; In English; AIAA/AAS Astroynamics Specialist Conference, 21-26 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40781>

The National Aeronautics and Space Administration (NASA) solicited proposals in 2006 for an opportunity to include a small secondary payload with the launch of the Lunar Reconnaissance Orbiter (LRO) scheduled for October 2008. The cost cap of the proposal was between \$50 and \$80M, and the mass cap was 1,000 kilograms. JPL proposed a Lunar Impactor (LI) concept for this solicitation. The mission objective of LI was to impact the permanently shadowed region of a South polar crater ultimately to detect the presence of water. The detection of water ice would prove to be an important factor on future lunar exploration. NASA Ames Research Center also proposed a similar concept, the Lunar Crater observation and Sensing Satellite (LCROSS), which was selected by NASA for the mission. However, in this paper, the trajectory design of the LI proposed by JPL is considered. Since the LI spacecraft was to be launched on the LRO launch vehicle as a secondary payload, its initial trajectory must be diverted at some later time from the LRO trans-lunar trajectory for the subsequent impact. Several such trajectories have been considered, where each trajectory option fields some specific values for the mission parameters. The mission parameters include the availability of LRO instruments at the time of impact for the observation by LRO, the mission duration, the impact velocity, the impact angle, etc. It is possible for the LI to be deflected with a relatively low delta-V to impact a South polar crater at a reasonable impact velocity and impact angle directly with no delay. However, the instruments on-board LRO may not be ready for observation. Thus, several delayed trajectory options have been considered further. The lunar phase at the time of impact may also play an important factor for observation, especially from Earth. Several lunar flyby trajectory maneuvers have been identified to arrive at the Moon for impact at the desired lunar phase. By using a combination of these successive lunar flyby maneuvers, the impact lunar phase may be adjusted to the desired location. A few such trajectories have been suggested. Also, some attempts have been made to maximize the impact velocity by converting the impact trajectory into a retrograde orbit with respect to Earth. Since these types of trajectories take advantage of the Sun-Earth three-body region to minimize the delta-V, the mission duration is relatively long. A few such trajectories are suggested. Also, an attempt has been made to adjust the lunar impact within a desired time period for the optimum Earth observation for the above trajectories. The mission parameters resulting from each trajectory option above are considered and weighed against the cost and robustness of the mission in a brief summary.

Author

*Impactors; Lunar Exploration; Lunar Orbiter; Lunar Trajectories; Satellite Observation; Earth Observations (From Space); Impact Velocity; Flyby Missions*



**20080022264** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Modeling of Deadbanding DV for the Stardust Earth Return: Calibration, Analysis, Prediction and Performance**

Kennedy, Brian M.; McElrath, Tim; Nandi, Sumita; August 21, 2006; 7 pp.; In English; AIAA/AAS Astrodynamics Specialist Conference and Exhibit, 21-24 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40798>

On January 15th, 2006, 0556 UTC, the Stardust spacecraft released a 42-kg Sample Return Canister (SRC) along a trajectory intended to impact a target on the Air Force Utah Test and Training Range (UTTR), near Dugway, Utah. Assurances of a successful SRC delivery to UTTR depended on identifying (and mitigating, if possible) a myriad of error sources. These sources included atmospheric effects, maneuver execution, Orbit Determination (OD) uncertainties and (Delta)V induced by the firing of the unbalanced Reaction Control System (RCS) thrusters needed for deadband attitude control. Every mm/s in prediction error at the TCM-19 epoch would amount to missing the target by approximately one kilometer. This paper will describe the work performed in analyzing and predicting the levels of (Delta)V caused by the attitude deadbanding, as well as prediction performance.

Author

*Sample Return Missions; Stardust Mission; Errors; Calibrating; Test Ranges; Orbit Determination; Attitude Control*

**92**

**SOLAR PHYSICS**

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 *Space Radiation*.

**20080021262** NASA Langley Research Center, Hampton, VA, USA

**Solar-Terrestrial Coupling Evidenced by Periodic Behavior in Geomagnetic Indexes and the Infrared Energy Budget of the Thermosphere**

Mlynczak, Martin G.; Martin-Torres, F. Javier; Mertens, Christopher J.; Marshall, B. Thomas; Thompson, R. Earl; Kozyra, Janet U.; Remsberg, Ellis E.; Gordley, Larry L.; Russell, James M.; Woods, Thomas; January 2008; 14 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 370544.04.12; Copyright; Avail.: CASI: [A03](#), Hardcopy

We examine time series of the daily global power (W) radiated by carbon dioxide (at 15 microns) and by nitric oxide (at 5.3 microns) from the Earth's thermosphere between 100 km and 200 km altitude. Also examined is a time series of the daily absorbed solar ultraviolet power in the same altitude region in the wavelength span 0 to 175 nm. The infrared data are derived from the SABER instrument and the solar data are derived from the SEE instrument, both on the NASA TIMED satellite. The time series cover nearly 5 years from 2002 through 2006. The infrared and solar time series exhibit a decrease in radiated and absorbed power consistent with the declining phase of the current 11-year solar cycle. The infrared time series also exhibits high frequency variations that are not evident in the solar power time series. Spectral analysis shows a statistically significant 9-day periodicity in the infrared data but not in the solar data. A very strong 9-day periodicity is also found to exist in the time series of daily A(sub p) and K(sub p) geomagnetic indexes. These 9-day periodicities are linked to the recurrence of coronal holes on the Sun. These results demonstrate a direct coupling between the upper atmosphere of the Sun and the infrared energy budget of the thermosphere.

Author

*Solar Cycles; Time Series Analysis; Spectrum Analysis; Infrared Radiation; Carbon Dioxide; Energy Budgets; Periodic Variations*

**20080022193** Arizona Univ., Tucson, AZ, USA

**Solar Wind Stream Interaction Regions without Sector Boundaries**

Neugebauer, M.; Liewer, P. C.; Goldstein, B. E.; Zhou., X.; Steinberg, J. T.; Journal Of Geophysical Research; October 9, 2004; Volume 109; 10 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40819>; <http://dx.doi.org/10.1029/2004JA010456>

During periods of high solar activity when there are many sources of solar wind on the solar disk, a spacecraft occasionally encounters consecutive solar wind streams with the same magnetic polarity. The low-speed wind in the region of interaction between the two streams exhibits many of the same features as, but has some differences from, the low-speed wind that includes crossings of the heliospheric current sheet (HCS) where the direction of the heliospheric magnetic field

reverses. The non-HCS slow wind exhibits many of the same small-scale structures usually associated with the slow wind around the HCS; these include discontinuous stream interfaces and other discontinuities, magnetic holes, and low-entropy structures. These entropy holes do not appear to have the same origin as the plasma sheets observed near the HCS, however. The helium abundances and heavy ion charge states in the non-HCS regions are not significantly different from those in HCS-associated regions. Some of the dynamical properties of the non-HCS regions differ from those found near the HCS; the regions between leading and trailing stream interfaces have a shorter duration or scale size, greater minimum speed, and lower peak and average densities. No correlation could be found between the non-HCS slow wind and visible coronal streamers.

Author

*Solar Wind; Low Speed; Magnetic Field Configurations; Plasma Interactions; Solar Activity; Helium Ions*

## 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.

**20080021621** NASA, Washington, DC, USA

#### **NASA Applied Sciences Program**

Frederick, Martin; Proceedings of the 2004 High Spatial Resolution Commercial Imagery Workshop; January 30, 2006; 25 pp.; In English; See also [20080021597](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation highlights the NASA Applied Sciences Program. The goal of the program is to extend the results of scientific research and knowledge beyond the science community to contribute to NASA's partners' applications of national priority, such as agricultural efficiency, energy management and Homeland Security. Another purpose of the program's scientific research is to increase knowledge of the Earth-Sun system to enable improved predictions of climate, weather, and natural hazards. The program primarily optimizes benefits for citizens by contributing to partnering on applications that are used by state, local and tribal governments.

Derived from text

*NASA Programs; Earth Sciences; Aerospace Sciences*

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