



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

**Scientific and Technical  
Information Program Office**

# **Scientific and Technical Aerospace Reports**

# STAIR

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## NASA STI Program ... in Profile

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

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

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

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

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

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

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

# Introduction

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

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

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

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

## The NASA STI Program

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

Through the NASA Center for AeroSpace Information (CASI), the NASA STI Program acquires, processes, archives, announces, and disseminates both NASA's internal STI and 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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[Subject Term Index](#)

[Personal Author Index](#)

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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 46, NUMBER 15

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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.

**20080023857** NASA Langley Research Center, Hampton, VA, USA

### **Focused Assessment of State-of-the-Art CFD Capabilities for Prediction of Subsonic Fixed Wing Aircraft Aerodynamics**

Rumsey, Christopher L.; Wahls, Richard A.; June 2008; 39 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.20.02

Report No.(s): NASA/TM-2008-215318; L-19484; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023857>

Several recent workshops and studies are used to make an assessment of the current status of CFD for subsonic fixed wing aerodynamics. Uncertainty quantification plays a significant role in the assessment, so terms associated with verification and validation are given and some methodology and research areas are highlighted. For high-subsonic-speed cruise through buffet onset, the series of drag prediction workshops and NASA/Boeing buffet onset studies are described. For low-speed flow control for high lift, a circulation control workshop and a synthetic jet flow control workshop are described. Along with a few specific recommendations, gaps and needs identified through the workshops and studies are used to develop a list of broad recommendations to improve CFD capabilities and processes for this discipline in the future.

Author

*Computational Fluid Dynamics; Aircraft Configurations; Fixed Wings; Aerodynamics; Subsonic Speed; Jet Control; Drag*

**20080025995** General Electric Aircraft Engines, Cincinnati, OH, USA

### **Intelligent Engine Systems: Adaptive Control**

Gibson, Nathan; June 2008; 85 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-01135; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215240; E-16499; No Copyright; Avail.: CASI: A05, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025995>

We have studied the application of the baseline Model Predictive Control (MPC) algorithm to the control of main fuel flow rate (WF36), variable bleed valve (AE24) and variable stator vane (STP25) control of a simulated high-bypass turbofan engine. Using reference trajectories for thrust and turbine inlet temperature (T41) generated by a simulated new engine, we have examined MPC for tracking these two reference outputs while controlling a deteriorated engine. We have examined the results of MPC control for six different transients: two idle-to-takeoff transients at sea level static (SLS) conditions, one takeoff-to-idle transient at SLS, a Bode power command and reverse Bode power command at 20,000 ft/Mach 0.5, and a reverse Bode transient at 35,000 ft/Mach 0.84. For all cases, our primary focus was on the computational effort required by MPC for varying MPC update rates, control horizons, and prediction horizons. We have also considered the effects of these MPC parameters on the performance of the control, with special emphasis on the thrust tracking error, the peak T41, and the sizes of violations of the constraints on the problem, primarily the booster stall margin limit, which for most cases is the lone constraint that is violated with any frequency.

Author

*Adaptive Control; Fuel Flow; Flow Velocity; Turbofan Engines; Engine Control; Algorithms; Predictions*



## 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.

**20080023920** NASA Langley Research Center, Hampton, VA, USA

### **Influence of Finite Span and Sweep on Active Flow Control Efficacy**

Greenblatt, David; Washburn, Anthony E.; [2008]; 44 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 305311.43; Copyright; Avail.: CASI: [A03](#), Hardcopy

Active flow control efficacy was investigated by means of leading-edge and flap-shoulder zero mass-flux blowing slots on a semispan wing model that was tested in unswept (standard) and swept configurations. On the standard configuration, stall commenced inboard, but with sweep the wing stalled initially near the tip. On both configurations, leading-edge perturbations increased  $CL_{max}$  and post stall lift, both with and without deflected flaps. Without sweep, the effect of control was approximately uniform across the wing span but remained effective to high angles of attack near the tip; when sweep was introduced a significant effect was noted inboard, but this effect degraded along the span and produced virtually no meaningful lift enhancement near the tip, irrespective of the tip configuration. In the former case, control strengthened the wingtip vortex; in the latter case, a simple semi-empirical model, based on the trajectory or 'streamline' of the evolving perturbation, served to explain the observations. In the absence of sweep, control on finite-span flaps did not differ significantly from their nominally twodimensional counterpart. Control from the flap produced expected lift enhancement and  $CL_{max}$  improvements in the absence of sweep, but these improvements degraded with the introduction of sweep.

Author

*Active Control; Flow Distribution; Leading Edges; Sweep Effect; Flaps (Control Surfaces); Wing Tips; Angle of Attack*

**20080023980** Cranfield Univ., Cranfield, UK

### **Recent Progress Towards Developing an Insect-Inspired Flapping-Wing Micro Air Vehicle**

Knowles, K; Ansari, S A; Wilkins, P C; Zbikowski, R W; Nov 1, 2007; 13 pp.; In English; Original contains color illustrations Report No.(s): AD-A478668; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Aerodynamic Characteristics; Aerodynamics; Aeroelasticity; Drone Vehicles; Flapping; Insects; Models; Wings*

**20080024011** Galileo Avionica Ronchi dei Legionari, Italy

### **Falco UAV Low Reynolds Airfoil Design and Testing at Galileo Avionica**

Cistriani, Luca; Apr 2007; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478707; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Aerodynamics; Airfoils; Drone Vehicles; Galileo Spacecraft; Surveillance*

**20080024105** NASA Langley Research Center, Hampton, VA, USA

### **Detailed Uncertainty Analysis for Ares I Ascent Aerodynamics Wind Tunnel Database**

Hensch, Michael J.; Hanke, Jeremy L.; Walker, Eric L.; Houlden, Heather P.; June 23, 2008; 19 pp.; In English; 26th AIAA Aerodynamic Measurement Technology & Ground Testing Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 136905.02.04.04.16.04

Report No.(s): AIAA Paper-2008-4259; Copyright; Avail.: CASI: [A03](#), Hardcopy

A detailed uncertainty analysis for the Ares I ascent aero 6-DOF wind tunnel database is described. While the database itself is determined using only the test results for the latest configuration, the data used for the uncertainty analysis comes from four tests on two different configurations at the Boeing Polysonic Wind Tunnel in St. Louis and the Unitary Plan Wind Tunnel at NASA Langley Research Center. Four major error sources are considered: (1) systematic errors from the balance calibration curve fits and model + balance installation, (2) run-to-run repeatability, (3) boundary-layer transition fixing, and (4) tunnel-to-tunnel reproducibility.

Author

*Uncertain Systems; Boundary Layer Transition; Systematic Errors; Aerodynamics; Calibrating*

**20080025108** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Demonstrative Maneuvers for Aircraft Agility Predictions**

Hall, David M; Mar 2008; 112 pp.; In English

Report No.(s): AD-A478854; AFIT/GAE/ENY/08-M13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study was motivated by a need to develop a reliable method of predicting the agility characteristics of various aircraft. To fully investigate the agility of an aircraft, maneuvers which push the limits of an aircraft's maneuvering capabilities must be simulated. In these cases, classic trajectory optimization techniques either require too many assumptions for a realistic solution or require a good guess of the final solution before the problem is even attempted. This study investigated both the utility of pseudospectral optimization methods for robust trajectory optimization as well as the potential for demonstrating differences in aircraft agility characteristics of several specific maneuvers. Three variations of a basic F-16 mathematical model were simulated for various maneuvers specifically designed to demonstrate aircraft maneuvering limits.

DTIC

*Aircraft; Maneuverability; Maneuvers*

**20080025278** National Aero-Space Plane Joint Program Office, Wright-Patterson AFB, OH, USA

**Enabling Technologies Research and Development for the National Aero-Space Plane**

Throckmorton, David A.; July 20, 1989; 9 pp.; In English; AIAA First National Aero-Space Plane Conference, 20-21 Jul. 1989, Dayton, OH, USA; Original contains black and white illustrations

Report No.(s): AIAA Paper-89-5009; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025278>

Fulfillment of the vision of the National Aero-Space Plane (NASP) Program--to build and flight test a horizontal-takeoff, single-stage-to-orbit (SSTO) research vehicle--will result from the achievement of significant advances in the state-of-the-art across the entire spectrum of applicable aerospace technologies. These technology advancements will not be merely 'enhancing' to the design or performance of an aero-space plane, but rather are required to 'enable' the successful design, fabrication, and ultimate flight of such an aircraft. The 'enabling' technologies encompass propulsion, aerodynamics (and the total integration of the propulsion system with the vehicle aerodynamic configuration), computational fluid dynamics, materials and structures, flight systems, and cryogenic fuels. No single technology, of itself, will 'enable' the successful development of an aero-space plane; rather, it is the synergy of advancements in each and every one of these technological disciplines which will ultimately 'enable' that development.

Author

*National Aerospace Plane Program; Research and Development; Aerospace Engineering; Fabrication; Computational Fluid Dynamics; Technology Utilization*

**20080025464** North Carolina State Univ., Raleigh, NC USA

**Numerical Study of Unsteady Low-Reynolds Number Wing Performance**

Gopalathnam, Ashok; McGowan, Gregory Z; Feb 29, 2008; 41 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0265

Report No.(s): AD-A479234; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Unsteady motions of airfoils at low Reynolds numbers were studied computationally using low-order vortex lattice methods and using two high-order methods: a Reynolds Averaged Navier-Stokes code and an Immersed Boundary method. Results from the low-order methods compared well with experimental and computational results in the literature for small reduced amplitudes and frequencies. The high-order methods were compared with experiments on high intensity pitch and plunging motions at Reynolds numbers of 10,000 and 40,000. The pitch (rotation about the quarter chord) and plunge motions were at reduced frequencies of 3.93 and with kinematically equivalent amplitudes of effective angle of attack at the quarter-chord location. For the plunge cases, agreement between computation and experiment was qualitatively excellent and quantitatively acceptable, but for the pitch cases, the wake structure in the experiment was markedly different from that predicted by both computations, which were however similar among one another. In all cases, Reynolds number effects were found to be negligible. On-going research aims to determine the parameters necessary for pitch-plunge equivalence and also resolve the poor experiment-computation agreement for pitch.

DTIC

*Low Reynolds Number; Reynolds Number; Unsteady Aerodynamics; Wings*

**20080025507** Defence Research and Development Canada, Valcartier, Quebec Canada

**Initial Investigation on the Aerodynamic Performance of Flapping Wings for Nano Air Vehicles**

Lesage, F; Hamel, N; Huang, X; Yuan, W; Khalid, M; Zdunich, P; Feb 2008; 166 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479341; DRDC-V-TM-2007-550; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A four year project was approved with the purpose of increasing our understanding of the issues concerning the flight of very small air vehicles using flapping wings. This technical memorandum presents the progress made during the first year of the project. The potential impact of this technology on military operations and R&D is first described. The project plan, as revised during the first year, is presented. It combines the development of an ability to capture detailed flow physics using both a highly accurate Computational Fluid Dynamics (CFD) solution and a tailored experimental facility with an engineering type method. The general characteristics of the target Nano Air Vehicle (NAV) to be studied, such as size, mass and wing motion, were established based on system considerations. Standard test cases in 2D and 3D for simulation and experimentation were set up by applying simplifications and scaling arguments to the target NAV. CFD simulations were initiated with the standard two dimensional test case previously defined. The in house INFlow code and the commercially available Fluent code were both used to solve this unsteady incompressible flow. Motion rigs in 2D and in 3D for the NRC IAR water tunnel were designed and are being fabricated. A micro PIV method was also developed. The required equipment, mainly a high frequency laser, was purchased. The system is being implemented.

DTIC

*Aerodynamic Characteristics; Aerodynamics; Computational Fluid Dynamics; Drone Vehicles; Flapping; Nanotechnology; Wings*

**20080025548** Stanford Univ., Stanford, CA USA

**Hybrid Verification of an Interface for an Automatic Landing**

Oishi, Meeko; Mitchell, Ian; Bayen, Alexandre; Tomlin, Claire; Degani, Asaf; Dec 2002; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-99-C-3014; N00014-00-1-0637

Report No.(s): AD-A479491; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Modern commercial aircraft have extensive automation which helps the pilot by performing computations, obtaining data, and completing procedural tasks. The pilot display must contain enough information so that the pilot can correctly predict the aircraft's behavior, while not overloading the pilot with unnecessary information. Human-automation interaction is currently evaluated through extensive simulation. In this paper, using both hybrid and discrete-event system techniques, we show how one could mathematically verify that an interface contains enough information for the pilot to safely and unambiguously complete a desired maneuver. We first develop a nonlinear, hybrid model for the longitudinal dynamics of a large civil jet aircraft in an autoland/go-around maneuver. We find the largest controlled subset of the aircraft's flight envelope for which we can guarantee both safe landing and safe go-around. We abstract a discrete procedural model using this result, and verify a discrete formulation of the pilot display against it. An interface which fails this verification could result in nondeterministic or unpredictable behavior from the pilot's point of view.

DTIC

*Automatic Pilots; Commercial Aircraft*

**20080025985** NASA Glenn Research Center, Cleveland, OH, USA

**Analysis of Plume Effects on Sonic Boom Signature for Isolated Nozzle Configurations**

Castner, Raymond S.; June 23, 2008; 14 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.13.05

Report No.(s): AIAA Paper-2008-3729; E-16535; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025985>

Computational fluid dynamics (CFD) analysis has been performed to study the plume effects on sonic boom signature for isolated nozzle configurations. The objectives of these analyses were to provide comparison to past work using modern CFD analysis tools, to investigate the differences of high aspect ratio nozzles to circular (axisymmetric) nozzles, and to report the effects of underexpanded nozzle operation on boom signature. CFD analysis was used to address the plume effects on sonic boom signature from a baseline exhaust nozzle. Near-field pressure signatures were collected for nozzle pressure ratios (NPRs)

between 6 and 10. A computer code was used to extrapolate these signatures to a ground-observed sonic boom N-wave. Trends show that there is a reduction in sonic boom N-wave signature as NPR is increased from 6 to 10. The performance curve for this supersonic nozzle is flat, so there is not a significant loss in thrust coefficient as the NPR is increased. As a result, this benefit could be realized without significant loss of performance. Analyses were also collected for a high aspect ratio nozzle based on the baseline design for comparison. Pressure signatures were collected for nozzle pressure ratios from 8 to 12. Signatures were nearly twice as strong for the two-dimensional case, and trends also show a reduction in sonic boom signature as NPR is increased from 8 to 12. As low boom designs are developed and improved, there will be a need for understanding the interaction between the aircraft boat tail shocks and the exhaust nozzle plume. These CFD analyses will provide a baseline study for future analysis efforts.

Author

*Computational Fluid Dynamics; Plumes; Sonic Booms; Supersonic Nozzles; Pressure Ratio; Exhaust Nozzles; Extrapolation*

### 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.

**20080023802** Secretary of the Air Force, Washington, DC USA

**Air Force Posture Statement 2008: Department of Air Force Presentation to the House Armed Services Committee, U.S. House of Representatives, Fiscal Year 2009 Air Force Posture Statement**

Wynne, Michael W; Moseley, Michael; Feb 27, 2008; 40 pp.; In English

Report No.(s): AD-A478317; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478317>

This Statement articulates the major elements of our Air Force Posture - our strategy for fulfilling our role in defending the Nation and its interests; our contributions to winning the Global War on Terrorism; our most critical efforts and concerns; and our top priority programs. Three overarching Service priorities serve as the organizing principles for all of our efforts: Winning Today's Fight; Taking Care of Our People; and Preparing for Tomorrow's Challenges. The Air Force's top acquisition priorities specifically begin to address our critical recapitalization and modernization needs the new Tanker (KC-X); the new Combat Search and Rescue Helicopter (CSAR-X); modern space systems to provide capabilities vital to our Joint warfighters; the F-35A Lightning II; and a new Bomber we intend to field by 2018. We will continue our efforts to modernize and protect America's vital air, space, and cyberspace capabilities. We strongly recommend extending the existing C-130J production line. We are also concerned with preserving America's aerospace industrial base. Additionally, we seek relief from restrictions on the retirement of aging, worn-out aircraft which are increasingly unsafe, unreliable, and obsolete. The Air Force is highly engaged in national efforts to assure sustainable energy, and we will continue to push the performance envelope on fuel efficiency and renewable energy technologies. We are committed to the Joint Basing initiative and want to work through the transfer of total obligation authority (TOA) and real property control without impacting command authorities, reducing installation service support, or negatively affecting quality of life. Finally, we will continue our practice of recruiting and retaining the world's highest quality Airmen. We will build upon our successes in achieving Total Force Integration of our Regular, Guard, Reserve, and Civilian Airmen.

DTIC

*Congressional Reports; Posture*

**20080023982** Systems Engineering and Assessment Ltd., Bristol, UK

**The Use of Simulation to De-risk Maritime UAV Operations**

Cox, Ian; Howitt, Jeremy; Duncan, John; Nov 1, 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478670; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Computerized Simulation; Drone Vehicles; Helicopters; Risk; Ships; Simulation*

**20080024028** Army Aeromedical Research Lab., Fort Rucker, AL USA

**Predictability of Pilot Performance from Simulated to Real Flight in the UH-60 (Black Hawk) Helicopter**

Schmeisser, Elmar T; Fuller, Daniel R; Van De Pol, Carina; Feb 2008; 48 pp.; In English

Report No.(s): AD-A478734; USAARL-2008-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Despite continued reliance on simulators during training, research, and pilot certification, the predictive relationship of data obtained from simulators and its relevance to the operational reality of flight remains inconclusive. If a pilot shows great proficiency in an aircraft simulator, perhaps the pilot will also exhibit similar levels of proficiency in the actual aircraft. The research presented in this report continues an almost thirty year attempt to establish pilot performance in an aircraft simulator as a valid predictor of anticipated performance in the corresponding aircraft. While a larger sample size may have strengthened the results of this study, it can be concluded that a significant lack of predictability in pilot performance exists from simulated to real flight in the UH-60 helicopter. These results follow and reinforce previous studies conducted in numerous airframes over the last 30 years.

DTIC

*Flight Simulators; Helicopters; Pilot Performance; Pilots; Predictions*

**20080024044** Sirehna S.A., Nantes, France

**Development and Tests of an Automatic Decking System Demonstrator of VTOL UAV on Naval Platform**

Doucy, Olivier; Cellier, Nicolas; Corrignan, Philippe; May 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478762; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Aircraft Landing; Drone Vehicles; Instrument Landing Systems; Proving; Vertical Landing; Vertical Takeoff Aircraft*

**20080024177** NASA Langley Research Center, Hampton, VA, USA

**Head-Worn Display Concepts for Surface Operations for Commerical Aircraft**

Arthur, Jarvis J., III; Prinzel, Lawrence J., III; Bailey, Randall E.; Shelton, Kevin J.; Williams, Steven P.; Kramer, Lynda J.; Norman, Robert M.; June 2008; 135 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 609866.02.07.07.02

Report No.(s): NASA/TP-2008-215321; L-19449; Copyright; Avail.: CASI: [A07](#), Hardcopy

Experiments and flight tests have shown that a Head-Up Display (HUD) and a head-down electronic moving map (EMM) can be enhanced with Synthetic Vision for airport surface operations. While great success in ground operations was demonstrated with a HUD, the research noted that two major HUD limitations during ground operations were its monochrome form and limited, fixed field-of-regard. A potential solution to these limitations found with HUDs may be emerging with Head Worn Displays (HWDs). HWDs are small display devices that may be worn without significant encumbrance to the user. By coupling the HWD with a head tracker, unlimited field-of-regard may be realized. The results of three ground simulation experiments conducted at NASA Langley Research Center are summarized. The experiments evaluated the efficacy of head-worn display applications of Synthetic Vision and Enhanced Vision technology to improve transport aircraft surface operations. The results of the experiments showed that the fully integrated HWD provided greater pilot performance with respect to staying on the path compared to using paper charts alone. Further, when comparing the HWD with the HUD concept, there were no differences in path performance. In addition, the HWD and HUD concepts were rated via paired-comparisons the same in terms of situation awareness and workload.

Author

*Head-Up Displays; Enhanced Vision; Pilot Performance; Display Devices; Flight Tests*

**20080025078** Advanced Technical Concepts, Berkshire, NY USA

**Multi-Agent Technology for Air Space Deconfliction**

Skormin, Victor; Jan 2008; 67 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0245; Proj-558B

Report No.(s): AD-A478341; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478341>

The objective of this effort is to develop computer-based multi-agent system technology that will enhance airspace

control. It is a project specifically dedicated to the problem of air traffic control within airport air space in emergency situations when a hijacked aircraft appears and operates in the airport air space while ignoring the safety provided by air traffic control rules and air traffic operator commands thus providing significant threat to the 'normal aircraft'

DTIC

*Air Piracy; Airspace*

**20080025287** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Optimum Design of a Flexible Wing Structure to Enhance Roll Maneuver in Supersonic Flow**

Veley, Duane E; Khot, Narendra S; Zweber, Jeffrey V; Hartong, Alicia R; Jan 2008; 8 pp.; In English

Report No.(s): AD-A478886; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478886>

This work combines two efforts that have been on-going in the Air Force Research Laboratory. The first effort is the work of the Design Modeling Group which is using the Adaptive Modeling Language (AML) to develop an object-based technology assessment system. One of the advantages of this effort is that the analytical tools (legacy codes) that are used may be integrated into the AML environment one at a time, thereby providing many intermediate products each of which may enhance productivity. So while this effort is still in its infancy, a graphical user interface to the Automated STRuctural Optimization System (ASTROS) has been developed and is used in this effort to develop a parametrically defined finite element model. The second effort is the work on designing flexible wings without ailerons for performing roll maneuvers. Here a flexible wing is optimized for weight with constraints on strength for a 9-g symmetric pull-up maneuver at  $M=0.85$  at 30 psi and on the modal frequency distribution. Differential wing twist and camber is achieved by providing a system of actuating elements distributed within the internal substructure of the wing to provide roll control power. The modal approach was used to develop equilibrium equations for the steady roll maneuver of a wing subjected to aerodynamic loads and actuating forces. The distribution of actuating forces to achieve a specified flexible roll rate was determined by using an optimal control design approach. Here, full-scale wings are considered for the assessment of strain energy as a measure of the necessary power required to produce the antisymmetric twist and camber deformation to achieve the required roll performance. The wings used here break the paradigm of the low aspect ratio wings typical for supersonic vehicles.

DTIC

*Flexible Wings; Maneuvers; Roll; Supersonic Flow; Wings*

**20080025304** Library of Congress, Washington, DC USA

**Aviation Security: Background and Policy Options for Screening and Securing Air Cargo**

Elias, Bart; Feb 25, 2008; 45 pp.; In English

Report No.(s): AD-A478933; CRS-RL34390; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478933>

The Aviation and Transportation Security Act contains general provisions for cargo screening, inspection, and security measures. Cargo carried in passenger airplanes must be screened or its security otherwise ensured. In practice, the Transportation Security Administration (TSA) has relied heavily on known shipper protocols to prevent shipments of cargo from unknown sources on passenger aircraft. ATSA also mandated development of a security plan for all-cargo operations. The TSA's air cargo security plan has focused on risk-based methods for assessing cargo shipments and targeting physical inspections. The National Intelligence Reform Act of 2004 (P.L. 108-458) included provisions establishing a pilot program for evaluating the deployment of blast-resistant cargo containers; promoting the research, development, and deployment of enhanced air cargo security technology; evaluating international air cargo threats; and finalizing operational regulations of air cargo security. Those regulations, finalized by the TSA in 2006, require use of an industry-wide known shipper database, background checks of air cargo workers, and enhanced security measures at air cargo operations areas. In addition to these measures, Congress has provided appropriations to hire more canine teams and cargo inspectors to step up cargo screening and regulatory inspections. Appropriations legislation over the past four years has called for continued increases to the amounts of air cargo placed on passenger airplanes that is physically screened. The Implementing Recommendations of the 9/11 Commission Act of 2007 (P.L. 110-53) requires the DHS to establish a system to physically screen 100% of all air cargo within three years, with an interim requirement of screening 50% of air cargo within 18 months of enactment. The act also directs the TSA to implement a program for deploying blast-resistant cargo containers for use by air carriers on a risk-managed basis. This report will be updated as needed.

DTIC

*Air Cargo; Air Transportation; Cargo; Inspection; Policies; Security*

**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.

**20080023809** Massachusetts Inst. of Tech., Cambridge, MA USA

**Automation Architecture for Single Operator, Multiple UAV Command and Control**

Cummings, M L; Bruni, S; Mercier, S; Mitchell, P J; Jan 2007; 29 pp.; In English

Report No.(s): AD-A478338; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478338>

In light of the Office of the Secretary Defense's Roadmap for unmanned aircraft systems (UAS), there is a critical need for research examining human interaction with heterogeneous unmanned vehicles. The OSD Roadmap clearly delineates the need to investigate the 'appropriate conditions and requirements under which a single pilot would be allowed to control multiple airborne UA (unmanned aircraft) simultaneously.' Toward this end, in this paper, we provide a meta-analysis of research studies across unmanned aerial and ground vehicle domains that investigated single operator control of multiple vehicles. As a result, a hierarchical control model for single operator control of multiple unmanned vehicles (UV) is proposed that demonstrates those requirements that will need to be met for operator cognitive support of multiple UV control, with an emphasis on the introduction of higher levels of autonomy. The challenge in achieving effective management of multiple UV systems in the future is not only to determine whether automation can be used to improve human and system performance, but how and to what degree across hierarchical control loops, as well as determining the types of decision support that will be needed by operators given the high-workload environment. We address when and how increasing levels of automation should be incorporated in multiple UV systems and discuss the impact on not only human performance, but more importantly, on system performance.

DTIC

*Command and Control; Control; Manual Control; Remotely Piloted Vehicles*

**20080023810** Army Research Lab., Aberdeen Proving Ground, MD USA

**Characterization of Two 12-mm Primers - the M129 and M125**

Howard, Stephen L; Williams, Anthony W; Dec 2007; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478342; ARL-TR-4346; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478342>

Increased precision/lethality of large-caliber weapons has been a goal of many for a number of years. Different (more energetic propellant compositions and configurations have provided much of the increases in performance. However, ever-increasing loading densities and the goal of more insensitive propellants translate to the need for ignition systems that are optimized for the propelling charge. Without such optimization, pressure waves can increase, thus endangering the gun and crew, or the ignition stimulus can be inappropriate, with resulting ignition delays and/or weakened ignition. The thrust of this investigation was to obtain interior pressure measurements and venting temperatures of the M129 and M125 primers (standard 120-mm primers). These data, coupled with the venting patterns revealed by high-speed video, provide baseline data for computer model formulation and validation so that the optimization process with the possibility of increase precision/lethality can be realized.

DTIC

*Pressure Measurement; Thermal Expansion*

**20080023820** Army Research Lab., Adelphi, MD USA

**Millimeter-Wave Propagation Measurement Through a Dust Tunnel**

Wikner, David; Mar 2008; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478383; ARL-TR-4399; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478383>

A one-week experiment was conducted to determine the millimeter-wave transmission loss due to dust. Transmission data was collected at 35, 94, and 217 GHz through a recirculating dust tunnel. Dust clouds of various densities were measured during the experiment. The millimeter-wave measurements were performed using transmitting sources on one side of the dust tunnel and antenna/detectors on the other. The hardware was designed to minimize noise and post-detection voltage drift. Even so, it was found that the transmission loss across the 1-m dust tunnel at high dust densities was lower than what could be

measured accurately with the equipment. Therefore, the results given are limited to system noise and represent maximum transmission losses at the various frequencies. The results show losses less than 0.02 and 0.08 dB for 94 and 217 GHz respectively across one meter of dust with density 3000 mg/m<sup>3</sup>. The actual losses are lower but more sensitive instrumentation is required to determine the loss values precisely. Despite the limitations of the experiment, the data show that millimeter-wave imager performance will not be significantly impacted by even a very dense dust cloud.

DTIC

*Dust; Helicopters; Instrument Landing Systems; Millimeter Waves; Vertical Landing*

**20080023936** RAND Corp., Santa Monica, CA USA

**Evaluating Novel Threats to the Homeland. Unmanned Aerial Vehicles and Cruise Missiles**

Jackson, Brian A; Frelinger, David R; Lostumbo, Michael J; Button, Robert W; Jan 2008; 131 pp.; In English

Contract(s)/Grant(s): W74V8H-06-C-0002

Report No.(s): AD-A478594; No Copyright; Avail.: Defense Technical Information Center (DTIC)

How to invest homeland security resources wisely in the USA can appear to be an intractable problem because the large, open American society seems to be vulnerable to so many threats in every corner of the country. This monograph is intended to present a defense-planning approach to bound the problem and thereby aid policy and resource decisions about one type of potential threat to the homeland: cruise missiles and unmanned aerial vehicles (UAVs). The methodology used can be applied to other modes of attack, and the insights gained from this approach extend to other threats as well. Indeed, although the focus of the research is on a specific class of weapons, it does not look at that class in isolation; rather, it considers the weapons as one of many options open to a potential attacker and seeks to identify investment strategies that are effective against multiple threats and weapons.

DTIC

*Cruise Missiles; Drone Vehicles; Pilotless Aircraft; Security*

**20080023953** Boeing Phantom Works, Saint Louis, MO USA

**Airframe Certification Methods for Unmanned Aircraft**

Saff, Charles R; Dec 1, 2006; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478627; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Aircraft Design; Airframes; Certification; Drone Vehicles; Pilotless Aircraft; Qualifications; Requirements*

**20080023971** Massachusetts Inst. of Tech., Cambridge, MA USA

**Multi-Vehicle Flight Testbed for Extended Mission Analysis, Fault Isolation, and Recovery**

Valenti, Mario; How, Jonathan P; Nov 1, 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0458

Report No.(s): AD-A478657; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Drone Vehicles; Faults; Real Time Operation; Test Stands*

**20080023972** Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France

**UAV Operations: From Autonomous Navigation to Multi Platform Cooperation Achievements in the ReSSAC Project at ONERA**

Fabiani, Patrick; Nov 1, 2007; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478658; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Autonomous Navigation; Helicopters; Pilotless Aircraft; Rotary Wing Aircraft*

**20080023981** Alenia Aeronautica, Turin, Italy

**UAV Autonomy - Which Level is Desirable? - Which Level is Acceptable? Alenia Aeronautica Viewpoint**

Protti, Marco; Barzan, Riccardo; Nov 1, 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478669; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Autonomy; Drone Vehicles; Pilotless Aircraft*



**20080023990** Northrop Grumman Systems Corp., San Diego, CA USA  
**Airworthiness Certification Strategy for Global Hawk HALE**  
Pourmand, Mostafa; May 15, 2007; 35 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478681; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Aircraft Reliability; Certification; Design Analysis; Drone Vehicles; Surveillance*

**20080023991** Massachusetts Inst. of Tech., Cambridge, MA USA  
**Multi-Vehicle Flight Experiments: Recent Results and Future Directions**  
How, Jonathan P; Nov 1, 2007; 11 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): F49620-01-1-0453; FA9550-04-1-0458  
Report No.(s): AD-A478682; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Autonomy; Control; Drone Vehicles; Flight Tests; Pilotless Aircraft; Prototypes; Real Time Operation; Test Stands*

**20080023992** Royal Military Academy, Brussels, Belgium  
**Platform Innovations and System Integration for Unmanned Air, Land and Sea Vehicles Symposium. Technical Evaluation Report**  
Decuypere, Roland; Selegan, David; Nov 1, 2007; 15 pp.; In English  
Report No.(s): AD-A478684; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Conferences; Robotics; Seas; Systems Integration*

**20080023993** Air Force Research Lab., Eglin AFB, FL USA  
**Biological Inspiration for Agile Autonomous Air Vehicles**  
Evers, Johnny H; Nov 1, 2007; 15 pp.; In English  
Report No.(s): AD-A478688; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Autonomy; Bionics; Drone Vehicles; Flight; Inspiration*

**20080023995** Military Academy, West Point, NY USA  
**Comparing Organic vs. Assigned UAV Support to the Maneuver Company**  
Nov 1, 2007; 29 pp.; In English  
Report No.(s): AD-A478690; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Drone Vehicles; Launch Windows; Reliability; Vertical Takeoff Aircraft*

**20080023996** Ontario Univ. Institute of Technology, Oshawa, Ontario Canada  
**Transitioning Intelligence to Embedded Platforms**  
Eklund, J M; Sprinkle, Jonathan; Templeton, Todd; Sastry, Shankar; Nov 1, 2007; 7 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478691; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Autonomous Navigation; Embedding; Intelligence; Systems Integration*

**20080023997** Beira Interior Univ., Covilha, Portugal  
**Design and Testing of a Morphing Wing for an Experimental UAV**  
Gamboa, P; Aleixo, P; Vale, J; Lau, F; Suleman, A; Nov 1, 2007; 31 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478692; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Drag Reduction; Drone Vehicles; Experiment Design; Wings*

**20080024000** Nangia Aero Research Associates, Bristol, UK

**Meeting Unmanned Air Vehicle Platform Challenges Using Oblique Wing Aircraft**

Nangia, R K; Nov 1, 2007; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478695; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Autonomous Navigation; Drone Vehicles; Oblique Wings*

**20080024002** Ecole Nationale Supérieure de l'Aéronautique et de l'Espace, Toulouse, France

**Fixed-Wing Micro Air Vehicles with Hovering Capabilities**

Bataille, Boris; Poinot, Damien; Thipyopas, Chinnapat; Moschetta, Jean-Marc; Nov 1, 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478697; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Aircraft Configurations; Fixed Wings; Hovering; Surveillance*

**20080024003** Polish Air Force Inst. of Tech., Warsaw, Poland

**The Issues of Developing UAVs at the Air Force Institute of Technology, and Those of Certification Problems**

Krugly, Marcin; Sibilski, Krzysztof; Warchulski, Jacek; Nov 1, 2007; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478698; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Certification; Detection; Drone Vehicles; Maneuverability; Target Acquisition*

**20080024005** European Aeronautic Defence and Space Co., Munich, Germany

**Operational Risk Assessment for Unmanned Aircraft Vehicles by using Structural Health and Event Management**

Buderath, Matthias; Neumair, Manfred; Nov 1, 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478700; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Combat; Drone Vehicles; Health; Pilotless Aircraft; Reliability; Risk; Risk Assessment*

**20080024006** Porto Univ., Portugal

**Mixed Initiative Control of Unmanned Air and Ocean Going Vehicles: Models, Tools and Experimentation**

Borges de Sousa, J; Goncalves, G; Nov 1, 2007; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478701; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Aircraft; Ocean Models; Remotely Piloted Vehicles; Underwater Vehicles*

**20080024012** Free Univ., Brussels, Belgium

**Optimal Control Strategies for a Ducted RUAV**

Hendrick, Patrick; Depouhon, Alexandre; Aernouts, Jean-Francois; May 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478710; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Ducts; Hovering; Optimal Control; Rotary Wing Aircraft; Vertical Takeoff Aircraft*

**20080024014** Naval Research Lab., Washington, DC USA

**The NRL MITE Air Vehicle**

Kellogg, James; Bovais, Christopher; Dahlburg, Jill; Foch, Richard; Gardner, John; Gordon, Diana; Hartley, Ralph; Kamgar-Parsi, Behrooz; McFarlane, Hugh; Pipitone, Frank; Ramamurti, Ravi; Sciambi, Adam; Spears, William; Srull, Donald; Sullivan, Carol; Apr 2001; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478713; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Micro Air Vehicles 'MAVs' offer the promise of affordably expendable, covert sensor platforms for a range of close-in situational awareness activities. Since 1996, the US Naval Research Laboratory 'NRL' has been developing technologies that will enable Navy-relevant missions with the smallest practical MAVs. This effort includes the development and integration of

sensors, avionics, and advanced intelligent autopilots for flight control, with aerodynamic technologies. The NRL Micro Tactical Expendable 'MITE' air vehicle is a result of this research. The operational MITE is a hand-launched, dual-propeller, fixed-wing air vehicle, with a 9-inch chord and a wingspan of 8 to 18 inches, depending on payload weight. The 14-inch MITE 2 can carry a one-ounce analog camera payload for mission flight durations in excess of 20 minutes, at air speeds of 10-20 miles/hour. While the MITE is presently a remote controlled air vehicle, both miniature 'traditional' autopilots and also 'advanced' autopilots, based on visual and spectral imaging techniques, are being developed. Autonomous MITEs will provide inexpensive, covert, highly portable sensor platforms for distribution and use in remote or urban environments. Multiple MITEs will provide distributed networks of roving and fixed sensor systems.

DTIC

*Aerodynamics; Aircraft; Remote Control*

**20080024017** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Goettingen, Germany

**Design Considerations for a UCAV Wing for Subsonic and Transonic Aeroelastic and Flight Mechanic Wind Tunnel Tests**

Kruger, Wolf R; Hoffmann, D; Nov 1, 2007; 11 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478721; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Aeroelasticity; Flight Mechanics; Subsonic Flow; Transonic Flight; Transonic Flow; Wind Tunnel Tests; Wings*

**20080024026** Boeing Co., Huntington Beach, CA USA

**Design Processes and Criteria for the X-51A Flight Vehicle Airframe**

Lane, Jeffrey; Nov 1, 2007; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478731; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Airframes; Design Analysis; Hypersonic Aircraft*

**20080024029** Akron Univ., Akron, OH USA

**Modeling of Flow about Pitching and Plunging Airfoil Using High-Order Schemes**

Povitsky, A; Gopalan, H; Mar 13, 2008; 39 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0314

Report No.(s): AD-A478735; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A high-order non-uniform compact finite-difference algorithm with numerical filtering and low storage Runge-Kutta scheme is developed to perform numerical simulations on orthogonal grids generated about plunging and pitching airfoils. The grids, which move with the pitching and plunging airfoil, are generated using 'Streamfunction as a coordinate approach' (SFC). SFC is widely used in combination with lower-order schemes in Computational Fluid Dynamics. The straightforward implementation of SFC create rather coarse grid at the solution accuracy, non-uniform SFC grid with appropriate grid stretching and filtering of solution is implemented. The different kinds of SFC grid generation methods and the grid clustering in the vicinity of stagnation point are discussed. The applications of the developed grid generator and numerical solver to problems based on linearized Euler equations, for which analytical solutions are available, are shown first. Then, the methodology is applied to unsteady aerodynamics of pitching and plunging airfoils. The application of the developed grid generator and numerical solver to plunging airfoil problems are discussed and compared with available experimental data including lift force for plunging NACA0012 airfoil and visualization of vortical flowfield for plunging SD7003 airfoil. Finally, the use of flapping airfoil for control of gust-induced oscillations of airfoil lift force is discussed.

DTIC

*Airfoils; Algorithms; Finite Difference Theory; Numerical Analysis; Runge-Kutta Method*

**20080024045** Bertin Technologies, Montigny-le-Bretonneux, France

**The Flight Control System of the Hovereeye (Trademark) VTOL UAV**

Binetti, Paolo; Trouchet, Daniel; Pollini, Lorenzo; Innocenti, Mario; Hamel, Tarek; Le Bras, Florent; May 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478763; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Drone Vehicles; Flight Control; Instrument Landing Systems; Vertical Landing; Vertical Takeoff Aircraft*

**20080024048** Air Force Research Lab., Wright-Patterson AFB, OH USA  
**UAV Design Processes / Design Criteria for Structures RTA AVT Workshop. Technical Evaluation Report**  
Pendleton, Ed; Sensburg, Otto; Nov 1, 2007; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478765; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Design Analysis; Drone Vehicles; Project Management; Technology Assessment; Tests*

**20080024253** Brigham Young Univ., Provo, UT USA  
**An Overview of MAV Research at Brigham Young University**  
McLain, Timothy W; Beard, Randal W; Barber, D B; Knoebel, Nathan B; May 2007; 21 pp.; In English  
Contract(s)/Grant(s): FA9550-0401-0209; FA9550-04-C-0032  
Report No.(s): AD-A478709; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Control Theory; Drone Vehicles; Miniaturization*

**20080025071** European Aeronautic Defence and Space Co., Munich, Germany  
**Electrically Driven General Systems for UAV's**  
Mentjes, Fokke; Nov 1, 2007; 11 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478722; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
No abstract available  
*Drone Vehicles; Pilotless Aircraft; Fly By Wire Control*

**20080025283** Naval Air Warfare Center, Patuxent River, MD USA  
**Trapped Vortex Combustor Development for Military Aircraft**  
Barlow, K; Burrus, D; Stevens, E; Duncan, B; Lamellar, S; Boehm, R; Jan 2008; 7 pp.; In English  
Contract(s)/Grant(s): N00421-02-C-3202  
Report No.(s): AD-A478875; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478875>

Tomorrow's military aircraft will require improved durability leading to life-cycle cost reductions and reduced emission levels while demanding higher performance. A combustor concept that is being developed with these goals in mind is the Trapped Vortex Combustor (TVC). Early testing at AFRL showed that the TVC has the potential to deliver exceptional performance and low emissions. Based on its potential for high power performance, the TVC was chosen as the ATEGG Phase 3 combustor. Although the ATEGG Phase 3 program has stopped, development of the TVC continues through a joint technology development effort between GE Aircraft Engines, the Navy, and ESTCP. This development program will take the TVC from the laboratory test stage through design and fabrication of engine worthy combustor hardware. Once the hardware fabrication is complete, the current program provides for one full annular test with an option for a second full annular test. The first full annular design of a TVC completed testing in April 2007. Ultimate plans are for the TVC to be transitioned into a demonstration engine to achieve a Technology Readiness Level (TRL) of 6.

DTIC

*Combustion Chambers; Trapped Vortices*

**20080025311** Cambridge Univ., Cambridge, UK  
**Constitutive Modeling of Epoxy Using the Mulliken-Boyce Model for Glassy Polymers**  
Foley, Jason R; Jordan, Jennifer L; Siviour, Clive R; Apr 2008; 5 pp.; In English  
Contract(s)/Grant(s): Proj-2302  
Report No.(s): AD-A478946; AFRL-RW-EG-TP-2008-7404; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478946>

Polymers are increasingly common in aerospace structural applications where they experience complex, non-static loads. Correspondingly, the high strain rate mechanical properties are of increasing importance. This paper gives results from an initial investigation of the properties of bisphenol-A/diethanolamine epoxy (Epon 826/DEA) across strain rates from 10(exp-3) to 10(exp5) s(exp-1). The samples were tested using Instron, traditional split Hopkinson pressure bars (SHPBs) and a miniaturized SHPB for ultra-high strain rates and dynamic mechanical analysis to look at the effects of time-temperature

superposition on the strain rate effects in the samples. The Mulliken-Boyce constitutive model for glassy polymers is used to describe the mechanical properties of epoxy across the range of strain rates tested.

DTIC

*Epoxy Resins; Glass; Mathematical Models; Mechanical Properties; Polymers*

**20080025312** Pennsylvania State Univ., University Park, PA USA

**Compliant Frame: A New Paradigm to Enable Reconfigurable Aircraft Structures**

Lesieutre, George A; Frecker, Mary I; Gandhi, Farhan S; Ramrakhyani, Deepak; Bharti, Smita; Browne, Jamie; Olympio, Raymond K; Mehta, Vipul; Feb 28, 2007; 24 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0165

Report No.(s): AD-A478947; AERSP-GAL-0228; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478947>

Reconfigurable ('morphing') aircraft offer the potential for efficient flight over a large range of airspeeds. The structural concept addressed herein is a tendon-actuated cellular compliant frame, with a flexible skin. 3-D cellular structures can perform well, but the need for active tendons to also carry passive lift loads limits their feasibility at larger scales. 2-D cellular structures can significantly change wing area and span, with lower actuation forces, and a system of parallel actuators is significantly lighter than a single actuator, especially at higher gross weights. Composite skins with cellular cores and flexible face sheets show promise for low-force actuation with reasonable lateral stiffness, while contact-aided cores offer additional benefits, including stress relief and increased lateral stiffness. Finally, while the potential benefits of morphing increase with aircraft gross weight, structural morphing capability decreases; this is accompanied by increasing structural and actuation weight fractions. This suggests that, for a given structural paradigm, there is a gross weight at which smooth morphing is most advantageous and practical. Continued research is needed to address the many challenges that remain before the promise of smoothly morphing aircraft can be realized.

DTIC

*Elastic Properties; Research Aircraft*

**20080025331** Defence Research and Development Canada, Toronto, Ontario Canada

**Effect of Search Window Size on Search and Rescue Call-Around Performance**

Grant, Stuart C; Dec 2007; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478989; DRDC-TORONTO-TR-2007-162; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478989>

The Fixed Wing Search and Rescue (FWSAR) project tasked Defence Research and Development Canada (DRDC) to provide guidance on the primary search window requirements for a new SAR aircraft. At issue was the effect of the size and location of the SAR technician's window on the SAR technician's ability to verbally guide a pilot to fly the aircraft over a search object. An answer was obtained through a two-stage approach. First, data were collected using a simulation of the call-around. In the synthetic environment, six SAR technicians performed a large number of call-arounds where the search window size and observer position in a simulated aircraft were adjusted on a trial-by-trial basis. Then, a live flying trial at CFB Comox involving two SAR technicians was conducted to validate the results obtained from the synthetic environment. Three recommendations emerged. First, the primary search window should provide a field of view of at least 160°. Second, performance is not affected by the visual effect of placing the window ahead of, or behind, the wing. Third, to obtain the full benefit of the field of view afforded by the window, the observer must be provided with an ergonomically sound work station.

DTIC

*Aircraft Configurations; Fixed Wings; Rescue Operations*

**20080025342** European Aeronautic Defence and Space Co., Munich, Germany

**Structural Design Aspects and Criteria for Military UAV**

Neubauer, Martin; Guenther, Georg; Fuellhas, Konrad; Apr 2007; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479056; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479056>

No abstract available

*Drone Vehicles; Structural Design*

**20080025353** Library of Congress, Washington, DC USA

**Strategic Airlift Modernization: Analysis of C-5 Modernization and C-17 Acquisition Issues**

Knight, William; Bolkcom, Christopher; Nov 28, 2007; 43 pp.; In English

Report No.(s): AD-A479125; CRS-RL34264; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479125>

Strategic airlift has played a pivotal role in U.S. national security strategy since World War II. Since then, strategic airlift has provided timely worldwide reach for both combat and humanitarian relief operations. The Department of Defense (DoD) currently operates a mix of C-5 and C-17 aircraft. C-5s were built in two production batches, designated the C-5A and C-5B, respectively. Both models of C-5s are scheduled to undergo two major modification programs, after which they will be redesignated C-5M Super Galaxies. C-17s are currently in production, but the C-17 production line is scheduled to close unless additional orders are placed in FY2008. A major issue currently before Congress is how big should the strategic airlift fleet be. Currently, the most pressing issue is whether Congress should authorize the purchase of more C-17s in FY2008 and, if so, how many. A third issue is the optimal mix of C-5s and C-17s that Congress should fund. At least five options have been proposed for C-5 modernization and C-17 procurement, including the following: (1) Buy additional C-17s and pursue modernization of all C-5s, (2) Halt C-17 production but modernize the current C-5 fleet, (3) Maintain the C-5 fleet but forego modernization on all or part of the C-5 fleet while replacing the capability gap with C-17s, (4) Replace all C-5A-models with new C-17s and (5) Replace 30 C-5s with 30 C-17s. Most agree the strategic airlift fleet should consist of a mix of C-17s and modified C-5s. Independent studies have analyzed policy options by attempting to measure long-term costs associated with various alternatives of C-5 modernization with C-17 acquisition. However, there remains disagreement over how many aircraft are required, and of what type. Policy considerations include costs, budget constraints, industrial base risk, aircraft performance considerations, and optimal fleet mix.

DTIC

*Cost Estimates; Government Procurement; Policies; Transport Aircraft*

**20080025355** Library of Congress, Washington, DC USA

**Military Aircraft: C-17 Program Background**

Knight, William; Bolkcom, Christopher; Dec 3, 2007; 7 pp.; In English

Report No.(s): AD-A479129; CRS-RS22763; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479129>

The C-17 Globemaster III is a long-range cargo/transport aircraft operated by the U.S. Air Force since 1993. To date, Congress has funded 190 C-17s for the Air Force. The C-17 program remains a key issue as Congress evaluates the needs of the Department of Defense's (DoD) strategic airlift force. This paper provides program background for the C-17. For more detailed analysis of current issues regarding the C-17 acquisition, see CRS Report RL34264, 'Strategic Airlift Modernization: Analysis of C-5 Modernization and C-17 Acquisition Issues.' This report will be updated as events warrant.

DTIC

*Armed Forces (United States); C-17 Aircraft; Federal Budgets; Government Procurement; Transport Aircraft*

**20080025485** Arizona Univ., Tucson, AZ USA

**Communication with Hypersonic Vehicles via Nonlinear Plasma Processes**

Newell, Alan C; Zakharov, Vladimir E; Feb 2007; 26 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0090

Report No.(s): AD-A479288; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We wish to transmit messages to and from a hypersonic vehicle around which a plasma sheath has formed. For long distance transmission, the signal carrying these messages must be necessarily low frequency, typically 2 GHz, to which the plasma sheath is opaque. The idea is to use the plasma properties to make the plasma sheath appear transparent. Numerical and analytical results show that it is possible to use proposed technique to receive GPS signal on the vehicle even using klystrons available on the open market. Transmission of the signal to the earth-based stations is also solved problem.

DTIC

*Hypersonic Vehicles; Nonlinearity; Plasma Sheaths; Plasmas (Physics)*

**20080025518** Library of Congress, Washington, DC USA

**Overview of the Air Carrier Access Act**

Henning, Anna; Jun 19, 2007; 11 pp.; In English

Report No.(s): AD-A479371; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Carrier Access Act, 49 U.S.C. 41705, prohibits discrimination by air carriers against individuals with disabilities.

Recent public attention regarding an airplane passenger who traveled while infected with Extensively Drug Resistant Tuberculosis (XDR-TB) raises timely questions regarding the ACAAs requirements and guarantees. This report briefly discusses the ACAAs statutory provisions, accompanying regulations, and relevant judicial opinions.

DTIC

*Air Transportation; Infectious Diseases*

**20080025519** Air Force Research Lab., Hanscom AFB, MA USA

**Modeling U-2 Flight Through Clear Air Turbulence**

Jumper, J Torgerson, George; Sep 11, 2007; 21 pp.; In English

Contract(s)/Grant(s): Proj-2301

Report No.(s): AD-A479374; AFRL-VS-HA-TR-2007-1100; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A dynamic three degrees-of-freedom simulation of the U-2 aircraft was developed in support of future Clear Air Turbulence (CAT) forecasting. Aerodynamic coefficients and the autopilot specification were obtained from the Lockheed Martin Aeronautics Company. The simulation used longitudinal aircraft equations of motion to model the aircraft's flight through CAT. The dynamics were modified to include non-steady relative wind conditions. Atmospheric inputs were created using wave models and other numerical simulations of CAT conditions. The results were compared to traditional turbulence sensitivity predictors, which appeared to under-predict the actual aircraft loads for some CAT conditions.

DTIC

*Clear Air Turbulence; Flight Simulation; U-2 Aircraft*

**20080025523** Air Force Test Pilot School, Edwards AFB, CA USA

**Back Up Velocity Estimate Following Air Data System Failure (Project Have Vest)**

McLaren, Scott; Jayashankar, Sreeram; Rothermel, William; Beaverson, Corey; Powers, Donny; Dec 1, 2007; 59 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479390; AFFTC-TIM-07-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the results of Project Have VEST, a limited evaluation of a back up velocity estimate following air data system failure. This test program demonstrated the potential of the VEST algorithm to provide an airspeed estimate using aircraft last known state and flight control computer accelerations and rates. The USAF Test Pilot School (TPS), Class 07A, conducted six flight tests totaling 11.3 hours at Edwards AFB, California, from 9 to 21 Sep 2007. All test objectives were met.

DTIC

*Air Data Systems; Airspeed; Algorithms; Evaluation; System Effectiveness; System Failures; Vests*

**20080025561** George C. Marshall European Center for Security Studies APO, New York, NY USA

**Why did Poland Choose the F-16**

Seguin, Barre R; Jun 2007; 39 pp.; In English

Report No.(s): AD-A479642; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On December 27, 2002, Poland's Minister of Defense Jerzy Sznajdzinski announced Poland's decision to purchase 48 state-of-the-art F-16's fighter aircraft from Lockheed Martin. The 'deal of the century,' as it was characterized by Christopher P. Hill, U.S. Ambassador to Poland, was sealed on April 18, 2003 with the signing of the contract by Polish and U.S. officials, and Lockheed Martin senior executives. The contracts involved three separate, but related, agreements: the sale of 48 F-16 52+; an offset package to invest in Poland over a 10 year period; and favorable U.S. Government-backed low-interest financing. Poland's decision to purchase the F-16 had interwoven capability, interoperability, economic, and political dimensions. The main issues that drove Poland's decision to purchase the F-16 included a technical analysis of competing aircraft, price, financing, offsets, and politics. The mass media and the business community, particularly in Poland, portrayed the deal primarily in economic terms, emphasizing the favorable financing offered by the U.S. and the unprecedented offset agreement. Polish officials and politicians painted a picture of a more balanced decision for their constituents, one that emphasized price, tactical, and operational criteria over offsets. Academics, pundits, and officials from the losing bidders, Dassault and Saab/BAE, weighed politics more heavily in their assessment of the decision process than aircraft capabilities or economics. The hypothesis of this paper is that although capability, interoperability and economic interests played important roles in the Polish decision to purchase the F-16, political considerations dominated. This paper provides a comprehensive

synthesis of the Polish fighter aircraft selection process, assesses the dominate issues, and answers the question, 'Why did Poland choose the F-16?'

DTIC

*Agreements; Aircraft; F-16 Aircraft; Fighter Aircraft; Jet Aircraft; Poland*

**20080025750** NASA Glenn Research Center, Cleveland, OH, USA

**An Adaptive Instability Suppression Controls Method for Aircraft Gas Turbine Engine Combustors**

Kopasakis, George; DeLaat, John C.; Chang, Clarence T.; [2008]; 25 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 984743.02.07.03.19.04; No Copyright; Avail.: Other Sources

An adaptive controls method for instability suppression in gas turbine engine combustors has been developed and successfully tested with a realistic aircraft engine combustor rig. This testing was part of a program that demonstrated, for the first time, successful active combustor instability control in an aircraft gas turbine engine-like environment. The controls method is called Adaptive Sliding Phasor Averaged Control. Testing of the control method has been conducted in an experimental rig with different configurations designed to simulate combustors with instabilities of about 530 and 315 Hz. Results demonstrate the effectiveness of this method in suppressing combustor instabilities. In addition, a dramatic improvement in suppression of the instability was achieved by focusing control on the second harmonic of the instability. This is believed to be due to a phenomena discovered and reported earlier, the so called Intra-Harmonic Coupling, These results may have implications for future research in combustor instability control.

Author

*Adaptive Control; Combustion Chambers; Engine Control; Gas Turbine Engines; Aircraft Engines; Stability*

**20080025910** Sandia National Labs., Albuquerque, NM USA

**Development and Validation of Bonded Composite Doubler Repairs for Commercial Aircraft**

Roach, D.; Rackow, K.; Jul. 2007; 220 pp.; In English

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

Report No.(s): DE2007-912655; SAND2007-4088; No Copyright; Avail.: National Technical Information Service (NTIS)

This report presents the array of engineering activities that were completed in order to make this technology available for widespread commercial aircraft use. Focused laboratory testing was conducted to compliment the field data and to address specific issues regarding damage tolerance and flaw growth in composite doubler repairs. Fatigue and strength tests were performed on a simulated wing repair using a substandard design and a flawed installation. In addition, the new Sol-Gel surface preparation technique was evaluated. Fatigue coupon tests produced Sol-Gel results that could be compared with a large performance database from conventional, riveted repairs. It was demonstrated that not only can composite doublers perform well in severe off-design conditions (low doubler stiffness and presence of defects in doubler installation) but that the Sol-Gel surface preparation technique is easier and quicker to carry out while still producing optimum bonding properties. Nondestructive inspection (NDI) methods were developed so that the potential for disbond and delamination growth could be monitored and crack growth mitigation could be quantified. The NDI methods were validated using full-scale test articles and the FedEx aircraft installations.

NTIS

*Commercial Aircraft; Composite Materials; Defects; Damage Assessment*

**20080025944** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Biomimetic Micro Air Vehicle Testing Development and Small Scale Flapping-Wing Analysis**

Svanberg, Craig E; Mar 2008; 114 pp.; In English

Report No.(s): AD-A478940; AFIT/GAE/ENY/08-M27; No Copyright; Avail.: Defense Technical Information Center

(DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478940>

The purpose of this research was to develop testing methods capable of analyzing the performance of a miniature flapping-wing mechanism that can later be adapted for the development a biomimetic flapping-wing micro air vehicle (MAV). Three small scale flapping mechanisms capable of single plane flapping, flapping with active pitch control, and flapping/pitch with out-of-plane movement were designed using SolidWorks. The flapping-only model was fabricated on an Objet 3-dimensional printer and miscellaneous parts. The flapping mechanism was mounted on a supported by air bearings, and thrust was measured for a variety of conditions. The testing was conducted using wings composed of carbon fiber and Mylar



in four different size configurations, with flapping speeds ranging from 3.5 - 15 Hertz. The thrust was measured using an axially mounted 50 gram load cell which resulted in an accuracy of +/- 0.1 gram. The flapping mechanism was then mounted on a 6-component force balance to measure dynamic loading, which demonstrated the ability to gather time-accurate data within a single flapping stroke at speeds as high as 15 Hz. High speed cameras were also used for capturing images of how the structure of the wing changed at various testing conditions. Overall this research successfully demonstrated testing procedures that can be utilized in developing small scale flapping-wing micro air vehicles.

DTIC

*Biomimetics; Drone Vehicles; Flapping; Wings*

**20080025963** EJR Engineering, Methuen, MA, USA

**Development of Simplified Procedure for Computing the Absorption of Sound By the Atmosphere and Its Applicability to Aircraft Noise Certification: The Volpe Method**

Rickley, E. J.; Fleming, G. G.; Roof, C. J.; Jan. 20, 2006; 39 pp.; In English

Report No.(s): PB2007-114483; RTV-4F-FA53-LR01; No Copyright; Avail.: National Technical Information Service (NTIS)

The USA Department of Transportation, John A. Volpe National Transportation Systems Center (Volpe Center) Environmental Measurement and Modeling Division, in support of the Federal Aviation Administrations (FAA) Office of Environment and Energy (AEE), and working under the auspices of the Society of Automotive Engineers (SAE) Project Working Team (PWT) has completed a study of a proposed a new method to modernize the requirements for calculating atmospheric-absorption losses for the purpose of aircraft noise certification as required by Federal Aviation Regulation, Part 36, 'Noise Standards: Aircraft Type and Airworthiness Certification' (FAR36). The new method (referred to herein as the Volpe Method) utilizes the accurate pure-tone sound absorption algorithms of the ISO/ANSI standards and will be used to calculate attenuation by atmospheric-absorption for wide-band sounds analyzed by one-third octave-band filters. This letter report presents the results of the study. Section 1, is an introduction to the topic of atmospheric absorption as it relates to aircraft noise certification along with the objective of the study. Section 2 describes the implementation of the one-third octave-band adaptations of the ISO/ANSI pure-tone equations. Section 3 describes the development of the new method. Section 4 describes the sensitivity testing of the new Method. Section 5 presents conclusions and recommendations.

NTIS

*Acoustic Attenuation; Atmospheric Attenuation; Aircraft Noise; Noise Measurement; Aeroacoustics*

**20080026076** NASA Johnson Space Center, Houston, TX, USA

**Fires in P-3 Aircraft Oxygen Systems**

Stoltzfus, Joel; Journal of Testing and Evaluation; September 2006; 19 pp.; In English; Original contains color illustrations

Report No.(s): Paper ID-13562; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026076>

Fires in three P3 aircraft oxygen systems have occurred: one in the Royal Australian Air Force (RAAF) in 1984 and two in the U.S. Navy in 1998 and 2003. All three fires started in the aluminum manifold and check valve (MCV) assembly and produced similar damages to the aircraft in which they occurred. This paper discusses a failure analysis conducted by the NASA Johnson Space Center White Sands Test Facility (WSTF) Oxygen Hazards and Testing Team on the 2003 U.S. Navy VP62 fire. It was surmised that the fire started due to heat generated by an oxygen leak past a silicone check valve seal or possibly because of particle impact near the seat of one of the MCV assembly check valves. An additional analysis of fires in several check valve poppet seals from other aircraft is discussed. These burned poppet seals came from P3 oxygen systems that had been serviced at the Naval Air Station (NAS) in Jacksonville following standard fill procedures. It was concluded that these seal fires occurred due to the heat from compression heating, particle impact, or the heat generated by an oxygen leak past the silicone check valve seal. The fact that catastrophic fires did not occur in the case of each check valve seal fire was attributed to the protective nature of the aluminum oxide layer on the check valve poppets. To prevent future fires of this nature, the U.S. and Canadian fleets of P3 aircraft have been retrofitted with MCV assemblies with an upgraded design and more burn-resistant materials.

Author

*Fires; Oxygen Supply Equipment; P-3 Aircraft; Failure Analysis; Systems Engineering*

**20080026085** NASA Ames Research Center, Moffett Field, CA, USA

**Buckling Analysis and Test Correlation of Hat Stiffened Panels for Hypersonic Vehicles**

Percy, Wendy C.; Fields, Roger A.; October 29, 1990; 8 pp.; In English; AIAA Second International Aerospace Plane Conference, 29-31 Oct. 1990, Orlando, FL, USA; Original contains black and white illustrations

Report No.(s): AIAA Paper-90-5219; Copyright; Avail.: CASI: [A02](#), Hardcopy

The paper discusses the design, analysis, and test of hat stiffened panels subjected to a variety of thermal and mechanical load conditions. The panels were designed using data from structural optimization computer codes and finite element analysis. Test methods included the grid shadow Moire method and a single gage force stiffness method. The agreement between the test data and analysis provides confidence in the methods that are currently being used to design structures for hypersonic vehicles. The agreement also indicates that post buckled strength may potentially be used to reduce the vehicle weight.

Author

*Buckling; Correlation; Hypersonic Vehicles; Panels; Stiffness; Structural Analysis; Thermodynamics*

**20080026127** General Dynamics Corp., San Diego, CA, USA

**Geometric Optimums for Transatmospheric Military Vehicles**

[1984]; 28 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): F33615-83-C-3003

Report No.(s): CN 165-486; 695-0-84-64; Report-9; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report covers the ninth month of activities for the Transatmospheric Military Vehicle Study. Trajectory performance including transatmospheric vehicle (TAV) hypersonic glide coupled with flight path variation (orbit inclination) was conducted in support of the new mission study task. The first of four performance categories to be evaluated was addressed: the capability of a TAV to perform a plane change during its hypersonic flight profile was studied for various roll angle-of-bank, flight-path (orbit) inclination change, and ground track (range capability). Modifications to the TRAJEX performance program to handle the outlined TAV mission analysis is progressing faster than originally anticipated. The building blocks developed for the plane change maneuver allowed a rapid progression into the second area of mission study, the minor circle turn. Although the control logic for this type of flight maneuver is more complex than the plane change, it is anticipated that the analysis will be soon completed. Based on the results of the plane change analysis, the BG-R-10B-TAV is being down-sized to carry a DeltaV package of 6000fps. Additionally, the booster used on the BG-7D is being up-sized to accommodate a TAV with a reboost capability.

Author

*Aerodynamic Characteristics; Transatmospheric Vehicles; Military Vehicles; Boostglide Vehicles; Aerospace Engineering; Aircraft Performance; Aircraft Design*

**20080026228** Coburn (Thompson) LLP, Saint Louis, MO, USA

**Landing Assist Apparatus Interface Bulkhead and Method of Installation**

Muylaert, N. W., Inventor; Tebon, D., Inventor; Lahaie, R. E., Inventor; 3 Jun 04; 34 pp.; In English

Contract(s)/Grant(s): AR-DMH23-99-C-0111

Patent Info.: Filed Filed 3 Jun 04; US-Patent-Appl-SN-10-860-162

Report No.(s): PB2007-110528; 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

*Bulkheads; Installing; Walls*

## 06

### AVIONICS AND AIRCRAFT INSTRUMENTATION

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

**20080025727** NASA Dryden Flight Research Center, Edwards, CA, USA

#### **Enhanced Flight Termination System (EFTS): Flight Demonstration and Results**

Tow, David; Arce, Dennis; May 06, 2008; 30 pp.; In English; International Test and Evaluation Association (ITEA) Test Instrumentation Workshop, 6-9 May 2008, Lancaster, CA, USA; Original contains color illustrations; Copyright; Avail.:

CASI: [A03](#), Hardcopy

The Enhanced Flight Termination System (EFTS) program was initiated and propelled due to the inadvertent terminations of Global Hawk and the Strategic Target System and the NASA Inspector General's assessment letter and recommendations regarding the exploration of low-cost, lightweight space COMSEC for FTS. Additionally, the standard analog and high alphabet systems most commonly used in FTS are secure, but not encrypted. A study group was initiated to select and document a robust, affordable, reliable technology that provides encrypted FTS capability. A flight demonstration was conducted to gain experience using EFTS in an operational environment, provide confidence in the use of the EFTS components, integrate EFTS into an existing range infrastructure to demonstrate the scalability of system components, to provide a command controller that generated the EFTS waveform using an existing range infrastructure, and to provide a report documenting the results of the demonstration. The primary goal of the demonstration was to obtain operational experience with EFTS. Areas of operational experience include: mission planning, pre-flight configuration and testing, mission monitoring and recording, vehicle termination, developing mission procedures, and post mission data reduction and other post mission activities. An Advanced Medium-Range Air-to-Air Missile (AMRAAM) was selected to support the EFTS demonstration due to interest in future use of EFTS by the AMRAAM program, familiarity of EFTS by range personnel, and the availability of existing operational environment to support EFTS testing with available program funding. For demonstration purposes, the AMRAAM was successfully terminated using an EFTS receiver and successfully demonstrating EFTS. The EFTS monitoring software with spectrum analyzer and digital graphical display of aircraft, missile, and target were also demonstrated.

Author

*Flight Tests; Systems Integration; Air to Air Missiles; Systems Engineering; Abort Apparatus; Control Systems Design*

## 07

### AIRCRAFT PROPULSION AND POWER

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

**20080025775** Ramgen Power Systems, Inc., Bellevue, WA, USA

#### **Supersonic Gas Compressor**

Lawlor, S. P., Inventor; Novaresi, M. A., Inventor; Cornelius, C. C., Inventor; 23 Mar 05; 17 pp.; In English

Contract(s)/Grant(s): DE-FC026-00NT40915

Patent Info.: Filed Filed 23 Mar 05; US-Patent-Appl-SN-11-087-336

Report No.(s): PB2007-110546; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A gas compressor based on the use of a driven rotor having a compression ramp traveling at a local supersonic inlet velocity (based on the combination of inlet gas velocity and tangential speed of the ramp) which compresses inlet gas against a stationary sidewall. In using this method to compress inlet gas, the supersonic compressor efficiently achieves high compression ratios while utilizing a compact, stabilized gasdynamic flow path. Operated at supersonic speeds, the inlet stabilizes an oblique/normal shock system in the gasdynamic flow path formed between the rim of the rotor, the strakes, and a stationary external housing. Part load efficiency is enhanced by the use of a pre-swirl compressor, and using a bypass stream to bleed a portion of the intermediate pressure gas after passing through the pre-swirl compressor back to the inlet of the pre-swirl compressor. Inlet guide vanes to the compression ramp enhance overall efficiency.

NTIS

*Patent Applications; Supersonic Flow; Turbocompressors*

**20080025990** General Electric Aircraft Engines, Cincinnati, OH, USA

**Intelligent Engine Systems: HPT Clearance Control**

June 2008; 24 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-01135; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215234; E-16493; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025990>

The Advanced Thermally Actuated Clearance Control System underwent several studies. Improved flow path isolation quantified what can be gained by making the HPT case nearly adiabatic. The best method of heat transfer was established, and finally two different borrowed air cooling circuits were evaluated to be used for the HPT Active Clearance Control System.

Author

*Gas Turbine Engines; Actuators; Active Control; Control Systems Design; Aircraft Control*

**20080025991** Ohio State Univ., Columbus, OH, USA

**Intelligent Propulsion System Foundation Technology: Summary of Research**

June 2008; 18 pp.; In English

Contract(s)/Grant(s): NCC3-1086; WBS 984754.03.07.03.11.03

Report No.(s): NASA/CR-2008-215226; E-16509; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025991>

The purpose of this cooperative agreement was to develop a foundation of intelligent propulsion technologies for NASA and industry that will have an impact on safety, noise, emissions, and cost. These intelligent engine technologies included sensors, electronics, communications, control logic, actuators, smart materials and structures, and system studies. Furthermore, this cooperative agreement helped prepare future graduates to develop the revolutionary intelligent propulsion technologies that will be needed to ensure pre-eminence of the U.S. aerospace industry. This Propulsion 21 - Phase 11 program consisted of four primary research areas and associated work elements at Ohio universities: 1.0 Turbine Engine Prognostics, 2.0 Active Controls for Emissions and Noise Reduction, 3.0 Active Structural Controls and Performance, and 4.0 System Studies and Integration. Phase 1, which was conducted during the period August 1, 2003, through September 30, 2004, has been reported separately.

Author

*Turbine Engines; Active Control; Propulsion; Propulsion System Performance; Systems Engineering; Smart Structures; Smart Materials; Systems Health Monitoring*

**20080025992** General Electric Aircraft Engines, Cincinnati, OH, USA

**Intelligent Engine Systems: Thermal Management and Advanced Cooling**

Bergholz, Robert; June 2008; 57 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-1135; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215236; E-16495; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025992>

The objective is to provide turbine-cooling technologies to meet Propulsion 21 goals related to engine fuel burn, emissions, safety, and reliability. Specifically, the GE Aviation (GEA) Advanced Turbine Cooling and Thermal Management program seeks to develop advanced cooling and flow distribution methods for HP turbines, while achieving a substantial reduction in total cooling flow and assuring acceptable turbine component safety and reliability. Enhanced cooling techniques, such as fluidic devices, controlled-vortex cooling, and directed impingement jets, offer the opportunity to incorporate both active and passive schemes. Coolant heat transfer enhancement also can be achieved from advanced designs that incorporate multi-disciplinary optimization of external film and internal cooling passage geometry.

Author

*Turbine Engines; Cooling; Flow Distribution; Heat Transfer; Systems Engineering*

**20080025993** General Electric Aviation, Cincinnati, OH, USA

**Intelligent Engine Systems: Thermal Management and Advanced Cooling**

Bergholz, Robert; June 2008; 103 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-1135; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215238; E-16497; No Copyright; Avail.: CASI: A06, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025993>

The objective of the Advanced Turbine Cooling and Thermal Management program is to develop intelligent control and

distribution methods for turbine cooling, while achieving a reduction in total cooling flow and assuring acceptable turbine component safety and reliability. The program also will develop embedded sensor technologies and cooling system models for real-time engine diagnostics and health management. Both active and passive control strategies will be investigated that include the capability of intelligent modulation of flow quantities, pressures, and temperatures both within the supply system and at the turbine component level. Thermal management system concepts were studied, with a goal of reducing HPT blade cooling air supply temperature. An assessment will be made of the use of this air by the active clearance control system as well. Turbine component cooling designs incorporating advanced, high-effectiveness cooling features, will be evaluated. Turbine cooling flow control concepts will be studied at the cooling system level and the component level. Specific cooling features or sub-elements of an advanced HPT blade cooling design will be downselected for core fabrication and casting demonstrations.

Author

*Turbine Engines; Cooling; Heat Transfer; Flow Distribution; Systems Engineering; Engine Monitoring Instruments; Systems Health Monitoring*

## 08

### AIRCRAFT STABILITY AND CONTROL

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

**20080025317** Army Research Lab., Aberdeen Proving Ground, MD USA

#### **The Use of a Steering Shaping Function to Improve Human Performance in By-Wire Vehicles**

Hill, Susan G; Metcalfe, Jason S; McDowell, Kaleb; Mar 2008; 34 pp.; In English

Report No.(s): AD-A478959; ARL-TR-4387; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478959>

The U.S. Army is examining evolutionary concepts for the command and control of military vehicles. Currently, there is a performance issue regarding vehicle control at higher speeds for some indirect vision, by-wire tactical vehicles. By-wire vehicles are those in which mechanical links between the driver and control devices are replaced by electronic or computerized signals. Specifically, an operator's ability to maintain reliable control of by-wire military vehicles while driving appears to be progressively compromised as vehicle speed increases. Several factors have been identified as possible sources of this difficulty, including lags in the system control loop, characteristics of the steering interface (such as its shaping function or lack of force feedback), inadequate visual display, and physical effects of vehicle motion on the operator (McDowell et al., 2007a). This report is a review of the current state of knowledge regarding the steering shaping function, which specifies the dynamic spatial relationship between steering input from the driver and vehicle heading direction. The overall goal of the review is to identify design parameters critical to improving current by-wire implementation in military tactical vehicles, thereby identifying design elements to optimize human-vehicle system performance for secure mobile operations. Through a review of general automotive literature related to variable gear ratio steering systems as well as steer-by-wire design and implementation, three main factors affecting steering control were identified. The primary factors of influence that were reviewed included the overall range of motion (throw) of the steering device, the steering shaping function, and modifications of the shaping function because of vehicle motion characteristics.

DTIC

*Fly By Wire Control; Human Performance; Steering; Wire*

## 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*.

**20080023806** Massachusetts Inst. of Tech., Cambridge, MA USA

#### **Human-Automation Collaboration: Support for Lunar and Planetary Exploration**

Marquez, Jessica J; Feb 2007; 227 pp.; In English

Report No.(s): AD-A478335; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478335>

Balancing task allocation between humans and computers is crucial to the development of effective decision support

systems. This thesis investigates the appropriate balance between humans and automation for geospatial path problem solving within the high-risk domain of human planetary surface exploration, where decisions are time critical and humans must adapt to uncertainty. In order to develop flexible and robust decision support systems for Lunar and planetary exploration, human-automation role allocations are examined to understand how humans conduct complex optimizations under different degrees of automated assistance. A work domain analysis of human planetary extravehicular activities (EVA) resulted in a framework for human-robotic planning, including key input variables, constraints, and outputs. Based on this analysis, a prototype path planning aid was developed. Under investigation was the use of partial automatic path generation and a visualization called levels of equal cost (LOEC, an aggregate cost map). Human-in-the-loop testing was employed to understand the effects of the automated assistance and different visualizations on path planning performance across multivariate cost functions. In two separate experiments, participants were tasked to make obstacle-free, least-costly paths based on given cost functions. Analysis of the experimental results indicated that knowledge-based reasoning is best supported when operators conduct manual sensitivity analysis, a strategy that was absent when path generation was allocated to automation. Leveraging computer-generated paths resulted in overall better path performance but also led to automation bias and decreased situation awareness. With respect to visualizations, participants using elevation contours had lower cost paths and short task times when automation was reliable. However, the LOEC visualization helped participants initially create least-costly paths for the most complex cost function.

DTIC

*Decision Support Systems; Lunar Exploration; Optimization; Planning; Space Exploration*

**20080023847** Army War Coll., Carlisle Barracks, PA USA

**Building for the Future: China's Progress in Space Technology During the Tenth 5-Year Plan and the U.S. Response**

Pollpeter, Kevin; Mar 2008; 75 pp.; In English

Report No.(s): AD-A478502; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478502>

China's space program has achieved spectacular success in recent years. Since 2003 China has launched two human space flight missions, destroyed a satellite with a direct ascent anti-satellite weapon, and launched a moon orbiter. In this monograph, Mr. Kevin Pollpeter assesses China's rise as a space power and its implications for the USA. He argues that China's use of space power is part of an integrated approach to increasing its comprehensive national power and achieving great power status. As a result, China's increasing space power challenges the USA militarily, economically, commercially, and politically. China's increasing space capabilities will erode the U.S. lead in space in both absolute and relative terms. Nevertheless, the loss of preeminence in space need not result in the USA losing its role as the leading space power. To maintain its lead, the USA will not only need to improve technologically, but also train and keep a competent workforce, develop new and innovative ways to compete commercially, and expand the role of space in its exercise of soft power. To this end, this monograph offers valuable insights into China's rise as a space power as well as a number of policies designed to respond to the challenges it presents.

DTIC

*Aerospace Engineering; China; Progress*

**20080025296** Department of the Air Force, Washington, DC USA

**Counterspace Operations**

Aug 2, 2004; 67 pp.; In English

Report No.(s): AD-A478906; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478906>

This document is prepared by the USA Air Force to guide the application of counterspace operations, the ways and means by which the Air Force achieves and maintains space superiority. It provides greater depth to warfighting doctrine as articulated in AFDD 1 Air Force Doctrine, AFDD 2, Organization and Employment of Aerospace Forces, and AFDD 2-2, Space Operations. This AFDD applies to all active duty, Air Force Reserve, Air National Guard, and civilian Air Force personnel. The doctrine in this document is authoritative, but not directive. Therefore, commanders need to consider the contents of this AFDD and the particular situation when accomplishing their missions. Airmen should read it, discuss it, and practice it. SCOPE This doctrine expands upon Air Force basic beliefs and concepts on space operations doctrine, codifying beliefs, principles, and practices for the application of the counterspace function. It provides commanders, planners, and operators with considerations and advice on conducting counterspace operations with a variety of capabilities as part of a joint or coalition action. This doctrine establishes unclassified operational-level guidance for tactics, techniques, and procedures

described in Air Force Tactics, Techniques, and Procedures (AFTTP) and Air Force Operational Tactics, Techniques, and Procedures (AFOTTP).

DTIC

*Military Operations; Space Missions*

**20080025549** New Mexico Inst. of Mining and Technology, Socorro, NM USA

**Exploring the Acoustic Nonlinearity for Monitoring Complex Aerospace Structures**

Zagrai, Andrei N; Doyle, Derek T; Feb 27, 2008; 46 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0470

Report No.(s): AD-A479504; NMT-MENG-2008-LISS-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The project explores the acoustic nonlinearity for monitoring complex aerospace structures. A particular attention is given to structural connectors and joints. For these structural elements, an embedded nonlinear ultrasonic (ENU) approach is developed that utilizes unobtrusive piezoelectric wafer active sensors bonded to or embedded into structural elements. The nonlinear manifestation of structural damage is studied and various damage identification methodologies are suggested. Experimental results show feasibility of ENU monitoring of bolted joints in thin-walled aeronautical structures and complex space structures with iso-grinds. The proposed acousto-elastic method has shown potential in quantifying the torque level on a bolt and locating loosened bolts. Promising results were obtained for ENU monitoring of epoxy bonds. Classical and new nonlinear acoustic methods were found to be effective in detecting relatively large damage, but showed misinterpretation errors for specimens with damage of smaller size. A new nonlinear acoustic technique was suggested for short pulse measurements in aerospace structures. Correlation of experimental results obtained with a classical nonlinear acoustic approach and a new technique was established. It is suggested that ENU may be used either as a stand-alone SHM technique or as a complement to existing embedded ultrasonic methods.

DTIC

*Acoustics; Aerospace Vehicles; Aircraft Structures; Nonlinearity; Structural Design*

**20080025880** Gracar Corp., Dayton, OH USA

**Smart Systems for Logistics Command and Control (SSLC2): Virtual Space Logistics Readiness Center (VSLRC) Living Laboratory**

Matthews, Elizabeth; Cagle, Ron; Gruenke-Saunders, Jessica; Hartley, Lonna; Golden, Greg; Quill, Laurie; Dec 2005; 33 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-6404; Proj-2830

Report No.(s): AD-A479199; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479199>

The Virtual Space Logistics Readiness Center (VSLRC) Living Laboratory was developed to provide Air Force Space Command (AFSPC) users with a consistent understanding of space system operational, equipment, communication, and logistics status. Cognitive Task Analysis was accomplished through interviews with AFSPC users to storyboard weapon system core screens. Through user interface design and visualization techniques, users were provided with an intuitive display of information which requires no user training. Each core screen was designed and developed in accordance with the storyboards to include the capability for users to manually update operational, equipment and communications status to identify impacts of logistics actions on operations.

DTIC

*Aerospace Systems; Command and Control; Display Devices; Logistics; Satellite Communication; Space Logistics*

## 13

### ASTRODYNAMICS

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

**20080024254** Romanian Academy, Bucharest, Romania

**Formation Flying through Geodesic Motion and the Different Geometrical Requirements**

Cucu-Dumitrescu, Catalin; Piso, Marius-Ioan; Sep 2006; 13 pp.; In English

Report No.(s): AD-A478833; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Formation Flying; Geodesic Lines; Mathematical Models*

**20080025140** American Inst. of Aeronautics and Astronautics, Reston, VA, USA

**Orbital Express: Rendezvous and Renewal**

Wilson, J. R.; Aerospace America; March 2008; ISSN 0740-722X; 8 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

The Orbital Express Space Operations Architecture program was designed to test the ability and practicality of two satellites rendezvousing in orbit and exchanging liquid fuel, batteries and even system upgrades. The satellites were mated atop an Atlas V rocket and launched in 2007 into a lightly populated LEO, where a four-month succession of decoupling, separations of up to 6 miles, and rendezvous/remating maneuvers would not interfere with nor be impacted by other satellites. The goal for the participants was to demonstrate that a satellite could be serviced in orbit without the intervention of astronauts. For Orbital Express, the NextSat was designed specifically to support such servicing, and ASTRO was equipped with mechanical arms and other devices to facilitate both mating and service. While Orbital Express proved that current technologies and processes are sufficient to make the concept of satellite servicing technically feasible, it could not predict how potential users will see the economic or even technology sustainment value. It was then thought to be more feasible to get various customers to commit ahead of time to being serviced, then using that leverage to build the spacecraft and launch it into orbit. The two satellites were shut down and decommissioned after NASA and the Air Force decided not to keep them active for additional experiments beyond the parameters of the DARPA program. Despite a computer malfunction that separated the satellites by 200 miles at one point, Orbital Express can go into DARPA's ledger as a successful venture.

Derived from text

*Orbital Rendezvous; Spacecraft Docking; Autonomous Docking; Rendezvous Spacecraft; Orbital Servicing*

## 15

### LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

**20080023961** Texas Univ., Austin, TX USA

**Formation Autonomy Spacecraft with Thrust, RELNAV, Attitude, and Crosslink (FASTRAC)**

Lightsey, E G; Jan 17, 2008; 15 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0210; Proj-2305/IX

Report No.(s): AD-A478646; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Detailed subsystem designs have been completed including communications, power, GPS, thruster, structure, and separation system. Most of these subsystems have had working engineering models fabricated and tested. A detailed project document tree has been created and populated with requirements, subsystem designs, operational modes, and system test procedures. A KC-135 weightless experiment was conducted by students to demonstrate and measure the tip off properties of the Lightband separation system for dynamic analysis.

DTIC

*Artificial Satellites; Attitude (Inclination); Autonomy; Crosslinking; Drone Vehicles; Nanosatellites*

**20080024009** GMV S.A., Madrid, Spain

**PLATFORM: The GMV's Test-Bench for Formation Flying, RvD and Robotic Validation**

Molina Cobos, Miguel A; Dec 1, 2006; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478705; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Artificial Satellites; Formation Flying; Robotics*

**20080024065** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Uncorrelated Track Avoidance**

Grob, Darrell L; Mar 2008; 112 pp.; In English

Report No.(s): AD-A478788; AFIT/GA/ENY/08-M10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this thesis is to examine what data requirements are necessary to avoid continual series of uncorrelated tracks when gathering observations. The constants of the motion for simple two-body motion for a satellite orbiting the Earth, known as the classical orbital elements do not remain constant due to zonal and sectoral harmonic variations in the Earth's gravitational field. There are other elements of the motion that should be considered and this paper discusses the constancy



of three elements: the Hamiltonian of the Earth-Centered Rotating System, Z-component of inertial angular momentum, and the time rate of change of the right ascension of the ascending. With an understanding of the constancy of these elements, simulated data was used to determine the effects sensor performance and observation quantity have on the ability to effectively estimate these constants. This information was used to determine an appropriate level of fidelity for a model to be utilized as a supplement in fitting observation data with current data available in the Satellite Catalog.

DTIC

*Artificial Satellites; Detectors; Gravitational Fields; Orbits*

**20080024081** EADS Astrium Ltd., Portsmouth, UK

**A Space Based Radar Antenna Concept to Counter Camouflage and Concealment**

Howard, Phillip; Notter, Mike; Hall, C D; Pellegrino, Sergio; Sep 7, 2006; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478834; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Antenna Design; Camouflage; Folding; P Band; Radar Antennas; Space Based Radar; Spacecraft Antennas; Synthetic Aperture Radar*

**20080025061** Library of Congress, Washington, DC USA

**Satellite Surveillance: Domestic Issues**

Best, Jr , Richard A; Elsea, Jennifer K; Mar 21, 2008; 30 pp.; In English

Report No.(s): AD-A478852; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reconnaissance satellites, first deployed in the early 1960s to peer into denied regions of the Soviet Union and other secretive enemy states, have from time to time been used by civilian agencies of the federal government to assist with mapping, disaster relief, and environmental concerns. These uses have been coordinated by the Civil Applications Office at the U.S. Geological Survey, a component of the Interior Department. Post 9/11, the Bush Administration has sought to encourage use of satellite-derived data for homeland security and law enforcement purposes, in addition to the civil applications that have been supported for years. In 2007, it moved to transfer responsibility for coordinating civilian use of satellites to the Department of Homeland Security. The transfer occurred, however, apparently without notification of key congressional oversight committees.

DTIC

*Reconnaissance; Artificial Satellites; Surveillance*

**20080025167** NASA Marshall Space Flight Center, Huntsville, AL, USA

**NASA and Army Collaboration on Unmanned Systems Presentation to the Association for Unmanned Vehicle Systems International (AUVSI)**

Fernandez, Ken; April 24, 2008; 8 pp.; In English; 2008 AUVSI/AHS Pathfinder Symposium: Unmanned Systems, the Path Forward, 23-14 Apr. 2008, Huntsville, AL, USA; Original contains black and white illustrations; No Copyright; Avail.:

CASI: C01, CD-ROM: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025167>

This viewgraph presentation describes the collaborative effort of NASA and the US Army on unmanned systems. The contents include: 1) Robotic/Autonomous Systems Architecture Development; 2) Synergy In Robotics/Autonomous Systems Development; 3) Surface Mobility Systems: Lunar Pylon Network Project; 4) Lunar Pylon Network Enables Multiple Vehicle Operations & Logistics; 5) Surface Mobility Systems: MARCbot IV-N Project Overview; 6) Autonomous Logistics Support Demonstration; and 7) Lunar Network Demonstration and Collaborative Effort.

CASI

*NASA Programs; Armed Forces (United States); Pilotless Aircraft; Lunar Communication; Robotics*

**20080025316** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Contamination Study of Micro Pulsed Plasma Thruster**

Kesenek, Ceylan; Mar 2008; 116 pp.; In English

Report No.(s): AD-A478952; AFIT/GA/ENY/08-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478952>

Satellite designing trend is progressing towards building smaller satellites. Small satellites require micro propulsion

devices for accurate control by the propulsion system. Micro-Pulsed Plasma Thrusters (PPTs) are highly reliable and simple micro propulsion systems that will offer attitude control, station keeping, constellation flying, and drag compensation for such satellites. As an unfortunate side effect, the plume induces contamination on spacecraft surfaces and may lead to significant problems with sensors and power generation. Solid particulates in the exhaust plume may deposit on spacecraft instrument and the solar array surfaces limiting or reducing the mission capability as well as the lifetime of a satellite. To better understand these contamination issues, a detailed characterization of the exhaust plume is necessary. This research employs PPTs, first developed at the Air Force Research Lab at Edwards AFB, CA, and is being operated in a simulated space environment, at the Air Force Institute of Technology micro-propulsion vacuum facilities.

DTIC

*Artificial Satellites; Contamination; Pulsed Plasma Thrusters*

**20080025544** Temple Univ., Philadelphia, PA USA

**Dynamical Characteristics of Hierarchical Hybrid System for Multiple Satellite Control**

Won, Chang-Hee; Feb 6, 2008; 30 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0319

Report No.(s): AD-A479466; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this proposal is to investigate the dynamical properties of a hierarchical hybrid system. In the prior studies, we have developed a three-tier, hybrid system architecture for multiple remote sensing satellite control. There, we concentrated in modeling and analysis of a dynamical system whose solution only depends on the initial states. In this study, we propose to introduce another hybrid automaton with input variables. Then we will study reachability, safety, and stability properties of the hybrid system. This study will lead to a software verification tool. We will utilize game theory for automata and continuous dynamical systems. For the low-level control, we will investigate the use of statistical control and game theory for N-players. This will lead to a more effective low-level controller.

DTIC

*Control Theory; Game Theory; Satellite Control*

**20080025924** Air Force Research Lab., Hanscom AFB, MA USA

**Bootstrap Surface Charging at GEO: Modeling and On-Orbit Observations From the DSCS-III B7 Satellite**

Krause, Linda H; Font, Gabriel; Putz, Victor; Cooke, David L; Lai, Shu T; Enloe, C L; McHarg, M G; Dec 2007; 8 pp.; In English

Contract(s)/Grant(s): Proj-5021

Report No.(s): AD-A479388; AFRL-RV-HA-TR-2008-1021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present an analysis of the charging interactivity between surrounding surface materials aboard a spacecraft at geosynchronous altitudes. In particular, bootstrap charging of a small surface may occur if it is surrounded by a large negatively charged surface. Here, a negative potential barrier forms above the small surface, resulting in suppression of photo- and secondary electron emission from that surface. Additionally, the small surface experiences an enhancement of the collection of the photo- and secondary electrons emitted from the surrounding surface. This mechanism results in the charging of the small surface to higher levels than that of the patch in isolation, and in many cases the final potential will reach that of the potential of the larger surrounding surface. With this study we examine bootstrap charging behavior with model data and with data collected on orbit. We have modeled the DSCS-III B7 geosynchronous satellite with realistic geometry and spacecraft materials. Additionally, a previous study has shown that bootstrap charging has been observed on the DSCS-III B7 geosynchronous spacecraft. Bot Astroquartz and Kapton cloth patches charged up to the frame potential of the satellite during periods of severe frame charging. The results of modeling bootstrap charging of a small Kapton patch floating relative to the DSCS-III frame fixed at a potential of 1,000 V show that the patch will indeed charge up negatively to match the frame potential, with the temporal increase in negative potential following an exponential time characteristic.

DTIC

*Defense Communications Satellite System; Spacecraft Charging*

**20080025936** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Space Based Satellite Tracking and Characterization Utilizing Non-Imaging Passive Sensors**

Townsend, Bradley R; Mar 2008; 112 pp.; In English

Report No.(s): AD-A478890; AFIT/GA/ENY/08-M06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478890>

A technique is developed to determine the orbit of a sunlight illuminated satellite passing through the field-of-view of a

sensor platform in a Highly Elliptical Orbit (HEO) and Geosynchronous orbit (GEO). The technique develops two different methods of initial orbit determination. The first relies on the Gauss initial orbit determination method to develop an estimate of the state from angular data. The second method relies on positional data of the target relative to the Earth's background to determine an estimate of the state. These estimates are then refined in a non-linear least squares routine. This estimate of the state is then used to identify the target from the Air Force Space Command satellite catalog.

DTIC

*Characterization; Detectors; Imaging Techniques; Satellite Tracking*

**20080025945** Defence Research and Development Canada, Ottawa, Ontario Canada

**The Addition of Enhanced Capabilities to NATO GMTIF STANAG 4607 to Support RADARSAT-2 GMTI Data**

Beaulne, Pierre D; Dec 2007; 88 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479333; DRDC-O-TM-2007-341; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Technical Memo describes the background, aims, and methodology for adding new capabilities, in the form of new extensions, to the North Atlantic Treaty Organization (NATO) Ground Moving Target Indication Format (GMTIF), known by NATO as Standardization Agreement (STANAG) 4607. These changes are required to accommodate new sensors, processing techniques, and sensor modes of operation, such as will be available from the Synthetic Aperture Radar - Ground Moving Target Indication (SAR-GMTI) mode onboard RADARSAT-2. Further additions are also made to provide a level of redundancy and flexibility. The RADARSAT-2 GMTI group at DRDC Ottawa was instrumental in identifying and developing these changes and having them incorporated into the GMTIF. The resulting changes, contained in Annex B, are preliminary and were needed to support data from the GMTI mode onboard RADARSAT-2. Dissemination of GMTI products is an important component of the Department of National Defence's (DND) RADARSAT-2 GMTI Technology Demonstration Project (TDP), which aims to demonstrate the utility of space-borne GMTI. RADARSAT-2 will be the first spaceborne SAR-GMTI platform to implement STANAG 4607. These advanced segment extensions will greatly enhance the dissemination capacity of GMTI data between various sensors and users. They will continue to evolve to further increase the utility and ease of use of GMTIF data to exploitation systems.

DTIC

*Interoperability; Moving Target Indicators; North Atlantic Treaty Organization (NATO); RADARSAT; Reconnaissance; Synthetic Aperture Radar; Targets*

**20080026003** NASA Johnson Space Center, Houston, TX, USA

**Preliminary Trade Study of Phase Change Heat Sinks**

Anderson, Molly; Leimkeuhler, Thomas; Quinn, Gregory; Gollhofer, Eric; July 17, 2006; 1 pp.; In English; International Conference on Environmental Systems, 17-20 Jul. 2006, Norfolk, VA, USA; Copyright; Avail.: Other Sources; Abstract Only

For short durations, phase change based heat rejection systems are a very effective way of removing heat from spacecraft. Future NASA vehicles, such as the Crew Exploration Vehicle (CEV), will require non-radiative heat rejection systems during at least a portion of the planned mission, just as their predecessors have. While existing technologies are available to modify, such as Apollo era sublimators, or the Space Shuttle Flash Evaporator System (FES), several new technologies are under development or investigation to progress beyond these existing heat rejection systems. Examples include the Multi-Fluid Evaporator developed by Hamilton Sundstrand, improvements upon the Contaminant Insensitive Sublimator originally developed for the X-38 program, and a Compact Flash Evaporator System (CFES). Other possibilities evaluate new ways of operating existing designs. The new developments are targeted at increasing operating life, expanding the environments in which the system can operate, improving the mass and volume characteristics, or some combination of these or other improvements. This paper captures the process and results of a preliminary trade study performed at Johnson Space Center to compare the various existing and proposed phase change based heat rejection systems for the CEV. Because the new systems are still in development, and the information on existing systems is extrapolation, this trade study is not meant to suggest a final decision for future vehicles. The results of this early trade study are targeted to aid the development efforts for the new technologies by identifying issues that could reduce the chances of selection for the CEV.

Author

*Evaporators; Heat Sinks; Space Shuttles; X-38 Crew Return Vehicle*

## SPACE TRANSPORTATION AND SAFETY

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

**20080025038** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; NASA Johnson Space Center, Houston, TX, USA

### **Evaluation of Various Cleaning Methods to Remove Bacillus Spores from Spacecraft Hardware Materials**

Venkateswaran, Kasthuri; Chung, Shirley; Allton, Judith; Kern, Roger; Astrobiology; September 29, 2004; Volume 4, No. 3, pp. 377-390; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40852>

A detailed study was made of the biological cleaning effectiveness, defined in terms of the ability to remove bacterial spores, of a number of methods used to clean hardware surfaces. Aluminum (Al 6061) and titanium (Ti 6Al-4V) were chosen for the study as they were deemed the two materials most likely to be used in spacecraft extraterrestrial sampler construction. None of the cleaning protocols tested completely removed viable spores from the surface of the aluminum. In contrast, titanium was capable of being cleaned to sterility by two methods, the JPL standard and the commercial SAMS cleaning process. Further investigation showed that the passivation step employed in the JPL standard method is an effective surface sterilant on both metals but not compatible with aluminum. It is recommended that titanium (Ti 6Al-4V) be considered superior to aluminum (Al 6061) for use in spacecraft sampling hardware, both for its potential to be cleaned to sterilization and for its ability to withstand the most effective cleaning protocols.

Author

*Spacecraft Equipment; Hardware; Bacillus; Contaminants; Spores*

## 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*.

**20080023787** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **Ares Integrated Vehicle System Safety Team**

Wetherholt, Jon; April 16, 2008; 18 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.:

CASI: C01, CD-ROM: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023787>

NASA is working on the Constellation Program to go to the Moon and beyond. The Program contains a number of projects: a) The Ares I Launch Vehicle for the Orion Crew Module; b) The Ares V Launch Vehicle to launch large payloads into orbit, including the Earth Departure Stage (EDS); d) The Orion vehicle to transport the crew to orbit and to other destinations; and d - The Altair Lunar Lander

Derived from text

*Constellation Program; Spacecraft Modules; Systems Integration; Launch Vehicles*

**20080024190** NASA Glenn Research Center, Cleveland, OH, USA

### **Space Telecommunications Radio System Software Architecture Concepts and Analysis**

Handler, Louis M.; Hall, Charles S.; Briones, Janette C.; Blaser, Tammy M.; June 11, 2008; 53 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 439432.04.07.01

Report No.(s): NASA/TP-2008-214813; E-15968; Copyright; Avail.: CASI: A04, Hardcopy

The Space Telecommunications Radio System (STRS) project investigated various Software Defined Radio (SDR) architectures for Space. An STRS architecture has been selected that separates the STRS operating environment from its various waveforms and also abstracts any specialized hardware to limit its effect on the operating environment. The design supports software evolution where new functionality is incorporated into the radio. Radio hardware functionality has been moving from hardware based ASICs into firmware and software based processors such as FPGAs, DSPs and General Purpose Processors (GPPs). Use cases capture the requirements of a system by describing how the system should interact with the users

or other systems (the actors) to achieve a specific goal. The Unified Modeling Language (UML) is used to illustrate the Use Cases in a variety of ways. The Top Level Use Case diagram shows groupings of the use cases and how the actors are involved. The state diagrams depict the various states that a system or object may be in and the transitions between those states. The sequence diagrams show the main flow of activity as described in the use cases.

Author

*Space Communication; Radio Communication; Telecommunication; Computer Programs; Software Engineering; Environment Effects; Architecture (Computers)*

**20080025036** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Site Distribution and Aliasing Effects in the Inversion for Load Coefficients and Geocenter Motion from GPS Data**

Wu, Xiaoping; Argus, Donald F.; Heflin, Michael B.; Ivins, Erik R.; Webb, Frank H.; *Geophysical Research Letters*; December 27, 2002; ISSN 0094-8276; Volume 29, No. 24; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2002GL016324>; <http://hdl.handle.net/2014/40838>

Precise GPS measurements of elastic relative site displacements due to surface mass loading offer important constraints on global surface mass transport. We investigate effects of site distribution and aliasing by higher-degree ( $n$  greater than or equal 2) loading terms on inversion of GPS data for  $n = 1$  load coefficients and geocenter motion. Covariance and simulation analyses are conducted to assess the sensitivity of the inversion to aliasing and mismodeling errors and possible uncertainties in the  $n = 1$  load coefficient determination. We found that the use of center-of-figure approximation in the inverse formulation could cause 10- 15% errors in the inverted load coefficients.  $n = 1$  load estimates may be contaminated significantly by unknown higher-degree terms, depending on the load scenario and the GPS site distribution. The uncertainty in  $n = 1$  zonal load estimate is at the level of 80 - 95% for two load scenarios.

Author

*Global Positioning System; Contamination; Coefficients; Displacement; Inversions; Covariance*

## 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*.

**20080024207** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**An Analysis of Spacecraft Localization from Descent Image Data for Pinpoint Landing on Mars and other Cratered Bodies Data Acquisition**

Ansar, Adnan; Cheng, Yang; *Photogrammetric Engineering and Remote Sensing*; October 2005; ISSN 0099-1112; Volume 71, No. 10, pp. 1197-1204; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40847>

A pinpoint landing capability will be a critical component for many planned NASA missions to Mars and beyond. Implicit in the requirement is the ability to accurately localize the spacecraft with respect to the terrain during descent. In this paper, we present evidence that a vision-based solution using craters as landmarks is both practical and will meet the requirements of next generation missions. Our emphasis in this paper is on the feasibility of such a system in terms of (a) localization accuracy and (b) applicability to Martian terrain. We show that accuracy of well under 100 meters can be expected under suitable conditions. We also present a sensitivity analysis that makes an explicit connection between input data and robustness of our pose estimate. In addition, we present an analysis of the susceptibility of our technique to inherently ambiguous configurations of craters. We show that probability of failure due to such ambiguity is becoming increasingly small.

Author

*Mars Landing; Probability Theory; Data Acquisition; Descent; Planetary Geology; Craters*

**20080025139** American Inst. of Aeronautics and Astronautics, Reston, VA, USA

**ISS: Countdown to Completion**

Sietzen, Frank, Jr.; *Aerospace America*; March 2008; ISSN 0740-722X; 7 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

The International Space Station (ISS), though impressive in size, is still only about 60% complete since assembly began

in 1998. What began as a national response to the Soviet-era Salyut and Mir stations has become a common home for Russia, the U.S. and more than a dozen international partners, nearly all of whom have waited for the space shuttle and federal budgets to come together to create a permanent low orbit space facility. Beginning in the later 1980s, however, the original station (Space Station Freedom) has been descoped and reduced in both size and capability. Satellite servicing and repair were among the early capabilities to be dropped, along with the maneuvering and transfer vehicles. A crew of 6 could occupy the base as soon as 2009, but that number has dwindled from the 8 originally envisioned. The inclusion of the Russian Federation as a partner in 1993 has added habitat space to the station's building block core, but some Russian elements, including a power tower, will never happen. Above all, completion of the station will be timed and shaped by shrinking access to the space shuttle fleet, itself diminished after 2 disasters reduced the fleet from 5 to 3. The Bush Administration announced the Vision for Space Exploration in 2004 which required the shuttles be retired in 2010, the research focus be changed to keeping future astronauts alive on other planets, and the station itself deorbited in 2016. As the retirement date approaches, matching the fleets orbiters to specific payload assignments will be a difficult task. The prospect of limited access to remaining shuttle flights has drastically changed even basic station re-supply training. However, the stations recent designation as a national laboratory may ultimately serve to lengthen its lifetime beyond the planned 2016 decommissioning and open its lab space beyond the existing partnership framework. In the handful of shuttle flight occurring over the next few years, the greatly diminished ISS may have a chance to match its promise with performance.

Derived from text

*International Space Station; Space Station Freedom; NASA Space Programs; Construction; International Cooperation; Logistics; Project Planning; Aerospace Industry*

**20080026002** NASA Johnson Space Center, Houston, TX, USA

**Thermal Control System Development to Support the Crew Exploration Vehicle and Lunar Surface Access Module**

Anderson, Molly; Westheimer, David; February 12, 2006; 22 pp.; In English; Space Technology and Application International Forum (STAIF), 12-16 Feb. 2006, Albuquerque, NM, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026002>

All space vehicles or habitats require thermal management to maintain a safe and operational environment for both crew and hardware. Active Thermal Control Systems (ATCS) perform the functions of acquiring heat from both crew and hardware within a vehicle, transporting that heat throughout the vehicle, and finally rejecting that energy into space. Almost all of the energy used in a space vehicle eventually turns into heat, which must be rejected in order to maintain an energy balance and temperature control of the vehicle. For crewed vehicles, Active Thermal Control Systems are pumped fluid loops that are made up of components designed to perform these functions. NASA has recently evaluated all of the agency's technology development work and identified key areas that must be addressed to aid in the successful development of a Crew Exploration Vehicle (CEV) and a Lunar Surface Access Module (LSAM). The technologies that have been selected and are currently under development include: fluids that enable single loop ATCS architectures, a gravity insensitive vapor compression cycle heat pump, a sublimator with reduced sensitivity to feedwater contamination, an evaporative heat sink that can operate in multiple ambient pressure environments, a compact spray evaporator, and lightweight radiators that take advantage of carbon composites and advanced optical coatings.

Author

*Temperature Control; Control Systems Design; Active Control; Technology Assessment; Systems Engineering; Lunar Exploration; Lunar Spacecraft*

**20080026216** NASA Johnson Space Center, Houston, TX, USA

**Spacecraft Design Considerations for Piloted Reentry and Landing**

Stroud, Kenneth J.; Klaus, David M.; January 2006; 42 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

With the end of the Space Shuttle era anticipated in this decade and the requirements for the Crew Exploration Vehicle (CEV) now being defined, an opportune window exists for incorporating 'lessons learned' from relevant aircraft and space flight experience into the early stages of designing the next generation of human spacecraft. This includes addressing not only the technological and overall mission challenges, but also taking into account the comprehensive effects that space flight has on the pilot, all of which must be balanced to ensure the safety of the crew. This manuscript presents a unique and timely

overview of a multitude of competing, often unrelated, requirements and constraints governing spacecraft design that must be collectively considered in order to ensure the success of future space exploration missions.

Author

*Spacecraft Design; Manned Space Flight; Manned Reentry; Spacecraft Landing; Lessons Learned; Biological Effects; Physiological Effects; Human Factors Engineering; Aerospace Engineering*

## 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*.

**20080026200** NASA Johnson Space Center, Houston, TX, USA

#### **Laboratory Simulation of Impacts upon Aluminum Foils of the Stardust Spacecraft: Calibration of Dust Particle Size from Comet Wild 2**

Kearsley, A. T.; Burchell, M. J.; Horz, F.; Cole, M. J.; Schwandt, C. S.; [2006]; 27 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 339767.04.06.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

Metallic aluminium alloy foils exposed on the forward, comet-facing surface of the aerogel tray on the Stardust spacecraft are likely to have been impacted by the same cometary particle population as the dedicated impact sensors and the aerogel collector. The ability of soft aluminium alloy to record hypervelocity impacts as bowl-shaped craters offers an opportunistic substrate for recognition of impacts by particles of a wide potential size range. In contrast to impact surveys conducted on samples from low Earth orbit, the simple encounter geometry for Stardust and Wild 2, with a known and constant spacecraft-particle relative velocity and effective surface-perpendicular impact trajectories, permits closely comparable simulation in laboratory experiments. For a detailed calibration programme we have selected a suite of spherical glass projectiles of uniform density and hardness characteristics, with well-documented particle size range from 10 microns to nearly 100 microns. Light gas gun buckshot firings of these particles at approximately  $6\text{ km s}^{-1}$  onto samples of the same foil as employed on Stardust have yielded large numbers of craters. Scanning electron microscopy of both projectiles and impact features has allowed construction of a calibration plot, showing a linear relationship between impacting particle size and impact crater diameter. The close match between our experimental conditions and the Stardust mission encounter parameters should provide another opportunity to measure particle size distributions and fluxes close to the nucleus of Wild 2, independent of the active impact detector instruments aboard the Stardust spacecraft.

Author

*Sensors; Calibrating; Spacecraft Equipment; Hypervelocity Impact; Cosmic Dust; Particle Size Distribution; Aluminum Alloys; Metal Foils*

## 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*.

**20080025248** Lawrence Livermore National Lab., Livermore, CA USA

#### **Pump Fed Propulsion for Mars Ascent and Other Challenging Maneuvers**

Whitehead, J. C.; Jun. 19, 2007; 8 pp.; In English

Report No.(s): DE2007-910209; UCRL-CONF-231032; No Copyright; Avail.: National Technical Information Service (NTIS)

Returning Mars geology samples to Earth within science mission budgets requires a miniature launch vehicle (100-200 kg) for ascending from Mars to an orbital rendezvous. A Mars Ascent Vehicle must deliver a velocity change exceeding 4 km/s within minutes, entirely outside the capabilities of satellite propulsion. A possible solution is to scale down liquid launch vehicle principles to achieve stage propellant mass fractions near 90 percent. Feeding a high-pressure engine from thin-walled low pressure tanks permits stage hardware to be sufficiently lightweight and compact, if very high performance pumps can

be made available. NASA's Mars Technology Program has funded refinement and testing of a miniature piston pump, powered by reacted propellant. A pump-fed bipropellant rocket stage remains to be developed. The technology could also benefit other future lunar and planetary science programs.

NTIS

*Ascent; Launch Vehicles; Miniaturization; Pistons; Propulsion; Pumps; Spacecraft Launching*

**20080025730** Institute for Scientific Research, Fairmont, WV, USA; Florida Univ., Gainesville, FL, USA

**Gas Core Reactor Numerical Simulation Using a Coupled MHD-MCNP Model**

Kazeminezhad, F.; Anghaie, S.; May 2008; 82 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC8-225

Report No.(s): NASA/CR-2008-215408; M-1228; Copyright; Avail.: CASI: A05, Hardcopy

Analysis is provided in this report of using two head-on magnetohydrodynamic (MHD) shocks to achieve supercritical nuclear fission in an axially elongated cylinder filled with UF<sub>4</sub> gas as an energy source for deep space missions. The motivation for each aspect of the design is explained and supported by theory and numerical simulations. A subsequent report will provide detail on relevant experimental work to validate the concept. Here the focus is on the theory of and simulations for the proposed gas core reactor conceptual design from the onset of shock generations to the supercritical state achieved when the shocks collide. The MHD model is coupled to a standard nuclear code (MCNP) to observe the neutron flux and fission power attributed to the supercritical state brought about by the shock collisions. Throughout the modeling, realistic parameters are used for the initial ambient gaseous state and currents to ensure a resulting supercritical state upon shock collisions.

Author

*Collisions; Nuclear Fission; Magnetohydrodynamics; Reactor Design; Flux (Rate)*

## 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*.

**20080023811** Army Research Lab., Aberdeen Proving Ground, MD USA

**Breathability Characterization of Ballistic Fabrics, Including Shear Thickening Fluid-Treated Fabrics**

Chin, Wai K; Wetzel, Eric D; Mar 2008; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478351; ARL-TR-4392; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478351>

The breathability of a series of ballistic fabrics and shear thickening fluid (STF)-treated ballistic fabrics was evaluated. Breathability was characterized using measurements of water vapor transport rate through fabric samples. The results show that uncoated ballistic fabrics offer good breathability that is only slightly lower than conventional military outer garments. Ballistic fabrics treated with STF show a slight decrease in breathability, as compared with uncoated fabrics. Ballistic fabrics with continuous polymer coatings, however, exhibit very low water vapor transport rates. These results indicate that fabrics treated with STF introduce no significant penalty in breathability relative to conventional, uncoated ballistic fabrics.

DTIC

*Ammunition; Armor; Coatings; Fabrics; Fragmentation*

**20080023924** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Transient Plasma Induced Production of OH and its Effects on Ignition in Atmospheric CH<sub>4</sub>-AIR Quiescent Mixtures (Postprint)**

Cathey, Charles; Cain, Jeremy; Wang, Hai; Gundersen, Martin A; Ryan, Michael; Carter, Campbell D; Jan 2008; 12 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A478541; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Transient plasma from a 60 kV, 70 ns pulse induced OH production in air and CH<sub>4</sub>/air quiescent mixtures inside a cylindrical chamber is analyzed. The resulting OH from the plasma discharge, ignition, and subsequent combustion is analyzed using planar laser induced fluorescence. A high-framing-rate camera was also used to image ignition and flame propagation



in the chamber, providing spatial and temporal resolution over the entire combustion event. Results indicate OH structures produced during the discharge in humid, ambient air are less branched, thicker, and last longer when compared to structures in CH<sub>4</sub>/dry-air. Transient plasma successfully ignited the CH<sub>4</sub>/air mixture, populating the discharge volume with radicals. Mean OH number densities produced by the discharge were found to decay within 100 s of the plasma. Ignition under these conditions was found to occur approximately 1 ms after the discharge along the anode, creating multiple ignition kernels whose proximity to the anode is consistent with the region of highest field and, thus, maximum radical density.

DTIC

*Air Pollution; Ignition; Laser Induced Fluorescence; Methane; Plasmas (Physics)*

**20080024038** Army Aeromedical Research Lab., Fort Rucker, AL USA

**Impact Protection Assessment of the Redesigned Oregon Aero ZetaLiner Fitting System in the HGU-56/P Aircrew Integrated Helmet System**

Brozoski, Frederick; Licina, Joseph; Phelps, Shean; Padgett, Katie; Vasquez, Kimberly; Lindsey, James; Harvey, Amy; Feb 2008; 33 pp.; In English

Report No.(s): AD-A478747; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The HGU-56/P Aircrew Integrated Helmet System (AIHS) uses the thermoplastic liner (TPL) to provide wearers with a custom helmet fit. While the TPL provides a comfortable helmet fit for most HGU-56/P AIHS wearers, there is a portion of the aviation warfighter population who cannot be comfortably accommodated by the TPL. Oregon Aero, Inc. markets an alternative helmet fitting system for the HGU-56/P AIRS (this fitting system is referred to as the Zetall throughout the manuscript). The impact of replacing the TPL with the Zetall fitting system on the blunt impact protection provided by the HGU-56/P AIHS is unknown. Fifty two (52) new HGU-56/P AIHSs in four sizes (small, medium, large, and extra-large) were subjected by blunt impact evaluations in accordance with the HGU-56/P purchase description. The TPL in each helmet was replaced with a 1/4-inch thick Zetall fitting system. Peak head accelerations measured during these trials were compared to peak head acceleration limits. Listed in the HGU-56/P AIHS purchase description; peak head accelerations exceeding the limits set forth in the purchase description represented reduced blunt impact protection. Peak head accelerations measured during this evaluation remained below these specified limits, indicating that the impact protection of the HGU-56/P AIHS is not degraded with the use of the Zetall fitting system.

DTIC

*Damage Assessment; Fitting; Flight Crews; Helmets; Impact; Linings; Protection; Systems Integration*

**20080024684** National Chung Hsing Univ., Taichung, Taiwan, Province of China

**The Annealing Effect on the Improvement of Hermetically Carbon-Coated Optical Fibers Prepared by Plasma Enhanced Chemical Vapor Deposition Method With Methane and Argon as Precursor Gases**

Lin, Hung-Chien; Shiue, Sham-Tsong; Chou, Yi-Ming; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 253-259; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 95-2221-E005-115; Copyright; Avail.: Other Sources

The annealing effect of the improvement of hermetically carbon-coated optical fibers prepared by plasma enhanced chemical vapor deposition method with methane and argon as precursor gases is studied. The annealing temperatures were selected as 100, 200, 300, 400, and 500 C. The film thickness of carbon films decreases with increasing annealing temperature. The analytic results of Raman, FTIR, and optical band gap show that the structure models of carbon coatings after annealing can be divided into three groups. When the annealing temperature is below 300 C, the unbonded hydrogen atoms in the carbon film recombine with unsaturated carbon bonds, and carbon coatings with a cross-linking structure are observed. Alternatively, when the annealing temperature exceeds 300 C, the desorption of hydrogen and hydrocarbon from the edges of the sp<sup>2</sup> clusters becomes conspicuous. Furthermore, when the annealing temperature rises to 500 C, the thermal annealing promotes the sp<sup>2</sup> clusters to combine and grow rapidly. Thus, a structural modification occurs in carbon films at this annealing temperature. The carbon films annealed at the temperature of 300 C have excellent ability to sustain thermal loading, so it is the best for production of carbon-coated optical fibers.

Author

*Annealing; Carbon Fibers; Optical Equipment; Vapor Deposition; Crosslinking; Energy Gaps (Solid State); Hydrocarbons*

**20080025205** California Univ., Berkeley, CA, USA

**Amphiphilic Mediated Sample Preparation for Micro-Flow Cytometry**

Clague, D. S., Inventor; Wheeler, E. K., Inventor; Lee, A. P., Inventor; 7 Jun 05; 9 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed Filed 7 Jun 05; US-Patent-Appl-SN-10-862-998

Report No.(s): PB2007-109302; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A flow cytometer includes a flow cell for detecting the sample, an oil phase in the flow cell, a water phase in the flow cell, an oil-water interface between the oil phase and the water phase, a detector for detecting the sample at the oil-water interface, and a hydrophobic unit operatively connected to the sample. The hydrophobic unit is attached to the sample. The sample and the hydrophobic unit are placed in an oil and water combination. The sample is detected at the interface between the oil phase and the water phase.

NTIS

*Cytology; Cytometry; Patent Applications*

**20080025207** Myers Bigel Sibley and Sajovec, Raleigh, NC, USA

**Methods and Compositions for Enhancing Cell Adhesion Properties**

Olsen, J. C., Inventor; Patel, M., Inventor; Wilcox, D. A., Inventor; 29 Apr 05; 24 pp.; In English

Contract(s)/Grant(s): NIH-HL 51818

Patent Info.: Filed Filed 29 Apr 05; US-Patent-Appl-SN-11-118-712

Report No.(s): PB2007-109304; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides a modified cell having adhesion properties that are increased as compared to the adhesion properties of an unmodified cell, comprising (a) a recombinant nucleic acid encoding an integrin (beta)(sub)3 subunit; (b) a recombinant nucleic acid encoding an integrin (alpha)(sub)v subunit; (c) a recombinant nucleic acid encoding an integrin (alpha)(sub)IIb subunit; and/or (d) any combination of (a), (b) and (c).

NTIS

*Adhesion; Augmentation; Patent Applications; Coding*

**20080025230** National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA

**Explosion Pressure Design Criteria for New Seals in U.S. Coal Mines**

Zipf, R. K.; Sapko, M. J.; Brune, J. F.; Jul. 2007; 84 pp.; In English

Report No.(s): PB2007-112652; DHHS/PUB/NIOSH-2007-144; IC-9500; No Copyright; Avail.: National Technical Information Service (NTIS)

Seals are barriers constructed in underground coal mines throughout the USA to isolate abandoned mining panels or groups of panels from the active workings. Historically, mining regulations required seals to withstand a 140-kPa (20-psig) explosion pressure. However, the Mine Improvement and New Emergency Response Act ('MINER Act') requires the Mine Safety and Health Administration (MSHA) to increase this design standard by the end of 2007. This report provides a sound scientific and engineering justification to recommend a three-tiered explosion pressure design criterion for new seals in coal mines in response to the MINER Act. Much of the information contained in this report also applies to existing seals. Engineers from the National Institute for Occupational Safety and Health (NIOSH) examined seal design criteria and practices used in the USA, Europe, and Australia and then classified seals into their various applications. Next, the engineers considered various kinds of explosive atmospheres that can accumulate within sealed areas and used thermodynamic calculations and simple gas explosion models to estimate worst-case explosion pressures that could impact seals. Three design pressure-time curves were developed for the dynamic structural analysis of new seals under the conditions in which those seals may be used: unmonitored seals where there is a possibility of methane-air detonation or high-pressure nonreactive shock waves and their reflections behind the seal; unmonitored seals with little likelihood of detonation or high-pressure nonreactive shock waves and their reflections; and monitored seals where the amount of potentially explosive methane-air is strictly limited and controlled.

NTIS

*Coal; Design Analysis; Explosions; Mines (Excavations); Mining; Seals (Stoppers)*

**20080025308** Teledyne Scientific and Imaging, LLC, Thousand Oaks, CA USA

**Ultrasonically Absorptive Coatings for Hypersonic Laminar Flow Control**

Marshall, David; Fedorov, Alexander; Malmuth, Norm; Davis, Janet; Dec 2007; 72 pp.; In English

Contract(s)/Grant(s): FA9550-06-C-0097

Report No.(s): AD-A478942; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478942>

This report summarizes results of theoretical, numerical and experimental studies related to ultrasonically absorptive coatings (UAC) for laminarization of hypersonic boundary layer flow. Laminar flow control (LFC) technologies reduce heat-transfer rates as well as the weight and complexity of thermal protection system (TPS). The effort has been focused on maturing of the UAC-LFC methodology. Key components of the effort include theoretical analysis, direct numerical simulation (DNS), wind-tunnel experiments, as well as fabrication of ceramic materials that integrate UAC and TPS functions. To aid in the design of UAC with regular microstructure to be tested the CUBRC LENS I tunnel, parametric studies of the UAC-LFC performance were conducted for Mach=7 and Mach=10 free-stream conditions. The UAC parameters providing significant (more than twice) increase of the laminar run were predicted. First steps have been made in mathematical (from first principles) modeling of acoustic processes in UAC-LFC random structure.

DTIC

*Absorption; Boundary Layer Control; Coatings; Hypersonic Flow; Laminar Boundary Layer; Laminar Flow*

**20080025344** Cincinnati Univ., OH USA

**Novel, One-Step, Chromate-Free Coatings Containing Anticorrosion Pigments for Metals That Can Be Used in a Variety of Industries**

Ashirgade, A; Puomi, P; van Ooij, W J; Bafna, S; Seth, A; Shivane, C; Jan 2007; 9 pp.; In English

Report No.(s): AD-A479061; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479061>

The concept of superprimers, i.e., primers for metals with the conversion coating built in, has proven to be feasible. Such primers can be applied on any bare metal, provided it is reasonably clean. These primers are based on water-dispersed organic resins and organofunctional silanes, which assure good adhesion both to the substrate and the overcoat. In this paper we will discuss an epoxy-novolac based system for AA20242-T3, but we will also present an overview of other coatings. The corrosion protection performance of these coatings has been evaluated using electrochemical methods and performance tests. All of the developed coatings survive 2000 hrs in ASTM B117 salt spray test. The systems have also been extensively characterized. The characterization methods have provided information on the formation of the coatings and the mechanism by which the coatings protect the metal substrates.

DTIC

*Chromates; Corrosion Prevention; Corrosion Resistance; Industries; Metals; Pigments*

**20080025362** California Univ., Santa Barbara, CA USA

**Oxide Coatings in Aero-Turbine Engines**

Evans, Anthony G; Hutchinson, John W; Feb 28, 2008; 3 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0801

Report No.(s): AD-A479151; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479151>

Oxide coatings used for various components in the hot section of aero-turbine engines experience temperature gradients at various stages during their flight cycle. One gradient exists during steady-state, due to the combination of the combustion environment next to the free surface and internal cooling of the underlying superalloy substrate. Other gradients develop during cooling of the surface when engine power is reduced. It is argued that deep delaminations, when observed within the oxide layer, can only be explained by the presence of a significant stress gradient in the coating, governed by these thermal circumstances. Two extreme cool-down scenarios are addressed. In one, the surface is cooled suddenly to a lower temperature, followed by slow uniform cooling. In the other, the entire system reduces its temperature uniformly before the temperature gradient in the TBC is eliminated. Criteria for guarding against delaminations within the oxide layer and along the interface with the substrate are provided and the outcome visualized in the form of delamination maps. A comparison with engine experience has provided a preliminary assessment of the relevant thermal scenarios.

DTIC

*Aircraft Engines; Coatings; Cooling; Delaminating; Gas Turbines; Oxides; Turbine Engines*

**20080025603** Reinhardt Boerner Van Deuren, S.C, Milwaukee, WI, USA

**Self-Assembled Peptide-Amphiphiles & Self-Assembled Peptide Nanofiber Networks Presenting Multiple Signals**

Stupp, S. I., Inventor; Niece, K. L., Inventor; Hartgerink, J. D., Inventor; 23 Sep 03; 9 pp.; In English

Contract(s)/Grant(s): DE-FG02-00ER45810; AF-F49620-00-1-0283

Patent Info.: Filed Filed 23 Sep 03; US-Patent-Appl-SN-10-668-672

Report No.(s): PB2007-109316; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The present invention provides a mixture of self-assembling peptide-amphiphiles with complementary charges whose design and function is patterned after proteins having biological functions. The oppositely charged peptide amphiphiles may be self-assembled by combining them in a charge equivalent ratio. Variations of structural peptide sequences in the oppositely charged peptide-amphiphiles enable the assembled nanofibers to exhibit two or more biologically relevant signals.

NTIS

*Peptides; Self Assembly; Molecular Structure*

**20080025626** Yale Univ., New Haven, CT, USA

**Ribosome Structure and Protein Synthesis Inhibitors**

Steitz, T. A., Inventor; Moore, P. B., Inventor; Sutcliffe, J. A., Inventor; Oyelere, A. K., Inventor; Ippolito, J. A., Inventor; 25 Feb 05; 127 pp.; In English

Contract(s)/Grant(s): NIH-GM22778; NIH-GM54216

Patent Info.: Filed Filed 25 Feb 05; US-Patent-Appl-SN-11-067-522

Report No.(s): PB2007-109317; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The invention provides methods for producing high resolution crystals of ribosomes and ribosomal subunits as well as crystals produced by such methods. The invention also provides high resolution structures of ribosomal subunits either alone or in combination with protein synthesis inhibitors. The invention provides methods for identifying ribosome-related ligands and methods for designing ligands with specific ribosome-binding properties as well as ligands that may act as protein synthesis inhibitors. Thus, the methods and compositions of the invention may be used to produce ligands that are designed to specifically kill or inhibit the growth of any target organism.

NTIS

*Inhibitors; Patent Applications; Protein Synthesis; Ribosomes*

**20080025627** Oklahoma State Regents for Higher Education, Oklahoma City, OK, USA

**Methods of Selectively Treating Diseases with Specific Glycosaminoglycan Polymers**

DeAngelis, P. L., Inventor; 30 Jun 05; 92 pp.; In English

Contract(s)/Grant(s): NSF-C2163601

Patent Info.: Filed Filed 30 Jun 05; US-Patent-Appl-SN-11-172-145

Report No.(s): PB2007-109318; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The present invention demonstrates that defined, specific GAG molecules have discerned differential effects, and that different types of cancers are prevented from proliferating and/or killed by oligosaccharides of different sizes; one size sugar does not treat all cancers effectively. Likewise, certain size GAGs have more potent angiogenic properties; thus, mixtures of different sizes of GAG molecules are not optimal. Therefore, the present invention is directed to methods of 'personalized medicine', in which customized defined, specific GAG molecules are administered to a patient, wherein the defined, specific GAG molecules are chosen based on the specific ailment from which the patient is suffering and/or the response of in vitro testing of the ability of the defined, specific GAG molecules to treat, inhibit and/or prevent the ailment in a sample from the patient.

NTIS

*Diseases; Molecules; Patent Applications*

**20080025653** Alliant Techsystems, Inc., Edina, MN USA

**EPDM rocket motor insulation**

Guillot, David G., Inventor; Harvey, Albert R., Inventor; May 13, 2008; 20 pp.; In English

Contract(s)/Grant(s): NAS8-38100

Patent Info.: Filed August 31, 2004; US-Patent-7,371,784; US-Patent-Appl-SN-10/931,778; No Copyright; Avail.: CASI:

[A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025653>

A novel and improved EPDM formulation for a solid propellant rocket motor is described wherein hexadiene EPDM

monomer components are replaced by alkylidene norbornene components, and, with appropriate adjustment of curing and other additives, functionally required rheological and physical characteristics are achieved with the desired compatibility with any one of a plurality of solid filler materials, e.g., powder silica, carbon fibers or aramid fibers, and with appropriate adhesion and extended storage or shelf-life characteristics.

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

*Rocket Engines; Insulation; Monomers; Alkylidene; Carbon Fibers*

**20080025654** NASA, Washington, DC USA

**Catalyst for treatment and control of post-combustion emissions**

Upchurch, legal representative, Wilhelmina H., Inventor; Schryer, David R., Inventor; Upchurch, Billy T., Inventor; May 13, 2008; 4 pp.; In English

Patent Info.: Filed October 25, 2004; US-Patent-7,371,358; US-Patent-Appl-SN-10/975,117; No Copyright; Avail.: CASI: **A01**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025654>

The present invention utilizes two precious metals with two to five different metal-oxides in a layered matrix to convert CO, HCs, and NO<sub>x</sub> to CO<sub>2</sub>, and N<sub>2</sub> by oxidation of two components and reduction of the other in a moderately high temperature gaseous environment containing excess oxygen.

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

*Combustion Products; Carbon Dioxide; Metal Oxides; Noble Metals; Nitrogen Oxides; Catalysts; Oxidation*

**20080025684** Savannah River National Lab., Aiken, SC, USA

**Traditional Metallurgy, Nanotechnologies and Structural Materials: A Sorby Award Lecture**

Luthan, M. R.; Jul. 17, 2007; 18 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2007-910176; WSRC-STI-2007-00370; No Copyright; Avail.: Department of Energy Information Bridge

Traditional metallurgical processes are among the many old fashion practices that use nanoparticles to control the behavior of materials. Many of these practices were developed long before microscopy could resolve nanoscale features, yet the practitioners learned to manipulate and control microstructural elements that they could neither see nor identify. Furthermore, these early practitioners used that control to modify microstructures and develop desired material properties. Centuries old colored glass, ancient high strength steels and medieval organ pipes derived many of their desirable features through control of nanoparticles in their microstructures. Henry Sorby was among the first to recognize that the properties of rocks, minerals, metals and organic materials were controlled by microstructure. Although he could not resolve nanoscale microstructural features, Mr. Sorby's observations revolutionized the study of materials. This lecture demonstrates that using nanotechnologies to control the behavior of metallic materials is almost as old as the practice of metallurgy and that many of the emergent nanomaterials technologists are walking along pathways previously paved by traditional metallurgists.

NTIS

*Lectures; Nanotechnology; Construction Materials*

**20080025731** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Triboluminescent Materials for Smart Optical Damage Sensors for Space Applications**

Aggarwal, M. D.; Penn, B. G.; Miller, J.; Sadate, S.; Batra, A. K.; May 2008; 24 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06GC58A

Report No.(s): NASA/TM-2008-215410; M-1230; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025731>

There is a need to develop a new technique of damage detection for composites, which could detect cracking or delamination from any desired location within a material structure in real time. Recently, triboluminescent materials have been proposed as smart sensors of structural damage. To sense the damage, these materials can be epoxy bonded, coated in a polymer matrix, or embedded in a composite host structure. When the damage or fracture takes place in the host structure, the resultant fracture of triboluminescent crystals creates a light emission. This will warn in real time that structural damage has occurred. The triboluminescent emission of the candidate phosphor has to be bright enough that the light reaching from the point of fracture to the detector through a fiber optic cable is detectable. There are a large number of triboluminescent materials, but few satisfy the above criterion. The authors have synthesized an organic material known as Europium tetrakis

(dibenzoylmethide) triethylammonium (EuD4TEA), which is a potential candidate for application as a damage sensor and could be made into a wireless sensor with the addition of microchip, antenna, and electronics. Preliminary results on the synthesis and characterization of this material are presented.

Author

*Luminescence; Optical Measuring Instruments; Damage; Organic Materials; Composite Structures; Delaminating; Epoxy Resins; Fiber Optics; Fracturing*

**20080025779** McLeod and Moyne, P.C., Okekmos, MI, USA

**Novel Anthraquinones and Process for the Preparation and Method of use Thereof**

Nair, M. G., Inventor; Dhananjayan, M. R., Inventor; Kron, M. A., Inventor; Milev, Y. P., Inventor; 7 Mar 05; 18 pp.; In English

Patent Info.: Filed Filed 7 Mar 05; US-Patent-Appl-SN-11-074-227

Report No.(s): PB2007-110502; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A process for the preparation of hydroxyl substituted anthraquinones is described. The process couples a phthalic anhydride (substituted or unsubstituted) to benzene ring moiety substituted with at least two hydroxyl groups. Remaining hydroxy groups were converted to methoxy groups in some anthraquinones. The compounds are particularly useful for the treatment of parasitic diseases. Also, a method of treating or preventing malaria, filariasis schistosomiasis and other parasitic diseases using anthraquinones.

NTIS

*Anthraquinones; Health; Parasitic Diseases; Patent Applications*

**20080025828** Texas Technological Univ., Lubbock, TX, USA

**Process for Making Chemical Protective Wipes and Such Wipes**

Ramkumar, S. S., Inventor; 20 Jun 05; 21 pp.; In English

Contract(s)/Grant(s): DAAD13-00-C-0051; DAAD13-01-C-0066-AE

Patent Info.: Filed Filed 20 Jun 05; US-Patent-Appl-SN-11-157-124

Report No.(s): PB2007-110513; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A process for making chemical protective wipes is disclosed. A top layer is fully needlepunched (102). A bottom layer is fully needlepunched (104). Then, an adsorption layer is sandwiched between the top layer and the bottom layer (106). Then, the sandwich is fully needlepunched (108).

NTIS

*Patent Applications; Protective Clothing*

**20080025848** Lawrence Livermore National Lab., Livermore, CA USA; California Univ., Berkeley, CA, USA

**Inline Evenflow Material Distributor for Pneumatic Material Feed Systems**

Thiry, M. J., Inventor; 1 Apr 04; 8 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed Filed 1 Apr 04; US-Patent-Appl-SN-10-817-489

Report No.(s): PB2007-110601; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An apparatus for reducing clogs in a pneumatic material feed line, such as employed in abrasive waterjet machining systems. The apparatus includes a hollow housing defining a housing volume and having an inlet capable of connecting to an upstream portion of the pneumatic material feed line, an outlet capable of connecting to a downstream portion of the pneumatic material feed line, and an air vent located between the inlet and outlet for venting excess air pressure out from the housing volume. A diverter is located at the inlet and in a path of incoming material from the upstream portion of the pneumatic material feed line, to break up clumps of ambient moisture-ridden material impinging on the diverter.

NTIS

*Distributors; Feed Systems; Patent Applications; Pneumatic Equipment; Pneumatics*

**20080025950** Sandia National Labs., Albuquerque, NM USA

**Method for Creating Gas Standards from Liquid HFE-7100 and FC-72**

Irwin, A. N.; Thornberg, S. M.; Brown, J. R.; White, M.; Hochrein, J. M.; Jul. 2007; 30 pp.; In English

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

Report No.(s): DE2007-912656; SAND2007-4470; No Copyright; Avail.: National Technical Information Service (NTIS)

HFE-7100 and FC-72 fluorinert are two fluids used during weapon component manufacturing. HFE-7100 is a solvent used

in the cleaning of parts, and FC-72 is the blowing agent of a polymeric removable foam. The presence of either FC-72 or HFE-7100 gas in weapon components can provide valuable information as to the stability of the materials. Therefore, gas standards are needed so HFE-7100 and FC-72 gas concentrations can be accurately measured. There is no current established procedure for generating gas standards of either HFE-7100 or FC-72. This report outlines the development of a method to generate gas standards ranging in concentration from 0.1 ppm to 10% by volume. These standards were then run on a Jeol GC-Mate II mass spectrometer and analyzed to produce calibration curves. We present a manifold design that accurately generates gas standards of HFE-7100 and FC-72 and a procedure that allows the amount of each to be determined.

NTIS

*Liquid Fuels; Solvents; Gas Analysis*

**20080026004** NASA White Sands Test Facility, NM, USA

**Explosive Event in MON-3 Oxidizer System Resulting from Pressure Transducer Failure**

Baker, David L.; Reynolds, Michael; Anderson, John; March 06, 2006; 11 pp.; In English; JANNAF Interagency Propulsion Committee, 6-10 Mar. 2006, Sandestin, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

In 2003, a Druck(Registered Trademark) pressure transducer failed catastrophically in a test system circulating nitrogen tetroxide at NASA Johnson Space Center White Sands Test Facility. The cause of the explosion was not immediately obvious since the wetted areas of the pressure transducer were constructed of materials compatible with nitrogen tetroxide. Chemical analysis of the resulting residue and a materials analysis of the diaphragm and its weld zones were used to determine the chain of events that led to the catastrophic failure. Due to excessive dynamic pressure loading in the test system, the diaphragm in the pressure transducer suffered cyclic failure and allowed the silicon oil located behind the isolation diaphragm to mix with the nitrogen tetroxide. The reaction between these two chemicals formed a combination of 2,4-di and 2,4,6-trinitrophenol, which are shock sensitive explosives that caused the failure of the pressure transducer. Further research indicated numerous manufacturers offer similar pressure transducers with silicone oil separated from the test fluid by a thin stainless steel isolation diaphragm. Caution must be exercised when purchasing a pressure transducer for a particular system to avoid costly failures and test system contamination.

Author

*Dynamic Pressure; Pressure Sensors; System Failures; Explosives; Chemical Analysis; Nitrogen Tetroxide*

**20080026008** NASA White Sands Test Facility, NM, USA

**Analysis of N-Nitrosodimethylamine and N-Nitrodimethylamine in Groundwater**

Greene, Ben; Mast, Dion; Baker, David L.; March 06, 2006; 34 pp.; In English; JANNAF 33rd PEDCS, 6-10 Mar. 2006, Sandestin, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for the analytical determination of N-nitrosodimethylamine (NDMA) and N-nitrodimethylamine (DMN) at parts-per-trillion (ppt) concentrations in groundwater is reported. The method uses a solid phase extraction (SPE) cartridge containing 2 g of activated coconut charcoal to extract a 500-mL water sample. NDMA and DMN are eluted from the SPE cartridge using acetone. The acetone is concentrated and brought to a final volume of 1.0 mL, which results in a theoretical 500-fold concentration of the analytes. The extracts are analyzed by gas chromatography (GC) with a nitrogenphosphorous detector (NPD), which is a highly sensitive and relatively inexpensive technique. The measured extraction efficiencies averaged 61 percent for NDMA and 74 percent for DMN. Extraction efficiencies were independent of NDMA and DMN concentrations from 40 to 2000 ppt. Several samples could be extracted then analyzed in a single day with the use of an extraction manifold and GC autosampler. A reporting limit of 10 ppt for NDMA and DMN was achieved. The MDLs for NDMA and DMN were 6.4 and 5.8 ppt, respectively. A typical turn-around time from beginning of extraction to reporting was 4 h. The method avoids the use of halogenated solvents, such as dichloromethane, and subsequent solvent exchange procedures necessary for use of the NPD detector.

Author

*Ground Water; Chlorine Compounds; Activated Carbon; Solid Phases; Elution; Gas Chromatography*

**20080026219** Brinks Hofer Gilson and Lione, Chicago, IL, USA

**Microfluidic System**

Ismagilov, R. F., Inventor; Zheng, B., Inventor; Gerdtts, C. J., Inventor; 1 Jul 05; 35 pp.; In English  
Contract(s)/Grant(s): NIH-R01 EB001903

Patent Info.: Filed Filed 1 Jul 05; US-Patent-Appl-SN-11-174-298

Report No.(s): PB2007-111574; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides microfluidic technology enabling rapid and economical manipulation of reactions on the femtoliter to microliter scale.

NTIS

*Chemical Reactions; Microfluidic Devices*

**20080026223** Foley and Lardner, LLP, Washington, DC, USA

**Surface and Site-Specific Polymerization by Direct-Write Lithography**

Mirkin, C. A., Inventor; Liu, X., Inventor; Guo, S., Inventor; 19 Jul 04; 17 pp.; In English

Contract(s)/Grant(s): ATOSR-F49620-00-1-0283-001; DARPA-DAAD19-03-1-0065

Patent Info.: Filed Filed 19 Jul 04; US-Patent-Appl-SN-10-893-543

Report No.(s): PB2007-110653; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Polymeric microstructures and nanostructures can be prepared with use of a tip to pattern a surface. A tip can be used to pattern a structure which can initiate polymerization. The structure can be then exposed to monomer to induce polymerization at the structure. Alternatively, a tip can be used to pattern a surface with a monomer in which the surface is treated with polymerization catalyst so that polymerization occurs at the patterning site. Ring-opening metathesis polymerization can be carried out with use of the tip to control the polymerization. The tip can be a sharp tip as used in for example an atomic force microscope tip. Norbornene types of monomers can be used. Biological macromolecules can be also prepared.

NTIS

*Lithography; Polymerization; Microstructure*

**20080026231** Senniger Powers Leavitt and Roedel, Saint Louis, MO, USA; Florida State Univ., Tallahassee, FL, USA

**Process for C7 Silylation of Hydroxy Substituted Taxanes and Intermediates Thereof**

Holton, R. A., Inventor; Zhang, Z., Inventor; Clarke, P. A., Inventor; 9 Jun 05; 26 pp.; In English

Contract(s)/Grant(s): NIH-CA-42031

Patent Info.: Filed Filed 9 Jun 05; US-Patent-Appl-SN-11-148-833

Report No.(s): PB2007-110657; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Processes for the preparation of taxol and other taxanes through selective derivatization of the C(7) hydroxyl and C(10) hydroxyl groups of 10-DAB, particularly a novel process using a new strategy in which the C(10) hydroxyl group is protected or derivatized prior to the C(7) hydroxyl group; and the provision of C(7) and C(10) derivatized 10-DAB compounds.

NTIS

*Synthesis (Chemistry); Drugs*

## 24

### COMPOSITE MATERIALS

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

**20080023818** Army Research Lab., Aberdeen Proving Ground, MD USA

**Characterization of Corrosion on Outdoor-Exposed Aluminum Metal-Matrix Composites as a Function of Reinforcement Specie and Volume Fraction**

Adler, Ralph P; Snoha, Daniel J; Hawthorn, George; Hihara, Lloyd H; Feb 2008; 52 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAE30-03-C-1071; Proj-M089-589131

Report No.(s): AD-A478372; ARL-TR-4372; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478372>

The Hawaii Corrosion Laboratory and the U.S. Army Research Laboratory collaborated to prepare, environmentally expose for up to 2 years, and evaluate multivariant sets of metal matrix composites (MMCs). The experimental matrix involved variations in particulate volume-percent and particulate reinforcement specie (higher purity green and less-pure black silicon carbide, boron carbide, and alumina). The specific objective of this study was to determine, mainly using x-ray powder diffractometry, how observed gravimetric variations in corrosion behavior of these sets of MMCs (differentiated by four kinds of reinforcing agents with some variations in volume-percent), after relatively heavy-rainfall outdoor exposures in Hawaii, could be related to the crystallographic and morphological characteristics of the resulting corrosion products. Compared to the



monolithic aluminum control specimens, the measured corrosion rates for these MMCs were considerably accelerated (by at least an order of magnitude) by the presence and relative amount of these second-phase particulates. The increased kinetics found for these MMCs were nominally proportional to the volume fraction of the particulate phase. Other differentials in gravimetric corrosion rates and corrosion product characteristics were related to the type of reinforcement phase present.

DTIC

*Aluminum; Concentration (Composition); Corrosion; Exposure; Metal Matrix Composites; Reinforcing Materials*

**20080023826** Army Research Lab., Aberdeen Proving Ground, MD USA

**Finite-Element Micromechanical Strength Modeling and Parametric Investigation of Three-Dimensional Orthogonal Composites**

Karkkainen, Ryan L; Tzeng, Jerome T; Jan 2008; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-8H75

Report No.(s): AD-A478403; ARL-TR-4355; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478403>

Three-dimensional (3-D) reinforcement is often employed in thick composite parts to increase delamination resistance and through-thickness properties. Such materials are of particular interest for employment as insulators for the composite electromagnetic railgun insulator, which exhibits delamination as its primary failure mode. In the current study, a 3-D orthogonal woven S2-glass composite is investigated using finite-element micromechanics to characterize and evaluate its potential use in this target application. The representative volume element (RVE) of the 3-D woven microstructure is modeled directly through the 3-D finite-element model. Direct modeling of the exact microstructure allows for precise knowledge of the mechanics and failure modes of the microstructure under various loading conditions. Stiffness and strength are determined using a series of simulated characterization tests upon the RVE, with a detailed analysis of the resulting microstress field. Modeling results are verified by comparing experimental data. Tensile tests and Iosipescu shear tests have been performed to determine in-plane and transverse shear properties. Off-axis tensile tests were performed for further model validation. In-plane stiffness and strength were predicted with 90% or better accuracy. Transverse shear properties were less well predicted, but strength was still predicted within 86% accuracy. The micromechanical methods were then employed towards a parametric study of the effect of stitch density on promising improvement of delamination resistance and shear properties, as well as consequent loss of in-plane properties.

DTIC

*Composite Materials; Delaminating; Finite Element Method; Insulation; Micromechanics; Three Dimensional Composites*

**20080024063** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Effects of Environment on Creep Behavior of Nextel 720/Alumina-Mullite Ceramic Composite at 1200 deg C**

Genelin, Christopher L; Mar 2008; 117 pp.; In English

Report No.(s): AD-A478784; AFIT/GAE/ENY/08-M11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The creep behavior of an oxide-oxide ceramic matrix composite (CMC) was investigated at 1200 deg C in Laboratory air, in steam and in argon. The composite consisted of a porous alumina-mullite matrix reinforced with laminated, woven mullite/alumina (Nextel/720) fibers. The composite had no fiber coating and relied on its porous alumina/mullite matrix for flaw tolerance. Tensile stress-strain behavior was investigated and the tensile properties were measured at 1200 deg C in laboratory air. Tensile creep behavior of the CMCs was examined for creep stress level of 73, 91, 1114 and 136 MPa. Creep run-out, set to 100 h, was achieved for stress levels  $\leq$  91 MPa in air. The presence of steam or argon accelerated the creep rates the N720/AM composite. Optical and scanning electron microscope (SEM) micrographs were used to examine fracture surfaces and to evaluate failure mechanisms. Fracture surfaces of the N720/AM composite were predominately planar. Limited areas of short fiber pull-out were observed for specimens tested at low creep stress levels in air.

DTIC

*Aluminum Oxides; Ceramic Matrix Composites; Ceramics; Creep Properties; Environmental Tests; Mullites*

**20080024212** ITT Kanpur, Kanpur, India

**Structural Health Monitoring of Ribbon Reinforced Composite Laminate using Piezoelectric Sensory Layer**

Jaiswal, Arvind Kumar; Bhattacharya, Bishakh; Kumar, Anand; International Journal of COMADEM, Volume 11, No. 1; January 2008, pp. 9-17; In English; See also [20080024209](#); Copyright; Avail.: Other Sources

Piezoelectric sensors are widely used for sensing of static and dynamic response of laminated composites. The present

work has proposed a high precision piezoelectric finite element which can be used with a piezoelectric sensory network to identify damage signals in composite laminate. In order to identify the damage, the voltage profile has been obtained for health and damaged laminates which can be used as a knowledge-base for fault detection. The ribbon reinforced composites are widely used in prosthetics for example, in the field of orthodontics where canine to canine retention is carried out with the help of resin composite retainers reinforced with Polyethylene/Kevlar ribbons. These structures typically work like a bridge between the canines. They are subjected to central loading and also support yielding due to unequal movement of the end supports. However, due to high strains in the laminate, the chances of delamination and laminate failures are quite high in such structure. The finite-element based development of knowledge-base technique has been used in delamination detection in such composites and which may help in timely replacement of the bridge.

Author

*Laminates; Ribbons; Reinforced Plates; Smart Structures; Damage Assessment; Piezoelectric Gages; Reinforcing Fibers; Reinforced Plastics*

**20080025347** Army Research Lab., Aberdeen Proving Ground, MD USA

**High-Speed Transmission Shadowgraphic and Dynamic Photoelasticity Study of Stress Wave and Impact Damage Propagation in Transparent Materials and Laminates Using the Edge-On Impact (EOI) Method**

Strassburger, Elmar; Patel, Parimal; McCauley, James W; Kovalchick, Christopher; Ramesh, K T; Templeton, Douglas W; Mar 2008; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD-19-01-2-0003; N62558-04-P-6031

Report No.(s): AD-A479090; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479090>

In order to accelerate the development of validated design and predictive performance models, the Army Research Laboratory, the U.S. Army Tank Automotive Research Development and Engineering Center, and the Material Center of Excellence at Johns Hopkins University have entered into a collaboration with The Ernst-Mach Institute (EMI) of Efringen-Kirchen, Germany. The unique, fully instrumented Edge-on Impact facility at EMI, modified for dynamic photoelasticity, is being used to quantify stress wave propagation, damage nucleation and propagation during high velocity impacts. Summarized in this report are a selection of results on monolithic and laminated glass (Starphire<sup>®</sup>) and AION, a polycrystalline transparent ceramic. Crack, damage and stress wave velocities have been determined directly. In addition, the stress wave and damage retardation by various thickness bonding interfaces has been measured: for a 5.08 mm interlayer, a delay of 1.7 s was determined. A computational model was constructed using ABAQUS Explicit to simulate the elastic wave propagation within AION. The simulations show that the damaged region observed in the experiments corresponds essentially to the region that has observed shear as a result of the wave propagation.

DTIC

*Damage; High Speed; Impact Damage; Laminates; Photoelasticity; Shadowgraph Photography; Stress Waves; Transparency; Wave Propagation*

**20080025364** California Univ., Santa Barbara, CA USA

**Advanced Transmission Electron Microscopy Characterization of Novel Thermoelectric Materials**

Stemmer, Susanne; Bowers, John; Mar 2008; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0358

Report No.(s): AD-A479170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479170>

The report described our research activities focused on the characterization of new epitaxial thermoelectric materials that are comprised of semimetallic, epitaxial ErAs nanoparticles embedded in a semiconducting epitaxial In<sub>0.53</sub>Ga<sub>0.47</sub>As (InGaAs) matrix. The composites were grown by molecular beam epitaxy. We used advanced transmission electron microscopy (TEM) techniques to perform a detailed analysis of the shapes and distribution of random ErAs particles and the overall morphology of the composites. We show that the size of the particles is relatively insensitive to most growth parameters, except for the growth temperature and matrix (GaAs or InGaAs). We found that particles tend to order in specific crystallographic planes. We discuss the mechanism leading to the ordering. We also report on the characterization of epitaxial ScN/Zr(W) N superlattices for thermoelectric applications.

DTIC

*Composite Materials; Erbium Compounds; Indium Gallium Arsenides; Microstructure; Thermoelectric Materials; Transmission Electron Microscopy*

**20080025696** NASA, Washington, DC USA

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

Stewart, David A., Inventor; Leiser, Daniel B., Inventor; June 3, 2008; 15 pp.; In English

Patent Info.: Filed February 12, 2004; US-Patent-7,381,459; US-Patent-Appl-SN-10/779,504; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025696>

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

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

*Coating; Composite Structures; Thermal Protection; Reentry Shielding; Ablative Materials; Heat Shielding; Oxidation Resistance*

**20080025761** Connolly Bove Lodge and Hutz, LLP, Wilmington, DE, USA

**Advanced Body Armor Utilizing Shear Thickening Fluids**

Wagner, N. J., Inventor; Wetzel, E. D., Inventor; 19 May 03; 10 pp.; In English

Contract(s)/Grant(s): ARL-DAAD19-01-2-0001

Patent Info.: Filed Filed 19 May 03; US-Patent-Appl-SN-10-441-655

Report No.(s): PB2007-110579; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An armor composite material has been invented which contains a ballistic fabric which has been impregnated with shear thickening fluid. This invention offers a ballistic resistant material that is more flexible and less bulky than comparable, conventional ballistic fabric. The invented material offers superior ballistic performance compared to conventional ballistic fabric-based materials of equal thickness. The invented material can be applied to applications requiring armor that is compact and/or flexible, such as body armor, protective clothing and flexible protective devices and shields, and stab resistant clothing and devices.

NTIS

*Armor; Patent Applications*

**20080025790** Nevada Univ., Reno, NV, USA

**Study of Concrete Bridge Columns Using Innovative Materials Subjected to Cyclic Loading**

Sadrossadat-Zadeh, M.; O'Brien, M.; Saiidi, M. S.; Jan. 2007; 68 pp.; In English

Report No.(s): PB2007-109640; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This project evaluated the application of super elastic shape memory alloy (SMA) reinforcement in combination with engineered cementitious composites (ECC) in bridge columns to minimize earthquake damage. Based on initial evaluation, Nitinol SMA and ECC compositions were selected for application in bridge columns. An analytical study was performed to determine optimum material properties and configuration for the concrete column. Bridge columns incorporating a combination of SMA and ECC or conventional concrete were constructed and subjected to quasi-static cyclic tests. The first column (RSC) utilized conventional concrete and steel reinforcement, the other two (RNC and RNE) utilized engineered cementitious composites (ECC) in the plastic hinge. The final report includes important experimental and analytical data to help develop design guidelines for improving the seismic response of bridge columns using SMA and ECC materials.

NTIS

*Bridges (Structures); Cements; Concretes; Cyclic Loads; Shape Memory Alloys*

**20080025813** Buchanan Ingersoll, PC, Alexandria, VA, USA; California Inst. of Tech., Pasadena, CA, USA

**Sensors and Sensor Arrays of Conducting and Insulating Composites and Methods of Use Thereof**

Lewis, N. S., Inventor; Grubbs, R. H., Inventor; Sotzing, G., Inventor; 11 Apr 05; 38 pp.; In English

Contract(s)/Grant(s): DAAK-60-97-K-9503; DAAG-55-97-1-1087

Patent Info.: Filed Filed 11 Apr 05; US-Patent-Appl-SN-11-103-033

Report No.(s): PB2007-110597; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides a class of sensors prepared from at least a first material having a positive temperature

coefficient of resistance and a second non-conductive or insulating material compositionally different than the first material that show an increase sensitivity detection limit for polar and non-polar analytes. The sensors have applications in the detection of analytes in the environment, associated with diseases and microorganisms.

NTIS

*Composite Materials; Insulation; Patent Applications*

**20080025874** Honeywell International, Inc., Morristown, NJ, USA

**Ternary Carbide and Nitride Composites Having Tribological Applications and Methods of Making Same**

Palanisamy, T. G., Inventor; Gupta, S., Inventor; Barsoum, M., Inventor; Li, C. W., Inventor; 10 May 05; 8 pp.; In English  
Contract(s)/Grant(s): N00421-03-C-0085

Patent Info.: Filed Filed 10 May 05; US-Patent-Appl-SN-11-127-524

Report No.(s): PB2007-110599; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A turbomachinery component includes a substrate having a surface, the surface consisting essentially of at least one composite of at least one metal and at least one compound having the chemical formula  $M(\text{sub } n+1)\text{AX}(\text{sub } n)$ , wherein M is at least one early transition metal selected from groups IIIB, IVB, VB, and VIB, A is at least one element selected from groups IIIA, IVA, VA, VIA, and VIIA, X is one or both of carbon and nitrogen, and n is an integer between 1 and 3. The component is made by compressing a powdered material to form a substrate that consists essentially of the composite and sintering the substrate, or by coating a substrate with the composite.

NTIS

*Carbides; Composite Materials; Nitrides; Patent Applications; Silicon Carbides; Silicon Nitrides; Tribology*

**20080025959** Traurig (Greenberg), LLP, Denver, CO, USA

**Polymer-Brush Modified Fillers for Composites**

Ding, X., Inventor; Stansbury, J. W., Inventor; 10 Mar 05; 27 pp.; In English

Contract(s)/Grant(s): NIH/NIDCR-1R01DE-14227-01

Patent Info.: Filed Filed 10 Mar 05; US-Patent-Appl-SN-11-077-829

Report No.(s): PB2007-113873; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates to polymer-brush modified fillers and methods, compositions and processes of modification of fillers and more particularly fillers useful in dental materials and other compositions that exhibit higher mechanical strength, longer hydrolytic stability, lower polymerization stress and improved wear and abrasion resistance. The present invention provides a method for making a polymer-brush modified filler comprising: providing a filler material; silanizing the filler material with a silane; and reacting the silanized filler with a telechelic oligomer. The present invention further provides a method of preparing a shaped dental prosthetic device for use in a human mouth comprising: dispensing a mixture having at least one monomer and a polymer brush modified filler; shaping the mixture; and photopolymerizing the mixture.

NTIS

*Brushes; Composite Materials; Fillers; Patent Applications*

**20080025997** NASA Glenn Research Center, Cleveland, OH, USA

**A Modeling Technique and Representation of Failure in the Analysis of Triaxial Braided Carbon Fiber Composites**

Littell, Justin D.; Binienda, Wieslaw K.; Goldberg, Robert K.; Roberts, Gary D.; June 2008; 25 pp.; In English; Aging Aircraft 2008, 21-24 Apr. 2008, Phoenix, AZ, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.03.05.03

Report No.(s): NASA/TM-2008-215245; E-16488-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

Quasi-static tests have been performed on triaxially braided carbon fiber composite materials with large unit cell sizes. The effects of different fibers and matrix materials on the failure mode were investigated. Simulations of the tests have been performed using the transient dynamic finite element code, LS-DYNA. However, the wide range of failure modes observed for the triaxial braided carbon fiber composites during tests could not be simulated using composite material models currently available within LS-DYNA. A macroscopic approach has been developed that provides better simulation of the material response in these materials. This approach uses full-field optical measurement techniques to measure local failures during quasi-static testing. Information from these experiments is then used along with the current material models available in LS-DYNA to simulate the influence of the braided architecture on the failure process. This method uses two-dimensional shell elements with integration points through the thickness of the elements to represent the different layers of braid along with a new analytical method for the import of material stiffness and failure data directly. The present method is being used to

examine the effect of material properties on the failure process. The experimental approaches used to obtain the required data will be described, and preliminary results of the numerical analysis will be presented.

Author

*Failure Modes; Braided Composites; Carbon Fibers; Composite Materials; Matrix Materials; Mechanical Properties; Failure Analysis*

**20080025999** NASA Glenn Research Center, Cleveland, OH, USA

**Thin Film Ceramic Strain Sensor Development for High Temperature Environments**

Wrbanek, John D.; Fralick, Gustave C.; Gonzalez, Jose M.; Laster, Kimala L.; June 2008; 21 pp.; In English; Aging Aircraft 2008, 21-24 Apr. 2008, Phoenix, AZ, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.03.02.03

Report No.(s): NASA/TM-2008-215256; TP975; E-16519; Copyright; Avail.: CASI: [A03](#), Hardcopy

The need for sensors to operate in harsh environments is illustrated by the need for measurements in the turbine engine hot section. The degradation and damage that develops over time in hot section components can lead to catastrophic failure. At present, the degradation processes that occur in the harsh hot section environment are poorly characterized, which hinders development of more durable components, and since it is so difficult to model turbine blade temperatures, strains, etc, actual measurements are needed. The need to consider ceramic sensing elements is brought about by the temperature limits of metal thin film sensors in harsh environments. The effort at the NASA Glenn Research Center (GRC) to develop high temperature thin film ceramic static strain gauges for application in turbine engines is described, first in the fan and compressor modules, and then in the hot section. The near-term goal of this research effort was to identify candidate thin film ceramic sensor materials and provide a list of possible thin film ceramic sensor materials and corresponding properties to test for viability. A thorough literature search was conducted for ceramics that have the potential for application as high temperature thin film strain gauges chemically and physically compatible with the NASA GRCs microfabrication procedures and substrate materials. Test results are given for tantalum, titanium and zirconium-based nitride and oxynitride ceramic films.

Author

*Thin Films; Ceramics; Strain Gages; High Temperature Environments; Turbine Engines*

**20080026053** NASA Johnson Space Center, Houston, TX, USA

**Frictional Ignition Testing of Composite Materials**

Peralta, Steve; Rosales, Keisa; Robinson, Michael J.; Stoltzfus, Joel; Journal of Test and Evaluation; September 2006; 9 pp.; In English; Flammability and Sensitivity of Materials in Oxygen-Enriched Atmospheres, 18-20 Oct. 2006, West Conshohocken, PA, USA; Original contains color illustrations

Report No.(s): Paper ID-13557; Copyright; Avail.: CASI: [A02](#), Hardcopy

The space flight community has been investigating lightweight composite materials for use in propellant tanks for both liquid and gaseous oxygen for space flight vehicles. The use of these materials presents some risks pertaining to ignition and burning hazards in the presence of oxygen. Through hazard analysis process, some ignition mechanisms have been identified as being potentially credible. One of the ignition mechanisms was reciprocal friction; however, test data do not exist that could be used to clear or fail these types of materials as 'oxygen compatible' for the reciprocal friction ignition mechanism. Therefore, testing was performed at White Sands Test Facility (WSTF) to provide data to evaluate this ignition mechanism. This paper presents the test system, approach, data results, and findings of the reciprocal friction testing performed on composite sample materials being considered for propellant tanks.

Author

*Composite Materials; Friction Factor; Ignition; Liquid Oxygen; Propellant Tanks; Combustion*

**20080026114** NASA Johnson Space Center, Houston, TX, USA

**Proficiency Testing for Evaluating Aerospace Materials Test Anomalies**

Hirsch, D.; Motto, S.; Peyton, S.; Beeson, H.; October 18, 2006; 7 pp.; In English; Eleventh International Symposium on Flammability, 18-20 Oct. 2008, Washington, DC, USA; Copyright; Avail.: CASI: [A02](#), Hardcopy

ASTM G 86 and ASTM G 74 are commonly used to evaluate materials susceptibility to ignition in liquid and gaseous oxygen systems. However, the methods have been known for their lack of repeatability. The inherent problems identified with the test logic would either not allow precise identification or the magnitude of problems related to running the tests, such as lack of consistency of systems performance, lack of adherence to procedures, etc. Excessive variability leads to increasing instances of accepting the null hypothesis erroneously, and so to the false logical deduction that problems are nonexistent when

they really do exist. This paper attempts to develop and recommend an approach that could lead to increased accuracy in problem diagnostics by using the 50% reactivity point, which has been shown to be more repeatable. The initial tests conducted indicate that PTFE and Viton A (for pneumatic impact) and Buna S (for mechanical impact) would be good choices for additional testing and consideration for inter-laboratory evaluations. The approach presented could also be used to evaluate variable effects with increased confidence and tolerance optimization.

Author

*Anomalies; Materials Tests; Polymers; Aerospace Systems*

**20080026147** ERC International, Inc., San Diego, CA, USA

**Carbon Nanotube Material Quality Assessment**

Yowell, Leonard; Arepalli, Sivaram; Sosa, Edward; Niolaev, Pavel; Gorelik, Olga; June 20, 2006; 2 pp.; In English; NT06: Seventh International Conference on the Science and Application of Nanotubes, 20 Jun. 2006, Nagano, Japan, Japan; Original contains color illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026147>

The nanomaterial activities at NASA Johnson Space Center focus on carbon nanotube production, characterization and their applications for aerospace systems. Single wall carbon nanotubes are produced by arc and laser methods. Characterization of the nanotube material is performed using the NASA JSC protocol developed by combining analytical techniques of SEM, TEM, UV-VIS-NIR absorption, Raman, and TGA. A possible addition of other techniques such as XPS, and ICP to the existing protocol will be discussed. Changes in the quality of the material collected in different regions of the arc and laser production chambers is assessed using the original JSC protocol. The observed variations indicate different growth conditions in different regions of the production chambers.

Author

*Carbon Nanotubes; Fabrication; Characterization; Technology Utilization; Aerospace Systems; Nanotechnology; Quality Control*

## 25

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

**20080023726** Chicago Univ., Chicago, IL USA

**Process for Production and Purification of Fermentation Derived Organic Acids**

Datta, R., Inventor; Henry, M., Inventor; St. Martin, E. J., Inventor; 2 Jun 04; 7 pp.; In English

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

Patent Info.: Filed 2 Jun 04; US-Patent-Appl-SN-10-859-259

Report No.(s): PB2007-109300; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method of producing and purifying an organic acid by producing an aqueous solution of the ammonium salt of the organic acid through fermentation and/or bioconversion and neutralization. The solution is heated to thermally crack the ammonium salt of the organic acid producing a vapor phase of ammonia and water and organic acid which is thereafter passed in contact with a membrane permeable to water and ammonia and substantially impermeable to the organic acid vapor to concentrate the aqueous solution of organic acid, and remove the ammonia and excess water.

NTIS

*Fermentation; Patent Applications; Purification*

**20080023737** Florida Univ., Gainesville, FL, USA

**Electro-catalytically Active, High Surface Area Cathodes for Low Temperature SOFCs. (Final Report, October 1, 2003-September 30, 2006)**

Wachsman, E. D.; Jan. 2007; 130 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT41959

Report No.(s): DE2007-909486; No Copyright; Avail.: National Technical Information Service (NTIS)

This research focused on developing low polarization (area specific resistance, ASR) cathodes for intermediate temperature solid oxide fuel cells (IT-SOFCs). In order to accomplish this we focused on two aspects of cathode development:

(1) development of novel materials; and (2) developing the relationships between microstructure and electrochemical performance. The materials investigated ranged from Ag-bismuth oxide composites (which had the lowest reported ASR at the beginning of this contract) to a series of pyrochlore structured ruthenates ( $\text{Bi}_{2-x}\text{M}_x\text{Ru}_2\text{O}_7$ , where  $\text{M} = \text{Sr}, \text{Ca}, \text{Ag}$ ;  $\text{Pb}_2\text{Ru}_2\text{O}_{6.5}$ ; and  $\text{Y}_{2-2x}\text{Pr}_{2x}\text{Ru}_2\text{O}_7$ ), to composites of the pyrochlore ruthenates with bismuth oxide. To understand the role of microstructure on electrochemical performance, we optimized the Ag-bismuth oxide and the ruthenate-bismuth oxide composites in terms of both two-phase composition and particle size/microstructure. We further investigated the role of thickness and current collector on ASR. Finally, we investigated issues of stability and found the materials investigated did not form deleterious phases at the cathode/electrolyte interface. Further, we established the ability through particle size modification to limit microstructural decay, thus, enhancing stability.

NTIS

*Catalytic Activity; Cathodes; Low Temperature; Solid Oxide Fuel Cells; Surfactants*

**20080023747** Scripps Research Inst., La Jolla, CA, USA

**Site Specific Incorporation of Heavy Atom-Containing Unnatural Amino Acids into Proteins for Structure Determination**

Xie, J., Inventor; Wang, L., Inventor; Wu, N., Inventor; Schultz, P. G., Inventor; Spraggon, G., Inventor; 24 May 05; 50 pp.; In English

Contract(s)/Grant(s): NIH-GM62159; DE-FG02-03ER46051

Patent Info.: Filed Filed 24 May 05; US-Patent-Appl-SN-11-137-850

Report No.(s): PB2007-109301; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Translation systems and other compositions including orthogonal aminoacyl tRNA-synthetases that preferentially charge an orthogonal tRNA with an iodinated or brominated amino acid are provided. Nucleic acids encoding such synthetases are also described, as are methods and kits for producing proteins including heavy atom-containing amino acids, e.g., brominated or iodinated amino acids. Methods of determining the structure of a protein, e.g., a protein into which a heavy atom has been site-specifically incorporated through use of an orthogonal tRNA/aminoacyl tRNA-synthetase pair, are also described.

NTIS

*Atoms; Amino Acids; Proteins; Nucleic Acids; Biochemistry*

**20080023815** Dynamic Science Engineering Operations, Phoenix, AZ USA

**Epoxy Nano-Reinforced Composite Systems**

Zander, Nicole E; Feb 2008; 20 pp.; In English

Contract(s)/Grant(s): DAAD17-02-C-0071; Proj-AH84

Report No.(s): AD-A478357; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478357>

Mechanical properties of epoxy nanocomposite systems were evaluated for nanoclay platelets, nanosilica spheres, and carbon nanotube fillers. The effect of surface modifiers, such as quaternary ammonium salts and epoxy groups, was examined. The Young's modulus and tensile strength for epoxy-clay systems are dependent on the chain length of the alkylammonium modifier. Longer chains allowed better intercalation and mechanical properties. For nanosilica composites, interparticle distance played a key role in the toughness of the composite. Peak performance of the composite was achieved when the spacing between particles equaled the particle diameter. Surface modification with pendant epoxy groups allowed the particles to react into the matrix with the curing agent and achieve proper dispersion. Carbon nanotubes were dispersed in the epoxy matrix via a plasma treatment that afforded free radical sites for maleic anhydride grafting. Higher modulus, strength, and 2 orders of magnitude higher conductivity were observed for the functionalized carbon nanotubes.

DTIC

*Carbon Nanotubes; Epoxy Matrix Composites; Epoxy Resins; Mechanical Properties; Nanocomposites; Nanostructures (Devices)*

**20080023821** Army Research Lab., Aberdeen Proving Ground, MD USA

**Thermo Stability of Highly Sulfonated Poly(Styrene-Isobutylene-Styrene) Block Copolymers: Effects of Sulfonation and Counter-Ion Substitution**

Sloan, James M; Suleiman, David; Napadensky, Eugene; Crawford, Dawn M; Jan 2008; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-H7G

Report No.(s): AD-A478384; ARL-TR-4357; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478384>

In this study, poly(styrene-isobutylene-styrene) (SIBS) block copolymers were characterized by thermogravimetry as a function of sulfonation level (53% to 97%) and counter-ion substitution (Mg+2, Ca+2, Ba+2). Sulfonated samples showed an additional minor loss of mass at ~290 plus/minus 2 deg. C, which was not observed in the unsulfonated polymer. At this temperature, desulfonation or a cleavage reaction of the aromatic carbon-sulfur bond occurs. The counter-ion substituted membranes did not show the degradation temperature at 290 deg. C, but additional unique degradation temperatures above 500 deg. C, which suggests improved thermal stability for the ionically cross-linked polymer with cations. Some cations (Mg+2, Ca+2, Ba+2) showed multiple high temperature degradations, which suggest that different cross-linked structures occur throughout the phase-segregated morphology.

DTIC

*Block Copolymers; Butenes; Stability; Styrenes; Substitutes*

**20080023927** National Tsing Hua Univ., Hsinchu, Taiwan, Province of China

**Covalent Percolation and Gold Templating of Carbon NanoTubes Network in Polymer Nanocomposites for Novel Mechanical, Electrical, and Optical Properties. Taiwan - US AFOSR Nanoscience Initiative**

Yang, Arnold C; Mar 26, 2008; 71 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0093

Report No.(s): AD-A478577; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The interactions between individual polymer chains with embedded carbon nanotubes (CNTs) in nanocomposites were investigated by using two model polymer systems, polystyrene and poly(phenylene oxide) representing respectively the ductile and brittle polymers, with surface-grafted multiwalled CNTs.

DTIC

*Carbon Nanotubes; Covalence; Electrical Properties; Gold; Mechanical Properties; Nanocomposites; Optical Properties; Percolation*

**20080023965** California Univ., San Diego, La Jolla, CA USA

**Self Assembly of Carbon Nanotubes by Ionic Charge Interaction**

Nemat-Nasser, Sia; Tor, Yitzhak; Feb 26, 2008; 2 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0535

Report No.(s): AD-A478650; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Carbon nanotubes of proper length can be functionalized to self-assemble into a three-dimensional structure. We have calculated the required length of single-walled carbon nanotubes and have purified, chemically cut to proper size, and functionalized, to test the basic concept. During this research period we have been able to demonstrate the fact that carbon nanotubes can indeed be functionalized and all the indications are is that they do self-assemble in a suitable environment.

DTIC

*Carbon Nanotubes; Charged Particles; Self Assembly; Self Organizing Systems*

**20080023968** Naval Research Lab., Washington, DC USA

**Current Status and Future Research Opportunities for Electrochemical Capacitors: Relevance for Naval and Civilian Applications**

Long, Jeffrey W; Mar 14, 2008; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478653; NRL/MR/6170-08-9119; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Electrochemical capacitors (ECs) are a class of energy-storage devices that offer significant promise in bridging the performance gap that exists between the high power density derived from electrostatic capacitors and the high energy density of batteries. As such, ECs will ultimately enable technologies and applications, ranging from microelectronics to hybrid- and all-electric vehicle platforms, where current energy-storage devices are not sufficient. Further advances in EC performance and



viability will require fundamental research investigations focused on the development of new materials for active electrodes and electrolytes, the design and synthesis of new multifunctional composite materials, and the development of new electrode and device architectures.

DTIC

*Capacitors; Electrochemical Capacitors; Electrochemistry*

**20080024018** Texas Univ. at Dallas, Richardson, TX USA

**Novel Conductive Coatings of Carbon Nanotubes: A Fundamental Study**

Yang, Duck J; Feb 29, 2008; 21 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0372

Report No.(s): AD-A478723; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Among several CNT samples we tested, the best performance result we have achieved is with metallic SWNT (m-SWNT) coated on PEN (poly-ethylene-naphthalate) transparent composite film: it gave conductivity of 1 30/sq with 80% transmittance at 400-700nm wavelength range. In contrast, current commercially available single side inorganic, brittle ITO coated PET film gave 88/sq with 80% transmittance. Our sample mentioned above was prepared with double side coating using a dipping method.

DTIC

*Carbon; Carbon Nanotubes; Coatings; Transparency*

**20080025075** Florida Univ., Gainesville, FL USA

**Effect of Environmental Parameters on the Biocidal Performance of Iodine-Treated Filters**

Wu, Chang-Yu; Lee, Jin-Hwa; Reiemenschneider, Lindsey; Theodore, Alexandros D; Jan 2008; 85 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8561-05-C-0136; Proj-ARMT

Report No.(s): AD-A478330; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478330>

Iodine-treated filter media were challenged at a face velocity of 14.2 cm/s by *Bacillus subtilis* spores and MS2 bacteriophage aerosols generated from a Collision nebulizer. The novel medium displayed excellent viable removal efficiency (VRE) for bacterial spores with a negligible pressure drop in various environmental conditions, suggesting an alternative to HEPA filters for the removal of bacterial spore aerosols. Different filter media tested for viral aerosols showed VRE >90% but lower than that for bacterial spores, with negligible variation in the pressure drop. The iodine-treated filter showed higher VRE than that of the untreated filters, possibly due to sublimation and dissolution of iodine molecules at HT/LRH and RT/MRH, respectively. Insignificant difference was observed between the (minimal) survival fractions of viral particles caught on iodine-treated and untreated filters at the same environmental condition, indicating negligible effect of iodine treatment of these particles. Encasement of microorganisms is a possible problem in the efficacy of an antimicrobial filter because the viability of microorganisms is preserved when shielded from disinfection agents. A condensation nuclei concept using water vapor was tested and shown to be an effective device for enhancing condensation and improving efficiency of collection of virus-containing aerosols smaller than ~100 nm. However, the problem of losses to reentrainment of bioparticles as air bubbles break in the impinger remains to be solved.

DTIC

*Aerosols; Airborne Infection; Bacillus; Bacteria; Bacteriophages; Iodine; Microorganisms; Pesticides; Spores; Viruses*

**20080025090** Air Force Research Lab., Hanscom AFB, MA USA; British Antarctic Survey, Cambridge, UK; California Univ., Los Angeles, CA, USA; Memorial Univ. of Newfoundland, Saint Johns, Newfoundland, Canada

**Energetic Outer Zone Electron Loss Timescales During Low Geomagnetic Activity**

Meredith, Nigel P; Horne, Richard B; Glauert, Sarah A; Thorne, Richard M; Summers, Danny; Albert, Jay M; Anderson, Roger R; Jan 2006; 15 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A478478; AFRL-RV-HA-TR-2008-1010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478478>

Following enhanced magnetic activity the fluxes of energetic electrons in the Earth's outer radiation belt gradually decay to quiet-time levels. We use CRRES observations to estimate the energetic electron loss timescales and to identify the principal

loss mechanisms. Gradual loss of energetic electrons in the region  $3.0 \leq L \leq 5.0$  occurs during quiet periods ( $K_p < 3$ ) following enhanced magnetic activity on timescales ranging from 1.5 to 3.5 days for 214keV electrons to 5.5 to 6.5 days for 1.09MeV electrons. The intervals of decay are associated with large average values of the ratio, indicating that the decay takes place in the plasmasphere. We compute loss timescales for pitch-angle scattering by plasmaspheric hiss using the PADIE code with wave properties based on CRRES observations. The resulting timescales suggest that pitch angle scattering by plasmaspheric hiss propagating at small or intermediate wave normal angles is responsible for electron loss over a wide range of energies and L shells.

DTIC

*Electrons; Geomagnetism; Losses*

**20080025104** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Effects of Corona, Spark and Surface Discharges on Ignition Delay and Deflagration-to-Detonation Times in Pulsed Detonation Engines (Postprint)**

Busby, Kenneth; Corrigan, Jennifer; Yu, Sheng-Tao; Williams, Skip; Carter, Campbell; Schauer, Frederick; Hoke, John; Cathey, Charles; Gundersen, Martin; Dec 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-02-C-0015; Proj-2308

Report No.(s): AD-A478624; AFRL-RZ-WP-TP-2008-2034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of the research described herein is to compare the ignition delays in an experimental pulsed detonation engine produced by thermal and non-thermal ignitions. The commercial thermal ignition has a pulse duration of about 1 microsec, whereas the non-thermal ignitions have pulse durations of 100 nanosec. Ignition delay is an important factor, along with fill and purge times, that limit the maximum repetition rate and thrust of pulsed detonation engines. For stoichiometric fuel-air mixtures with aviation gasoline at 1 atmosphere and 360 - 480 K, an ignition delay of 6 millisecc was observed with a non-thermal ignition, whereas the ignition delay was 11 millisecc with an aftermarket automotive ignition. By replacing the resistive cable and resistor of the aftermarket ignition with a non-resistive cable and surface discharge igniter, its ignition delay was reduced to 7 millisecc, which is comparable to that produced by the non-thermal ignitions.

DTIC

*Deflagration; Detonation; Electric Corona; Electric Sparks; Ignition; Ignition Systems; Pulse Detonation Engines; Time Lag*

**20080025122** Applied Research Associates, Inc., Tyndall AFB, FL USA

**The Hydroxyl Radical Reaction Rate Constant and Products of Cyclohexanol**

Bradley, William R; Wyatt, Sheryl E; Wells, J R; Henley, Michael V; Graziano, Gina M; Oct 2007; 12 pp.; In English

Contract(s)/Grant(s): F08637-98-C-6002; Proj-4915

Report No.(s): AD-A478758; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The gas phase reaction of the hydroxyl radical (OH) with cyclohexanol (COL) has been studied. The rate coefficient was determined to be  $(19.0 \pm 4.8) \times 10^{-12}$  cu cm/molecule/s (at  $297 \pm 3$  K and 1 atmosphere total pressure) using the relative rate technique with pentanal, decane, and tridecane as the reference compounds. Assuming an average OH concentration of  $1 \times 10^6$  molecules/cu cm, an atmospheric lifetime of 15 h is calculated for cyclohexanol. Products of the OH + COL reaction were determined to more clearly define COL's atmospheric degradation mechanism. The observed products and their formation yields were: cyclohexanone (0.55  $\pm$  0.06), hexanedial (0.32  $\pm$  0.15), 3-hydroxycyclohexanone (0.31  $\pm$  0.14), and 4-hydroxycyclohexanone (0.08  $\pm$  0.04). Consideration of the potential reaction pathways suggests that each of these products is formed via hydrogen abstraction at a different site on the COL ring. The products and their relative amounts are discussed in light of the predicted yields for each reaction channel.

DTIC

*Constants; Cyclic Compounds; Hydroxyl Radicals; Reaction Kinetics; Vapor Phases*

**20080025181** Sandia National Labs., Livermore, CA, USA

**Nano-Scale Optical and Electrical Probes of Materials and Processes**

Bogart, K. H.; Mar. 2007; 29 pp.; In English

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

Report No.(s): DE2007-909620; SAND2006-7678; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes the investigations and milestones of the Nano-Scale Optical and Electrical Probes of Materials and Processes Junior/Senior LDRD. The goal of this LDRD was to improve our understanding of radiative and non-radiative

mechanisms at the nanometer scale with the aim of increasing LED and solar cell efficiencies. These non-radiative mechanisms were investigated using a unique combination of optical and scanning-probe microscopy methods for surface, materials, and device evaluation. For this research we utilized our new near-field scanning optical microscope (NSOM) system to aid in understanding of defect-related emission issues for GaN-based materials. We observed micrometer-scale variations in photoluminescence (PL) intensity for GaN films grown on Cantilever Epitaxy pattern substrates, with lower PL intensity observed in regions with higher dislocation densities. By adding electrical probes to the NSOM system, the photocurrent and surface morphology could be measured concurrently.

NTIS

*Semiconductors (Materials); Near Fields; Nanostructure (Characteristics)*

**20080025186** Lawrence Livermore National Lab., Livermore, CA USA

**Compact, Low-Power Cantilever-Based Sensor Array for Chemical Detection**

Loui, A.; Ratto, T.; Wilson, T.; Mukerjee, E.; Hu, Z.; Mar. 01, 2007; 6 pp.; In English

Report No.(s): DE2007-909629; UCRL-CONF-228511; No Copyright; Avail.: National Technical Information Service (NTIS)

A compact and low-power cantilever-based sensor array has been developed and used to detect various vapor analytes. This device employs sorptive polymers that are deposited onto piezoresistive cantilevers. We have successfully detected several organic vapors, representing a breadth of chemical properties and over a range of concentrations. Comparisons of the polymer/vapor partition coefficient to the cantilever deflection responses show that a simple linear relationship does not exist, emphasizing the need to develop an appropriate functional model to describe the chemical-to-mechanical transduction that is unique to this sensing modality.

NTIS

*Vapors; Detection; Genetics; Deflection*

**20080025187** Eltron Research, Inc., Boulder, CO USA

**Fischer-tropsch catalysts**

White, James H., Inventor; Taylor, Jesse W., Inventor; July 1, 2008; 15 pp.; In English

Patent Info.: Filed December 16, 2005; US-Patent-7,393,876; US-Patent-Appl-SN-11/303,451; No Copyright; Avail.:

CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025187>

Catalyst compositions and methods for F-T synthesis which exhibit high CO conversion with minor levels (preferably less than 35% and more preferably less than 5%) or no measurable carbon dioxide generation. F-T active catalysts are prepared by reduction of certain oxygen deficient mixed metal oxides.

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

*Fischer-Tropsch Process; Catalysts*

**20080025188** NASA, Washington, DC USA

**Stabilized tin-oxide-based oxidation/reduction catalysts**

Jordan, Jeffrey D., Inventor; Schryer, David R., Inventor; Davis, Patricia P., Inventor; Leighty, Bradley D., Inventor; Watkins, Anthony Neal, Inventor; Schryer, Jacqueline L., Inventor; Oglesby, Donald M., Inventor; Gulati, Suresh T., Inventor; Summers, Jerry C., Inventor; June 24, 2008; 4 pp.; In English

Patent Info.: Filed January 22, 2002; US-Patent-7,390,768; US-Patent-Appl-SN-10/056,845; No Copyright; Avail.: CASI:

A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025188>

The invention described herein involves a novel approach to the production of oxidation/reduction catalytic systems. The present invention serves to stabilize the tin oxide reducible metal-oxide coating by co-incorporating at least another metal-oxide species, such as zirconium. In one embodiment, a third metal-oxide species is incorporated, selected from the group consisting of cerium, lanthanum, hafnium, and ruthenium. The incorporation of the additional metal oxide components serves to stabilize the active tin-oxide layer in the catalytic process during high-temperature operation in a reducing environment (e.g., automobile exhaust). Moreover, the additional metal oxides are active components due to their oxygen-retention capabilities. Together, these features provide a mechanism to extend the range of operation of the

tin-oxide-based catalyst system for automotive applications, while maintaining the existing advantages.  
Official Gazette of the U.S. Patent and Trademark Office  
*Tin Oxides; Catalysts; Oxidation-Reduction Reactions*

**20080025189** Lawrence Livermore National Lab., Livermore, CA USA

**Droplet-Based Segregation and Extraction of Concentrated Samples**

Buie, C. R.; Buckley, P.; Hamilton, J.; Ness, K. D.; Rose, K. A.; Feb. 28, 2007; 6 pp.; In English

Report No.(s): DE2007-909630; UCRL-PROC-228474; No Copyright; Avail.: National Technical Information Service (NTIS)

Microfluidic analysis often requires sample concentration and separation techniques to isolate and detect analytes of interest. Complex or scarce samples may also require an orthogonal separation and detection method or off-chip analysis to confirm results. To perform these additional steps, the concentrated sample plug must be extracted from the primary microfluidic channel with minimal sample loss and dilution. We investigated two extraction techniques; injection of immiscible fluid droplets into the sample stream (capping) and injection of the sample into an immiscible fluid stream (extraction). From our results we conclude that capping is the more effective partitioning technique. Furthermore, this functionality enables additional off-chip post-processing procedures such as DNA/RNA microarray analysis, realtime polymerase chain reaction (RT-PCR), and culture growth to validate chip performance.

NTIS

*Drops (Liquids); Extraction; Microfluidic Devices*

**20080025191** Lawrence Livermore National Lab., Livermore, CA USA

**LCLS XTOD UHV Specifications**

Duffy, P.; Stefan, P.; Apr. 05, 2007; 24 pp.; In English

Report No.(s): DE2007-909640; UCRL-PROC-229720; No Copyright; Avail.: Department of Energy Information Bridge

This specification defines the requirements for leak checking ultrahigh vacuum components using a helium mass spectrometer leak detector.

NTIS

*Helium; Leakage; Mass Spectrometers; Ultrahigh Vacuum*

**20080025195** Lawrence Livermore National Lab., Livermore, CA USA

**Environmental Degradation of Materials for Nuclear Waste Repositories Engineered Barriers**

Rebak, R. B.; Jan. 04, 2007; 14 pp.; In English

Report No.(s): DE2007-909646; UCRL-PROC-227056; No Copyright; Avail.: Department of Energy Information Bridge

Several countries are considering geological repositories for the storage of nuclear waste. Most of the environments for these repositories will be reducing in nature, except for the repository in the US, which is going to be oxidizing. For the reducing repositories, alloys such as carbon steel, copper, stainless steels and titanium are being evaluated. For the repository in the US, some of the most corrosion resistant commercially available alloys are being investigated. This paper presents a summary of the behavior of the different materials under consideration for the repositories and the current understanding of the degradation modes of the proposed alloys in ground water environments from the point of view of general corrosion, localized corrosion and environmentally assisted cracking.

NTIS

*Degradation; Geology; Radioactive Wastes; Waste Disposal*

**20080025208** Klauber and Jackson, Hackensack, NJ, USA

**Assays for Screening Compounds Which Interact with Cation Channel Proteins, Mutant Prokaryotic Cation Channel Proteins, and Uses Thereof**

MacKinnon, R., Inventor; 3 Jul 03; 87 pp.; In English

Contract(s)/Grant(s): NIH-GM 43949

Patent Info.: Filed Filed 3 Jul 03; US-Patent-Appl-SN-10-613-744

Report No.(s): PB2007-109303; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Assays for screening potential drugs or agents that can interact and potentially bind to cation channel proteins, and potentially have uses in treating conditions related to the function of cation channel proteins is provided, along with

prokaryotic cation channel proteins mutated to mimic eukaryotic cation channels, which can then be used in assays of the present invention.

NTIS

*Assaying; Cations; Patent Applications; Prokaryotes; Proteins*

**20080025297** Nebraska Univ., Lincoln, NE USA

**Experimental Investigation of the Role of Defects in Detonation Sensitivity of Energetic Materials: Development of Techniques for Characterization**

Eckhardt, Craig J; Mar 4, 2008; 11 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0265

Report No.(s): AD-A478911; 25-0509-0055-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478911>

A report of the activity related to the research on the role of defects and electronic structure on the sensitivity of energetic materials detonation.

DTIC

*Characterization; Defects; Detonation; Sensitivity*

**20080025336** Army Research Lab., Aberdeen Proving Ground, MD USA

**Global Mechanical Response and Its Relation to Deformation and Failure Modes at Various Length Scales Under Shock Impact in Alumina AD995 Armor Ceramic**

Dandekar, D P; McCauley, J W; Green, W H; Bourne, N K; Chen, M W; Mar 2008; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479014; ARL-RP-202; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479014>

Polycrystalline aluminum oxide (Al<sub>2</sub>O<sub>3</sub>) based materials have both personnel and ground vehicle armor applications. However, their ballistic performance can vary significantly. At the root of this problem is the identification of the fundamental macro and micro mechanisms of deformation and failure in the ballistic event which has proven very elusive over the years. Using a newly developed soft recovery plate impact experiment, a multi-disciplinary, multi-national collaboration has, for the first time, determined micro and macro deformation and damage mechanism maps relating the experimentally measured global mechanical response of a material through matured shock wave diagnostics to the nature of concurrent deformation and damage generated at varying length scales under shock wave loading.

DTIC

*Aluminum Oxides; Armor; Ceramics; Deformation; Failure Modes; Polycrystals; Shear Stress; Shock Waves*

**20080025349** Army Construction Engineering Research Lab., Champaign, IL USA

**Anaerobic Treatment of Wastewaters Containing Perchlorate from Munitions Handling and Production**

Maloney, Stephen W; Atikovic, Emina; Suidan, Makram T; Jan 2008; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479114; ERDC/CERL-TR-08-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479114>

Perchlorate, an oxidizer routinely used in solid rocket motors, is easily washed out of old motors. The washout operation, however, leads to wastewater containing perchlorate. Royal Demolition Explosive (RDX), a major component of military high explosives, is transferred to Army industrial wastewaters during assembly of new munitions and during demilitarization of old munitions. New high explosives contain perchlorate, commingling perchlorate and RDX for the first time. In addition to their damaging effect to the environment, perchlorate and RDX can also be detrimental to human health. This study focused on determining the effectiveness of removing perchlorate and RDX individually and when commingled, using ethanol as an electron donor at steady-state conditions. Three laboratory-scale anaerobic fluidized bed reactors were monitored. A fourth reactor, located at McAlester Army Ammunition Plant, currently used to treat pinkwater, was also tested. The experimental results demonstrated that the biodegradation of perchlorate and RDX was more effective in bioreactors receiving a single contaminant than in the bioreactor fed both contaminants. Results from perturbation experiments revealed that competition within the microbial consortia for substrate played a major role in determining the structure of that community.

DTIC

*Activity (Biology); Ammunition; Anaerobes; Perchlorates; Waste Water*

**20080025371** Cincinnati Univ., OH USA

**Potential of Silanes for Chromate Replacement in Metal Finishing Industries**

van Ooij, Wim J; Zhu, Danqing; Palanivel, Vignesh; Lamar, J A; Stacy, Matthew; Sep 16, 2002; 46 pp.; In English  
Contract(s)/Grant(s): F49620-01-1-0352

Report No.(s): AD-A479184; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479184>

Trialkoxysilanes (or silanes) have emerged as a very promising alternative for chromates in metal finishing industries. Compared to the conventional chromating processes, the major merits of silane-based surface treatments include: eco-compliance, easy-control processing, comparable corrosion protection of metals as well as paint adhesion to a variety of topcoats. In this overview paper, we will report the recent status of silane studies including results of corrosion performance tests, mechanism of corrosion protection of metals by silanes and thermal stabilities of silane films. We will also address the new fields that we are beginning to explore such as nano-structured silane films, self-healing silanes, super-primers and methods for inline detection of silane films.

DTIC

*Chromates; Industries; Metal Finishing; Replacing; Silanes*

**20080025473** Naval Research Lab., Bay Saint Louis, MS USA

**Indian Ocean Rossby Waves Deteced in HYCOM Sea Surface Salinity**

Heffner, David; Subrahmanyam, B; Shriver, Jay; Feb 5, 2008; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479250; NRL/JA/7320--07-7233; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Rossby waves have been well identified in satellite derived sea surface height (SSH), sea surface temperature (SST) and ocean color observations. Studies of Rossby waves have yet to include sea surface salinity (SSS) as a parameter, largely because presently available in situ measurements of salinity lack sufficient spatial and temporal coverage, and as of now no methods are available for measuring salinity from a satellite. In this paper, we demonstrate that Rossby waves can be observed in SSS in the Indian Ocean by using simulations of the 1/12 deg global Hybrid Coordinate Ocean Model (HYCOM). HYCOM results compared favorably to SSS data provided by Argo floats and the World Ocean Atlas 2005 (WOA05) in selected grid boxes in the Indian Ocean. Hovmoeller diagrams of HYCOM SSS anomalies and gradient show the distinct westward propagating signature of Rossby waves, with a steeper slope in longitudel time plots further from the equator. The propagation speeds, calculated from a 2D Radon Transform are comparable with new theoretical speeds for Rossby waves. Annual westward propagating signals in the SSS simulations at most of the latitudes in the Indian Ocean coincide with previous studies. We hope that future studies of Rossby waves in SSS using model results and eventually satellite measurements of salinity data will allow a better understanding of Rossby wave dynamics.

DTIC

*Indian Ocean; Ocean Surface; Planetary Waves; Salinity; Surface Temperature; Water Waves*

**20080025481** California Univ., Berkeley, CA USA

**Innovative Growth and Defect Analysis of Group III - Nitrides for High Speed Electronics**

Specht, Petra; Weber, Eicke R; Feb 29, 2008; 84 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0408

Report No.(s): AD-A479284; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The project focused on novel techniques in growth and characterization which may enhance group III - nitride applications. On the growth side nitride deposition on diamond templates was characterized as the most promising novel growth techniques. The continuing progress can be supported applying the novel characterization technique described below. Local inhomogeneities are a common feature in group III - nitrides. With standard characterization methods such materials cannot be properly evaluated. Multiple group III - nitride epilayers were investigated utilizing VEELS in combination with high resolution TEM in order to characterize the materials in high spatial and energy resolution. It was found that possible side effects such as sample damage due to electron irradiation or falsified results due to retardation effects can be avoided if proper sample treatment is applied. It is assumed that the occurrence of local electronic transitions in close vicinity to interfaces is due to the presence of local point or surface defects. For the first time it may become possible to investigate the impact of such defects on the performance of devices. For the InGaN alloy system nano-cluster formation which changes optical responses was investigated. It was found that the III-V compound InN exists as a composite InN:In material. InN commonly exhibits multiple optical responses including an interface and/or surface related effect, which triggered confusing

scientific models in the past. The prospect of exploiting multiple energy transitions within ONE material offers completely new alternatives for novel device development.

DTIC

*Defects; Electron Microscopy; Gallium Nitrides; High Speed; Nitrides*

**20080025531** Strategic Environmental Research and Development Program, Arlington, VA USA

**SERDP/ESTCP Expert Panel Workshop on Research and Development Needs for Cleanup of Chlorinated Solvent Sites**

Aug 1, 2001; 88 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) are designed to develop and transition innovative research and technology to help the Department of Defense (DoD) perform its mission. These programs together conducted an expert panel workshop on August 6-7, 2001 to evaluate the needs for research and development in the general area of chlorinated solvent site cleanup. This area is a major focus for both programs, and this workshop was held to help establish the funding priorities for the coming years. This workshop was intended to develop a strategic plan to guide research and technology development in the next 5-10 years. The overall objective was to provide guidance on how these programs can best invest their limited research, development, and demonstration funds to improve DoD's ability to effectively address its CAH-contaminated sites. The workshop participants were asked to identify the major basic and applied research, development, and demonstration needs, the specific technical issues that must be addressed to meet regulatory and other stakeholder concerns, and the major gaps in our scientific understanding of CAH contamination and cleanup. Further, the participants were asked to prioritize these research and development needs and identify those areas with the greatest promise to help DoD accomplish its goals.

DTIC

*Aliphatic Hydrocarbons; Chlorination; Chlorocarbons; Cleaning; Contamination; Environmental Cleanup; Hydrocarbons; Liquids; Research Management; Solvents; Technology Transfer*

**20080025536** Naval Research Lab., Bay Saint Louis, MS USA

**Deriving Sea Surface Salinity and Density Variations From Satellite and Aircraft Microwave Radiometer Measurements: Application to Coastal Plumes Using STARRS**

Burrage, Derek M; Wesson, Joel C; Miller, Jerry; Mar 2008; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479432; NRL/JA/7330--07-7162; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Using brightness temperature  $T_b$  measurements from L-band airborne microwave radiometers, with independent sea surface temperature (SST) observations, sea surface salinity (SSS) can be remotely determined with errors of about 1 psu in temperate regions. Nonlinearities in the relationship between  $T_b$ , SSS, and SST produce variations in the sensitivity of salinity  $S$  to variations in  $T_b$  and SST. Despite significant efforts devoted to SSS remote sensing retrieval algorithms, little consideration has been given to deriving density  $D$  from remotely sensed SSS and SST. Density is related to  $S$  and  $T$  through the equation of state. It affects the ocean's static stability and its dynamical response to forcings. By chaining together two empirical relationships (flat-sea emissivity and equation of state) to form an inversion algorithm for sea surface density (SSD) in terms of  $T_b$  and SST, we develop a simple L-band SSD retrieval algorithm. We use this to investigate the sensitivity of SSD retrievals to observed  $T_b$  and SST and infer errors in  $D$  for typical sampling configurations of the airborne Salinity, Temperature, And Roughness Remote Scanner (STARRS) and satellite-borne Soil Moisture and Ocean Salinity (SMOS) and Aquarius radiometers. We then derive  $D$  from observations of river plumes obtained using STARRS and demonstrate several oceanographic applications: the observations are used to study variations in  $T$  and  $S$  effects on  $D$  in the Mississippi plume, and the across-shelf density gradient is used to infer surface geostrophic shear and subsurface geostrophic current in the Plata plume. Future basin-scale applications of SSD retrievals from satellite-borne microwave radiometers such as SMOS and Aquarius are anticipated.

DTIC

*Coasts; Microwave Equipment; Microwave Radiometers; Ocean Surface; Plumes; Radiometers; Remote Sensors; Salinity; Seas; Surface Roughness*

**20080025586** Greenlee Winner and Sullivan, P.C., Boulder, CA, USA

**Materials and Methods for the Preparation of Anisotropically-Ordered Solids**

Carson, T. D., Inventor; Casey, S. M., Inventor; Iverson, I. K., Inventor; Seo, W., Inventor; Tam Chang, S. W., Inventor; 22 Nov 04; 46 pp.; In English

Contract(s)/Grant(s): NSF DMR0405532; NSF DMR 9876027

Patent Info.: Filed Filed 22 Nov 04; US-Patent-Appl-SN-10-996-133

Report No.(s): PB2007-109107; No Copyright; Avail.: CASI: A03, Hardcopy

The invention provides materials and methods for making anisotropic solids which may be in the form of films, layers, shaped elements, and other shaped articles. The methods provide anisotropic solids without the need for rolling, rubbing, or stretching to impart orientational alignment of the molecules of the solid. The methods employ organic or organometallic compounds which are soluble orienting molecules. The solvent or solvent system must be sufficiently volatile to be removed without disruption of the molecular orientation. The soluble orienting molecules include those containing one or more hydrophilic and/or ionic groups and the solvent or solvent system can be a polar organic solvent or solvent system or an aqueous solvent or solvent system. The invention also provides novel compounds having quaterylene, perylene and naphthalene ring systems carrying one or more hydrophilic and/or ionic groups. These novel compounds can exhibit useful absorption and fluorescence properties in solution and in the solid phase and can exhibit useful liquid crystalline properties.

NTIS

*Anisotropy; Patent Applications; Solids*

**20080025635** CC Technologies Labs., Inc., Dublin, OH, USA; CH2M/Hill Hanford Group, Inc., Richland, WA, USA  
**Hanford Tanks 241-AN-107 and 241-AN-102: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking**

Oct. 2006; 411 pp.; In English

Contract(s)/Grant(s): DE-AC27-99RL14047

Report No.(s): DE2007-895754; No Copyright; Avail.: Department of Energy Information Bridge

CC Technologies, Inc. of Dublin, Ohio (contracted by ARES Corporation of Richland, WA) performed a series of cyclic potentiodynamic polarization, potentiostatic polarization, slow strain rate, and constant load crack growth rate tests. The key findings of these test are included in this report.

NTIS

*Carbon Steels; Corrosion; Radioactive Wastes; Stress Corrosion Cracking; Waste Management*

**20080025663** CH2M/Hill Hanford Group, Inc., Richland, WA, USA

**Corrosion Study for the Effluent Treatment Facility Chrome (VI) Reductant Solution Using 301 and 316L Stainless Steel**

Duncan, J. B.; Jun. 27, 2007; 18 pp.; In English

Contract(s)/Grant(s): DE-AC27-99RL14047

Report No.(s): DE2007-910133; RPP-PLAN-34065-REV-0; No Copyright; Avail.: Department of Energy Information Bridge

The Effluent Treatment Facility has developed a method to regenerate spent resin from the groundwater pump and treat intercepting chrome (VI) plumes (RPP-RPT-32207. Laboratory Study on Regeneration of Spent DOWBX 21 K 16-20 Mesh Ion Exchange Resin). Subsequent laboratory studies have shown that the chrome (VI) may be reduced to chrome (III) by titrating with sodium metabisulfite to an oxidation reduction potential (ORP) of +280 mV at a pH of 2. This test plan describes the use of cyclic potentiodynamic polarization and linear polarization techniques to ascertain the electrochemical corrosion and pitting propensity of the 304 and 316L stainless steel in the acidified reducing solution that will be contained in either the secondary waste receiver tank or concentrate tank.

NTIS

*Chromium; Corrosion; Effluents; Ground Water; Oxidation; Plumes; Pumps; Resins; Stainless Steels*

**20080025780** McKinley Law Office, Richland, WA, USA

**Method for Enhanced Accuracy in Predicting Peptides Elution Time Using Liquid Separations or Chromatography**

Petritis, K., Inventor; Kangas, L. J., Inventor; Anderson, G. A., Inventor; Smith, R. D., Inventor; 14 May 04; 19 pp.; In English

Contract(s)/Grant(s): DE-AC0676RLO1830

Patent Info.: Filed Filed 14 May 04; US-Patent-Appl-SN-10-846-188

Report No.(s): PB2007-110507; No Copyright; Avail.: CASI: A03, Hardcopy

A method for predicting the elution time of a peptide in chromatographic and electrophoretic separations by first providing a data set of known elution times of known peptides, then creating a plurality of vectors, each vector having a plurality of dimensions, and each dimension representing positional information about at least a portion of the amino acids present in the



known peptides. A hypothetical vector is then created by assigning dimensional values for at least one hypothetical peptide, and a predicted elution time for the hypothetical vector is created by performing at least one multivariate regression fitting the hypothetical peptide to the plurality of vectors. Preferably, the multivariate regression is accomplished by the use of an artificial neural network and the elution times are first normalized using linear regression.

NTIS

*Chromatography; Elution; Liquid Chromatography; Patent Applications; Peptides; Predictions*

**20080025799** Texas Univ. System, Austin, TX, USA

**Applications of Light-Emitting Nanoparticles**

Korgel, B. A., Inventor; Johnston, K. P., Inventor; Brosh, K., Inventor; Thurk, P., Inventor; 5 May 05; 60 pp.; In English  
Contract(s)/Grant(s): NSF-26-1122-20XX

Patent Info.: Filed Filed 5 May 05; US-Patent-Appl-SN-11-122-223

Report No.(s): PB2007-110503; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A method for the production of a robust, chemically stable, crystalline, passivated nanoparticle and composition containing the same, that emit light with high efficiencies and size-tunable and excitation energy tunable color. The methods include the thermal degradation of a precursor molecule in the presence of a capping agent at high temperature and elevated pressure. A particular composition prepared by the methods is a passivated silicon nanoparticle composition displaying discrete optical transitions.

NTIS

*Metals; Nanoparticles; Patent Applications; Thermal Degradation*

**20080025850** LuKacher, (Kenneth J.), Esq., Rochester, NY, USA

**Glassy Chiral-Nematic Liquid Crystals and Optical Devices Containing Same**

Chen, S. H., Inventor; Chen, H. M. P., Inventor; 19 Mar 04; 31 pp.; In English

Contract(s)/Grant(s): NSF-CTS-0204827; NSF-CTS-9816234

Patent Info.: Filed Filed 19 Mar 04; US-Patent-Appl-SN-10-805-150

Report No.(s): PB2007-110603; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A glassy chiral-nematic liquid crystal composition includes a compound having the structural formula 1 wherein each N represents a nematic group connected to the 1,3,5-benzenetricarbonyl central moiety by a carboxylic ester linkage and Ch represents a chiral group connected to the central moiety by a carboxylic ester linkage. An optical device is formed from at least one of the glassy chiral-nematic liquid crystal compositions.

NTIS

*Chirality; Glass; Liquid Crystals; Optical Equipment; Optical Materials; Patent Applications*

**20080025852** Johns Hopkins Univ., Laurel, MD, USA

**Threat Identification in Time of Flight Mass Spectrometry Using Maximum Likelihood**

Hayek, C. S., Inventor; Cooch, F. A., Inventor; 14 May 04; 28 pp.; In English

Contract(s)/Grant(s): DARPA-MDA972-01-D-0005

Patent Info.: Filed Filed 14 May 04; US-Patent-Appl-SN-10-846-819

Report No.(s): PB2007-110605; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for determining a threat substance encountered by a time-of-flight mass spectrometer (TOF-MS) using a pre-computed threat library is described. The method comprising the steps of acquiring a spectrum of a test substance, wherein the acquired spectrum is an average of individual spectra acquired from a plurality of laser shots on the analyte; identifying mass/charge (m/z) values corresponding to each of a plurality of spectral peaks of the acquired spectrum; assigning a corresponding ranking code to the acquired spectrum based on the plurality of its spectral peaks and troughs, wherein a peak presence is indicated by a numeral 1, while peak absence is indicated by a numeral 0, relative to each of a set of substances in a threat library; comparing the assigned rankings of the acquired spectrum over all threat substances stored in the threat library; and identifying the threat substance as that which produced the highest ranking.

NTIS

*Mass Spectrometers; Mass Spectroscopy; Maximum Likelihood Estimates; Patent Applications; Time of Flight Spectrometers*

**20080025870** Air Force Research Lab., Kirkland AFB, NM USA

**Theory of Intrinsic Defects in Crystalline GeTe and of Their Role in Free Carrier Transport Novel Materials and Device Research**

Edwards, Arthur H; Jan 1, 2008; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A479324; AFRL-RV-PS-TR-2008-1005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a study of the electronic structure and formation energies of germanium/tellurium vacancy and antisite defects in germanium telluride. We find that germanium vacancies are the most readily formed defect, independent of Fermi level. Furthermore, we find that, while the ideal crystal is predicted to be a semiconductor, the predicted large densities of germanium vacancies result in partially filled valence band and p-type conductivity.

DTIC

*Chalcogenides; Crystallinity; Defects; Germanium; Semiconductors (Materials); Tellurides*

**20080025904** Applied Research Associates, Inc., Tyndall AFB, FL USA

**The Hydroxyl Radical Reaction Rate Constant and Products of Dimethyl Succinate**

Calidonna, Sheryl E; Bradley, William R; Mar 2008; 32 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A479436; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The relative rate technique has been used to examine the kinetics for the reaction of the hydroxyl radical (OH) with dimethyl succinate (DMS,  $\text{CH}_3\text{OC}(=\text{O})\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{OCH}_3$ ). The measured rate constant for  $\text{OH} + \text{DMS}$  was  $1.5 + 0.4 \times 10^{-12} \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$  at  $297 + 3 \text{ oK}$  and 1 atmosphere total pressure. This is in agreement with the predicted value of  $1.15 \times 10^{-12} \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$  determined by structure activity relationships. To more clearly define DMS's atmospheric degradation mechanism, the products of the  $\text{OH} + \text{DMS}$  reaction were also investigated. The only primary product detected was mono methyl succinate (MMS,  $\text{CH}_3\text{OC}(=\text{O})\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{OH}$ ) at a yield of only  $2.17 + 0.25\%$ . Extensive efforts were used to identify other primary products but none were measured. Formic acid ( $\text{HC}(=\text{O})\text{OH}$ ); however, was observed as a secondary product being formed at a rate of  $(4.6 \pm 1.3) \times 10^{14} \text{ molecules second}^{-1}$ , 60 minutes after initiating the  $\text{OH} + \text{DMS}$  reaction. Formic acid is believed to be a degradation product of the primary product, methyl glyoxylate (MG,  $\text{CH}_3\text{OC}(=\text{O})\text{C}(=\text{O})\text{H}$ ). Product formation pathways are discussed in light of current understanding of the atmospheric chemistry of oxygenated organic compounds.

DTIC

*Constants; Hydroxyl Radicals; Methyl Compounds; Radicals; Reaction Kinetics*

**20080025918** Florida Atlantic Univ., Dania Beach, FL, USA; Florida State Dept. of Transportation, Gainesville, FL, USA

**Corrosion Resistant Alloys for Reinforced Concrete**

Hartt, W. H.; Powers, R. G.; Lysogorski, D. K.; Liroux, V.; Virmani, Y. P.; Jul. 2007; 136 pp.; In English

Report No.(s): PB2007-112639; FHWA-HRT-07-039; No Copyright; Avail.: National Technical Information Service (NTIS)

Initial cost considerations have historically precluded widespread utilization of high performance (corrosion resistant) reinforcements such as stainless steels in bridge construction. However, with the advent of life-cycle cost analysis as a project planning tool and of a requirement that major bridge structures have a 75- to 100-year design life, the competitiveness of such steels has increased such that enhanced attention has focused in recent years upon these materials. This investigation was initiated to evaluate the corrosion resistance of various types of corrosion resistant reinforcement, including new products that are becoming available, in bridge structures that are exposed to chlorides. Both long-term (4-year) test yard exposures and accelerated laboratory experiments in simulated concrete pore waters are being performed. The ultimate objective is to, first, evaluate the corrosion properties and rank the different candidate materials and, second, develop tools whereby long-term performance in actual structures can be projected from short-term tests. This interim report presents results from the initial 3 years of an overall 5-year program.

NTIS

*Composite Materials; Concretes; Corrosion Prevention; Corrosion Resistance*

**20080025920** Applied Research Associates, Inc., Tyndall AFB, FL USA

**Hexaaluminate Combustion Catalysts for Fuel Cell Fuel Reformers**

Thomas, Fred S; Campbell, Timothy J; Shaaban, Aly H; Binder, Michael J; Holcomb, Frank H; Knight, James; Dec 2004; 4 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4819-07-D-0001; Proj-4915

Report No.(s): AD-A479481; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Fuel cells may offer significant advantages over conventional diesel generator sets for mobile military electric power applications. Fuel cells can provide quiet, flexible, and fuel-efficient operation, making them suitable for use in 'stealth' vehicles or quiet portable power systems. A key requirement for the deployment of fuel cells is the conversion of logistics fuels into hydrogen. Logistics fuels can be converted into hydrogen through steam reforming -- a reaction which requires heat input. When heat is produced by combustion of logistics fuel in an open-flame or radiant burner, the rate of hydrogen production in the steam reforming reactor is generally limited by the rate of heat transfer from the burner. The rate of heat transfer from the burner into the reforming catalyst bed is limited by wall film and bed resistances. Catalytic combustion of logistics fuel can increase the heat transfer rate by eliminating these resistances. Fuel combustion can be carried out using a catalyst coated on a thin metal channel wall, with steam reforming catalyst coated on the other side of the wall. In this way heat is transferred by conduction directly from the source to the sink, allowing for faster hydrogen production in a more compact catalytic reactor. This approach, however, requires the development of active, stable combustion catalysts that can be coated directly onto metal supports.

DTIC

*Aluminates; Catalysts; Combustion; Fuel Cells; Heat Transfer; Steam*

**20080025935** Iowa State Univ. of Science and Technology, Ames, IA USA

**Detecting Molecular Properties by Various Laser-based Techniques**

Hsin, T.; January 2007; 121 pp.; In English

Report No.(s): DE2007-910305; No Copyright; Avail.: Department of Energy Information Bridge

Four different laser-based techniques were applied to study physical and chemical characteristics of biomolecules and dye molecules. These techniques are hole burning spectroscopy, single molecule spectroscopy, time-resolved coherent anti-Stokes Raman spectroscopy and laser-induced fluorescence microscopy

NTIS

*Detection; Lasers; Molecules*

**20080026087** NASA White Sands Test Facility, NM, USA

**Contamination Detection and Mitigation Strategies for Unsymmetric Dimethylhydrazine/Nitrogen Tetroxide Non-Combustion Product Residues**

Greene, Benjamin; Buchanan, Vanessa D.; Baker, David L.; March 06, 2006; 49 pp.; In English; JANNAF 33rd PEDCS, 6-10 Mar. 2006, Sandestin, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Dimethylamine and nitrite, which are non-combustion reaction products of unsymmetrical dimethylhydrazine (UDMH) and nitrogen tetroxide (NTO) propellants, can contaminate spacesuits during extra-vehicular activity (EVA) operations. They can react with water in the International Space Station (ISS) airlock to form N-nitrosodimethylamine (NDMA), a carcinogen. Detection methods for assessing nitrite and dimethylamine contamination were investigated. The methods are based on color-forming reactions in which intensity of color is proportional to concentration. A concept color detection kit using a commercially available presumptive field test for methamphetamine coupled with nitrite test strips was developed and used to detect dimethylamine and nitrite. Contamination mitigation strategies were also developed.

Author

*Contamination; Dimethylhydrazines; International Space Station; Nitrogen Tetroxide; Reaction Products; Residues*

**20080026226** Kansas Univ. Center for Research, Inc., Lawrence, KS, USA

**Multiple Corrosion Protection Systems for Reinforced Concrete Bridge Components**

Darwin, D.; Browning, J.; Locke, C. E.; Nguyen, T. V.; Jul. 2007; 96 pp.; In English

Contract(s)/Grant(s): DTFH61-03-C-00131

Report No.(s): PB2007-111508; FHWA-HRT-07-043; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Eleven systems combining epoxy-coated reinforcement with another corrosion protection system are evaluated using the

rapid macrocell, Southern Exposure, cracked beam, and linear polarization resistance tests. The systems include bars that are pretreated with zinc chromate to improve the adhesion between the epoxy and the reinforcing steel; two epoxies with improved adhesion to the reinforcing steel; one inorganic corrosion inhibitor, calcium nitrite; two organic corrosion inhibitors; an epoxy-coated bar with a primer containing microencapsulated calcium nitrite; the three epoxy-coated bars with improved adhesion combined with the corrosion inhibitor calcium nitrite; and multiple coated bars with an initial 50-um (2-mil) coating of 98 percent zinc and 2 percent aluminum followed by a conventional epoxy-coating. The systems are compared with conventional uncoated reinforcement and conventional epoxycoated reinforcement. The results presented in this report represent the findings obtained during the first half of a 5-year study that includes longer-term ASTM G 109 and field tests.

NTIS  
*Composite Materials; Concretes; Corrosion Prevention; Reinforced Plastics*

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### METALS AND METALLIC MATERIALS

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

**20080024218** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

#### **Disordered Zinc in Zn<sub>4</sub>Sb<sub>3</sub> with Phonon-Glass and Electron-Crystal Thermoelectric Properties**

Snyder, G. Jeffrey; Christensen, Mogens; Nishibori, Eiji; Caillat, Thierry; Brummerstedt Iversen, Bo; Nature Materials; July 2004; Volume 3, Issue 7, pp. 458-463; In English; Original contains color illustrations; Copyright; Avail.: Other Sources  
ONLINE: <http://dx.doi.org/10.1038/nmat1154>; <http://hdl.handle.net/2014/40843>

By converting waste heat into electricity, thermoelectric generators could be an important part of the solution to today's energy challenges. The compound Zn<sub>4</sub>Sb<sub>3</sub> is one of the most efficient thermoelectric materials known. Its high efficiency results from an extraordinarily low thermal conductivity in conjunction with the electronic structure of a heavily doped semiconductor. Previous structural studies have been unable to explain this unusual combination of properties. Here, we show through a comprehensive structural analysis using single-crystal X-ray and powder-synchrotron-radiation diffraction methods, that both the electronic and thermal properties of Zn<sub>4</sub>Sb<sub>3</sub> can be understood in terms of unique structural features that have been previously overlooked. The identification of Sb<sup>3-</sup> ions and Sb-2(4-) dimers reveals that Zn<sub>4</sub>Sb<sub>3</sub> is a valence semiconductor with the ideal stoichiometry Zn<sub>13</sub>Sb<sub>10</sub>. In addition, the structure contains significant disorder, with zinc atoms distributed over multiple positions. The discovery of glass-like interstitial sites uncovers a highly effective mechanism for reducing thermal conductivity. Thus Zn<sub>4</sub>Sb<sub>3</sub> is in many ways an ideal 'phonon glass, electron crystal' thermoelectric material.

Author  
*Thermal Conductivity; Thermodynamic Properties; Thermoelectric Materials; Thermoelectricity; Zinc; Zinc Alloys*

**20080025339** Strategic Environmental Research and Development Program, Arlington, VA USA

#### **DoD Metal Finishing Workshop: Chromate Alternatives for Metal Treatment and Sealing**

Legg, Keith O; May 17, 2007; 48 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A479033; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA479033>

This technical workshop was designed to bring together DoD and industry engineers to identify specific DoD needs, commercial solutions, and engineering data for replacing chromate processes used for overhaul and new weapons systems in vehicles, aircraft and vessels: DoD needs for chromates and their alternatives; Commercial and military experience with alternatives; Specific COTS treatments to meet DoD requirements; Data and specifications for making engineering decisions; Data gaps are and how they can best be filled; Options where no potential COTS products are available.

DTIC  
*Alternatives; Chromates; Metal Finishing; Metals; Sealing; Surface Finishing*

**20080025466** California Univ., Los Angeles, CA USA

#### **Two-Dimensional Electron Gas in Strained Silicon for Studying Ultra-Low Energy Electronic Processes**

Xie, Ya-Hong; Tsui, Daniel; Mar 10, 2008; 18 pp.; In English  
Contract(s)/Grant(s): FA9550-04-1-0370

Report No.(s): AD-A479239; 2008-FINAL; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The proposed research focuses on the fabrication of high mobility 2D electron gases or low density for the understanding of correlated electron behavior under extreme conditions: low temperature and high magnetic field. The experimental efforts

are in 3 related topics: (1) fabricate 2DES in strained Si with the highest achievable electron mobility; (2) fabricate 2DES in strained Si with low electron density; and (3) explore alternative approaches for fabricating strained Si without the relaxed buffer layer that is heavily dislocated and therefore causing strain undulation in the Si channel. Significant progress has been made in carrier mobility and the fabrication of strained films using porous Si. We have gained the ability to reproducibly fabricate 2DES samples with mobility above 300,000 cm<sup>2</sup>/V-s. By controlled oxidation of porous Si, we have obtained strained films with up to 0.8% tensile strain, suitable for 2DES transport research without ever introducing dislocations. The outcome of our research has led to significant advancement in our ability of fabricating high quality samples for the understanding of correlated electron behavior.

DTIC

*Electron Gas; Electron Mobility; Magnetic Fields; Silicon; Tensile Strength*

**20080025691** NASA, Washington, DC USA

**Miniaturized metal (metal alloy)/ PdO.sub.x/SiC hydrogen and hydrocarbon gas sensors**

Hunter, Gary W., Inventor; Xu, Jennifer C., Inventor; Lukco, Dorothy, Inventor; June 24, 2008; 18 pp.; In English  
Patent Info.: Filed May 12, 2006; US-Patent-7,389,675; US-Patent-Appl-SN-11/434,578; No Copyright; Avail.: CASI:

A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025691>

A miniaturized Schottky diode hydrogen and hydrocarbon sensor and the method of making same is disclosed and claimed. The sensor comprises a catalytic metal layer, such as palladium, a silicon carbide substrate layer and a thin barrier layer in between the catalytic and substrate layers made of palladium oxide (PdO.sub.x). This highly stable device provides sensitive gas detection at temperatures ranging from at least 450 to 600.degree. C. The barrier layer prevents reactions between the catalytic metal layer and the substrate layer. Conventional semiconductor fabrication techniques are used to fabricate the small-sized sensors. The use of a thicker palladium oxide barrier layer for other semiconductor structures such as a capacitor and transistor structures is also disclosed.

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

*Fabrication; Gas Detectors; Hydrogen; Miniaturization; Oxides; Palladium; Silicon Carbides*

**20080025826** Materials and Electrochemical Research Corp., Tucson, AZ, USA

**Gun Barrel and Method of Forming**

Withers, J. C., Inventor; Bracamonte, L. A., Inventor; Storm, R. S., Inventor; Pickard, S. M., Inventor; Loutfy, R. O., Inventor; 27 Apr 05; 10 pp.; In English

Contract(s)/Grant(s): NV-M67854-03-C-1011; AR-W15QKN-04-C-1028

Patent Info.: Filed Filed 27 Apr 05; US-Patent-Appl-SN-11-115-929

Report No.(s): PB2007-110515; No Copyright; Avail.: CASI: A02, Hardcopy

A fabrication technique is described for producing lighter weight and improved wear and erosion resistant gun barrels. The barrels are produced in an unconventional manner from the inside bore to the outside diameter of the barrel and combine a refractory metal, metal alloy, or ceramic composite inner liner with a metal matrix composite (MMC) or titanium or other suitable high strength, lightweight metal or metal alloy outer shell. A unique aspect of the invention is that there is a compositional gradation from the liner at the inside bore to the overwrap which extends to the outside diameter of the barrel. A process is also described to produce barrels with a refractory metal liner with improved wear and erosion resistance by depositing the refractory metal on the ID of a pre-fabricated barrel.

NTIS

*Linings; Patent Applications; Refractory Metals*

**20080025859** Ross (Sheridan) PC, Denver, CO, USA

**Functionally Graded Alumina-Based Thin Film Systems**

Moore, J. J., Inventor; Zhong, D., Inventor; 23 May 05; 5 pp.; In English

Contract(s)/Grant(s): DE-FC36-00ID13850

Patent Info.: Filed Filed 23 May 05; US-Patent-Appl-SN-11-136-613

Report No.(s): PB2007-110598; No Copyright; Avail.: CASI: A01, Hardcopy

The present invention provides coating systems that minimize thermal and residual stresses to create a fatigue- and soldering-resistant coating for aluminum die casting dies. The coating systems include at least three layers. The outer layer is an alumina- or boro-carbide-based outer layer that has superior non-wettability characteristics with molten aluminum

coupled with oxidation and wear resistance. A functionally-graded intermediate layer or 'interlayer' enhances the erosive wear, toughness, and corrosion resistance of the die. A thin adhesion layer of reactive metal is used between the die substrate and the interlayer to increase adhesion of the coating system to the die surface.

NTIS

*Aluminum Oxides; Patent Applications; Thin Films*

**20080025989** NASA Glenn Research Center, Cleveland, OH, USA

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

Nathal, Michael V.; June 2008; 14 pp.; In English; 11th International Symposium (Superalloys 2008), 14-18 Sep. 2007, Champion, PA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.02

Report No.(s): NASA/TM-2008-215205; E-16479; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025989>

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; Shape Memory Alloys; Space Shuttles; General Overviews*

## 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*.

**20080023734** Materials Resources International, Lansdale, PA, USA; Oak Ridge National Lab., TN USA

**High Density Infrared (HDI) Transient Liquid Coatings for Improved Wear and Corrosion Resistance (Final Report, March 1, 2002-September 29, 2006)**

Smith, R. W.; January 2006; 68 pp.; In English

Contract(s)/Grant(s): DE-FC36-021D14240

Report No.(s): DE2007-909431; No Copyright; Avail.: National Technical Information Service (NTIS)

A 4 year, \$350,000/yr effort to develop high density infrared (HDI) coating methodology that could replace furnace or flame fusing was the subject of this investigation. The effort was a collaborative effort between Oak Ridge National Laboratory (ORNL), Materials Resources International and an industry team of participants. The project's aim was to develop, evaluate and understand how high density infrared heating technology could be used to improve infiltrated carbide wear coatings and/or to densify sprayed coatings. In the proposed work both applied and fundamental investigations were conducted. The applied work at ORNL aimed at developing practical High Density Infrared (HDI) heating systems and techniques that were able to fuse thermally sprayed coating and to infiltrate carbide coatings for use in applications such as agricultural blades. The expectation was that the developments would also have application in coating rolls for metallurgical processing, in coating of components used in construction and mining vehicles, components for paper and polymer processing. Engineering development focused on developing process technology and know-how to implement HDI systems that could fuse coatings on a range and size of components. Fundamental research and process modeling was conducted that developed some understanding the

interaction of HDI processing with the coating materials and the base materials, and determined selected coating properties, focusing in particular on wear resistance.

NTIS

*Wear Resistance; Corrosion Resistance; Coatings*

**20080023812** Army Research Lab., Aberdeen Proving Ground, MD USA

**Manufacturing of a Composite Tailcone for an XM-1002 Training Round**

Sands, James M; Vaidya, Uday; Husman, George; Serrano, Juan; Brannon, Robert; Feb 2008; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-2-0018

Report No.(s): AD-A478353; ARL-TR-4381; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478353>

Recent work on the cost-effective manufacturing of an extrusion-compression molded, long-fiber thermoplastic (LFT) XM-1002 tailcone for training rounds of military ammunition is compiled in this technical report. During the last decade, the engineering community has expanded the use of thermoplastic composites due to their inherent advantages over traditional thermoset composites including: high toughness, inexpensive resin systems, short processing cycle times, recycling potential, excellent environmental resistance, and damage tolerance. Thermoplastic composites have a wide range of applications in the automotive and transportation industry for replacement of heavy metal components and/or structures. LFT composites are a family of compounds with reinforcing fiber strands (fiber lengths typically range from 6 to 24 mm) combined with a thermoplastic matrix (which can be any commodity or engineering thermoplastic polymer). LFTs have the ability to be molded into complex geometries featuring ribs, knock-outs, and thickness variations within the parts. LFT parts/components can be processed by extrusion-compression, injection-compression, and/or injection-molding processes.

DTIC

*Ammunition; Compressing; Education; Manufacturing; Molds; Thermoplastic Resins*

**20080023817** Army Research Lab., Aberdeen Proving Ground, MD USA

**Hybrid Helmet Cure Cycle Optimization**

Spagnuolo, David M; Napadensky, Eugene; Feb 2008; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-DE25

Report No.(s): AD-A478366; ARL-TR-4384; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478366>

Some of the recent work involving the use of thermoplastic materials for combat helmets has shown significant weight savings and improved protection. Unfortunately, the change to thermoplastic materials brings with it some important concerns. First, the stiffness is compromised with these materials so a hybrid type of helmet (a thermoplastic shell with thermoset inner or outer skins) is needed to reduce the deflection properties. This brings us to the second concern, processability. A typical combat helmet is made with a thermoset phenolic/polyvinylbutyral material, usually cured at 250 deg. F with a 1-hour soaking time. Thermoplastics require higher temperatures for the fusion process to commence but require a much shorter soaking time. This work investigates potential cure cycles for a carbon fiber-epoxy prepreg, BT250-E, cured at higher temperatures, faster ramp rates, and shorter soaking times. A differential scanning calorimeter was used for measuring the degree of cure for the various cure cycles from which the most optimized cycle was selected, based on degree of cure and process time.

DTIC

*Curing; Helmets*

**20080024001** Nevada Univ., Reno, NV USA

**Structurally Efficient Anisotropic Organized Reticulated structures for Cooling of Electronics and Sensors**

Wirtz, Richard A; Jiang, Yanyao; Aug 31, 2006; 112 pp.; In English

Contract(s)/Grant(s): F49620-03-1-342

Report No.(s): AD-A478696; 1320-11J-300A; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Anisotropic Organized Reticulated-Filament Structures (AORS), consisting of group- interconnected and purposely oriented thermally conductive filaments, can be configured to have wide ranging porosity and a large specific surface area. When deployed as heat exchanger matrices, these structures produce high ntu-values (number of transfer units) because of the large specific surface area inherent to the media. Examples of structures with the above described characteristics are: laminations of orthogonal-weave fine-wire screen, three-filament stacked weaves and box lattice structures. Box lattice

structures offer increased design flexibility relative to woven structures since filament cross section shape (in addition to filament orientation) can be tailored to a specific application. Relative to a box lattice with circular cross section filaments, ellipticity adds surface area to the structure, as well as the possibility to streamline flow through the array. Furthermore, box lattices have superior strength characteristics. Research focuses on characterizing the geometric, thermal and structural attributes of box lattice structures. Geometric models of porosity and specific surface area are developed along with a thermal model of the effective of the effective thermal conductivity. They show that metal fraction can range as: 00/0 - 0.94%; dimensionless specific surface area can range as: 0.93- 3.14 and dimensionless effective thermal conductivity can range as: 0 - 0.78.

DTIC

*Anisotropy; Cooling; Electromechanical Devices; Thermal Conductivity*

**20080024211** Indian Inst. of Tech., Madras, India

**Modeling of the Viscoelastic Properties of PVDF through the Fractional Differential Model**

Naarayan, S. Sathiya; Rao, C. Lakshmana; Sivakumar, Srinivasan M.; International Journal of COMADEM, Volume 11, No. 1; January 2008, pp. 2-8; In English; See also [20080024209](#); Copyright; Avail.: Other Sources

Polyvinylidene fluoride (PVDF), a piezoelectric material has many useful applications like sensors, transducers and surface acoustic wave devices. Since PVDF is a polymer, it is possible that its mechanical response is likely to be frequency and time dependent. It is important therefore, to characterize the frequency or time dependent behavior of PVDF using appropriate models that are based on experimental observations. Dynamical Mechanical Tests were conducted on bi-axially stretched PVDF at different temperatures (35 C - 70 C) and frequencies (0.33 Hz - 10 Hz). It was observed from the experimental results that at higher temperatures, the rate of change of modulus with frequency reduces. Time-temperature superposition was done for the storage and the loss moduli to arrive at a single master curve at a temperature of 35 C. The results obtained by the superposition were then modeled using a simple viscoelastic three parameter model with ordinary dashpot. This model predicted the storage modulus well but was found short of the required predictive capability for the loss modulus. A four parameter model with fractional dashpot was used and it is found that it models the loss and storage modulus results better than the model with ordinary dashpot.

Author

*Viscoelasticity; Fluoropolymers*

**20080025273** Syracuse Univ., NY USA

**Method of Fabricating a Cylindrical Optical Fiber Containing a Light Interactive Film**

Kornreich, P. G., Inventor; Keller, D. V., Inventor; Flattery, J., Inventor; 12 Jan 05; 14 pp.; In English

Contract(s)/Grant(s): AF-F30602-96-C-0172

Patent Info.: Filed Filed 12 Jan 05; US-Patent-Appl-SN-11-033-699

Report No.(s): PB2007-109083; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of forming a preform which has a glass core surrounded by an outer glass cladding with a coating of a light interactive material disposed between the core and cladding. The method includes providing a glass core having a viscosity which lies within a given preselected temperature range, followed by forming a substantially homogeneous coating of a light interactive material over the surface of the core, with the coating material having a viscosity which is equal to or less than the viscosity of the glass core. A glass cladding is formed over the coated layer, with the cladding glass having a viscosity which overlaps the viscosity of the core glass and a thermal coefficient of expansion compatible with that of the core. The light interactive material is an inorganic material which includes a metal, metal alloy, ferrite, magnetic material and a semiconductor.

NTIS

*Cladding; Cylindrical Bodies; Fabrication; Fiber Optics; Glass; Optical Fibers; Patent Applications; Preforms*

**20080025370** Naval Research Lab., Washington, DC USA

**Stacking Nematic Elastomers for Artificial Muscle Applications**

Spillmann, Christopher M; Naciri, Jawad; Martin, Brett D; Farahat, Waleed; Herr, Hugh; Ratna, Banahalli R; Apr 2006; 7 pp.; In English

Report No.(s): AD-A479182; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479182>

Nematic liquid crystal elastomers are thermally actuated to produce macroscopic, anisotropic shape changes. Uniaxial



contraction and extension of liquid crystal elastomers can be achieved by cycling the temperature of the material through the nematic to isotropic phase transition. In this report, a new approach is introduced by layering liquid crystal elastomer films to create thermally actuated stacks. A heating element and thermally conductive grease embedded between elastomer films provide a means for rapid internal heat application and distribution when a current is passed through the heating element, thus providing contractile force production in a minimal amount of time. Upon voltage application, stacks composed of two 100 m-thick films and a single heating element produce 18% strain between contracted and relaxed states. In addition, the stacked elastomer films are capable of producing 10% contraction within 1 s and the blocked stress of the thermally actuated stacked films is calculated to be 130 kPa. The stacking approach provides new opportunities to use liquid crystal elastomers in applications requiring forces greater than those capable of being produced by single elastomer films.

DTIC

*Actuators; Contraction; Elastomers; Heating; Liquid Crystals; Muscles*

**20080025375** IAP Research, Inc., Dayton, OH USA

**SiC Armor Tiles via Magnetic Compaction and Pressureless Sintering**

Chelluri, Bhanu; Knoth, Ed A; Franks, L P; Jan 27, 2008; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W56HZBV-06-C-0568

Report No.(s): AD-A479204; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479204>

The purpose of the SBIR, entitled 'Continuous Dynamic Processing of Ceramic Tiles for Ground Vehicle Protection', was to create a high rate, cost effective manufacturing method for producing silicon carbide (SiC) tiles via a combination of high density Dynamic Magnetic Compaction (DMC) for near net shape green body forming and Pressure-less Sintering (PS) for full density sintered body.

DTIC

*Armor; Compacting; Silicon Carbides; Sintering; Tiles*

**20080025682** Savannah River National Lab., Aiken, SC, USA

**Statistical Review of the Chemical Composition Measurements and PCT Results for the Glasses Fabricated as Part of the US Test Matrix**

Edwards, T. B.; Joner, M. D.; Tuckfield, R. C.; Jun. 12, 2007; 196 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2007-910174; SRNL-SCS-2007-00029; No Copyright; Avail.: National Technical Information Service (NTIS)

A statistical review of the PSAL measurements of the chemical compositions and of the PCT results for the glasses making up the US test matrix is provided in this memorandum. Target, measured, and measured bias-corrected compositional views were determined for these glasses. The durability results for the US study glasses are compared to those of the Environmental Assessment (EA) glass. All of the US glasses yielded PCTs that are lower than those of the EA glass. The largest PCT values are those measured for the ccc versions of US-27 and US-18 whose boron normalized leachate (NL(B)) values in grams per liter (g/L) were 16.4 g/L (based on the targeted composition) and 10.7 g/L (based on the targeted composition), respectively. The 16.4 g/L is just below the value of 16.695 g/L for EAs NL(B) that was reported by Jantzen et al. in WSRC-TR-92-0346, Revision 1. For the quenched version of the glasses, the largest NL(B) value is 0.67 g/L (based on the targeted composition). Thus, some statistically significant differences were seen between the quenched and ccc versions for some of the glasses. It should be noted that the thirty (30) glasses making up the KRI test matrix were not included in these analyses.

NTIS

*Chemical Composition; Fabrication; Glass; Radioactive Wastes; Sludge; Waste Management*

**20080025768** Siemens Westinghouse Power Corp., Pittsburgh, PA, USA

**Flexible Ceramic Gasket for SOFC Generator**

Zafred, P., Inventor; Previsih, T., Inventor; 27 May 04; 9 pp.; In English

Contract(s)/Grant(s): DE-FC26-97FT34139

Patent Info.: Filed Filed 27 May 04; US-Patent-Appl-SN-10-854-915

Report No.(s): PB2007-110550; No Copyright; Avail.: CASI: A02, Hardcopy

A solid oxide fuel cell generator (10) contains stacks of hollow axially elongated fuel cells (36) having an open top end

(37), an oxidant inlet plenum (52), a feed fuel plenum (11), a combustion chamber (94) for combusting reacted oxidant/spent fuel; and, optionally, a fuel recirculation chamber (106) below the combustion chamber (94), where the fuel recirculation chamber (94) is in part defined by semi-porous fuel cell positioning gasket (108), all within an outer generator enclosure (8), wherein the fuel cell gasket (108) has a laminate structure comprising at least a compliant fibrous mat support layer and a strong, yet flexible woven layer, which may contain catalytic particles facing the combustion chamber, where the catalyst, if used, is effective to further oxidize exhaust fuel and protect the open top end (37) of the fuel cells.

NTIS

*Ceramics; Gaskets; Patent Applications; Solid Oxide Fuel Cells*

**20080025771** Virginia Univ. Patent Foundation, Charlottesville, VA, USA

**Extremely Strain Tolerant Thermal Protection Coating and Related Method and Apparatus Thereof**

Wortman, D. J., Inventor; Wadley, H. N. G., Inventor; 12 Nov 03; 25 pp.; In English

Contract(s)/Grant(s): AF-GI 11083

Patent Info.: Filed 12 Nov 03; US-Patent-Appl-SN-10-533-993

Report No.(s): PB2007-110549; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Method and Apparatus for efficiently applying coating systems to a surface that can survive the thermal gradient that is encountered in high temperature, high heat flux environments such as a rocket engine or like using vapor or cluster deposition process such as a directed vapor deposition (DVD) approach. Method and Apparatus provides electron or other energetic beam technique to evaporate and deposit compositionally and morphologically controlled bond coats at high rate while providing a highly strain tolerant thermal barrier coating that has an improved porosity morphology between columnar grains.

NTIS

*Coating; Patent Applications; Thermal Analysis; Thermal Protection*

**20080025953** Texas A&M Univ., College Station, TX USA

**Preliminary Results of Repeatability and Sensitivity Study on Overlay Tester for Crack Sealants**

Zhou, J.; Hu, S.; Scullion, T.; Aug. 2007; 20 pp.; In English

Report No.(s): PB2007-114494; REPT-0-5457-1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This brief summary report documents the main findings from the work done in the last fiscal year. This summary report is composed of three major components: (1) Overlay Tester for crack sealants and associated draft test protocol, (2) repeatability of Overlay Tester for crack sealant, and (3) sensitivity of Overlay Tester for crack sealant. Finally, this report discusses the work recommended by the Pavement Monitoring Committee on October 11, 2006.

NTIS

*Cracks; Sealers; Sensitivity*

**20080025960** Texas A&M Univ., College Station, TX USA

**Polymer Modified Asphalt Durability in Pavements**

Woo, W. J.; Ofori-Abebe, E.; Chowdhury, A.; Hilbrich, J.; Kraus, Z.; Jul. 2007; 424 pp.; In English

Report No.(s): PB2007-114491; REPT-0-4688; No Copyright; Avail.: National Technical Information Service (NTIS)

This project was designed to develop (1) a better quantitative understanding of the relation between laboratory accelerated binder aging and field aging, (2) a test procedure to measure properties of an aged binder that relate to failure on the road, and (3) a proposed specification for estimating the relative durability of binders in the presence of oxidative aging. Tests were conducted on original base and polymer modified binders, laboratory compacted mixtures, and pavement-aged binders. The project necessarily evolved to a more comprehensive approach to improving pavement service life. Methods for significantly improving pavement durability should be implemented: (1) construct pavements with the lowest possible accessible (interconnected) air voids, consistent with other best construction and mix design practices; (2) use mix designs that have an inherently low decrease in fatigue life with binder oxidation, coupled with an appropriately high initial fatigue life; (3) use binders with a minimum stiffness at the PAV\* 16 hour condition (consistent with the appropriate performance grade); (4) use the pavement aging model for pavement design; (5) use binders that have inherently slow hardening rates kinetics; and (6) use modifiers that provide the most reduction in the hardening rate. Items 1 and 2 have a dramatic impact on pavement service life but require additional research for the most effective implementation: (1) determine the parameters that govern the decline of mixture fatigue life with binder hardening; (2) determine methods to reliably, and with minimal risk to other construction parameters, achieve very low accessible air voids in pavements.

NTIS

*Aging (Materials); Asphalt; Binders (Materials); Polymer Blends; Durability; Pavements*

**20080025967** Emrich and Dithmar, LLC, Chicago, IL, USA

**Construction Material and Method**

Wagh, A. S., Inventor; Antink, A. L., Inventor; 30 Dec 02; 8 pp.; In English

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

Patent Info.: Filed Filed 30 Dec 02; US-Patent-Appl-SN-10-335 462

Report No.(s): PB2007-113857; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A structural material of a polystyrene base and the reaction product of the polystyrene base and a solid phosphate ceramic. The ceramic is applied as a slurry which includes one or more of a metal oxide or a metal hydroxide with a source of phosphate to produce a phosphate ceramic and a poly(acrylic acid or acrylate) or combinations or salts thereof and polystyrene or MgO applied to the polystyrene base and allowed to cure so that the dried aqueous slurry chemically bonds to the polystyrene base. A method is also disclosed of applying the slurry to the polystyrene base.

NTIS

*Ceramics; Patent Applications; Phosphates; Polystyrene*

**20080025998** NASA Glenn Research Center, Cleveland, OH, USA

**Optical Properties of Thermal Control Coatings After Weathering, Simulated Ascent Heating, and Simulated Space Radiation Exposure**

Jaworske, Donald A.; Tuan, George C.; Westheimer, David T.; Peters, Wanda C.; Kauder, Lonny R.; June 2008; 18 pp.; In English; 39th Central Regional Meeting of the American Chemical Society, 10-14 Jun. 2008, Columbus, OH, USA; Original contains color and black and white illustrations

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

Report No.(s): NASA/TM-2008-215259; E-16525; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025998>

Spacecraft radiators reject heat to their surroundings and coatings play an important role in this heat rejection. The coatings provide the combined optical properties of low solar absorptance and high infrared emittance. The coatings are applied to the radiator panel in a number of ways, including conventional spraying, plasma spraying, or as an applique. Not designed for a terrestrial weathering environment, the durability of spacecraft paints, coatings, and appliques upon exposure to weathering and subsequent exposure to ascent heating, solar wind, and ultraviolet radiation was studied. In addition to traditional aluminum panels, new isocyanate ester composite panels were exposed for a total of 90 days at the Atmospheric Exposure Site of Kennedy Space Center's (KSC) Beach Corrosion Facility for the purpose of identifying their durability to weathering. Selected panel coupons were subsequently exposed to simulated ascent heating, solar wind, and vacuum ultraviolet (UV) radiation to identify the effect of a simulated space environment on as-weathered surfaces. Optical properties and adhesion testing were used to document the durability of the paints, coatings, and appliques.

Author

*Spacecraft Radiators; Thermal Control Coatings; Optical Properties; Space Weathering; Heating; Space Environment Simulation; Extraterrestrial Radiation; Atmospheric Effects; Paints; Composite Materials*

**28**

**PROPELLANTS AND FUELS**

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

**20080023799** Army Construction Engineering Research Lab., Champaign, IL USA

**Ramgen Power Systems for Military Engine Applications**

Holcomb, Franklin H; Sohn, Chang W; Tamm, Gunnar; Brown, Daniel; Mahoney, Daniel; Baldwin, Peter; Belshaw, Karen; Koopman, Aaron; Witmer, Dennis; May 2007; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478293; ERDC/CERL-TR-07-14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478293>

Ramgen Power Systems, Inc. (RPS) is developing two high efficiency gas turbine engine concepts that combine many of the proven features of supersonic compression and expansion systems, commonly used in supersonic flight inlet and nozzle designs, with conventional axial flow turbo-machinery practices to create two entirely new gas turbine engines. The superior efficiency is a result of high pressure shock wave compression and supersonic expansion phenomena to produce high

component efficiencies, and a unique engine configuration that minimizes flow stream turning losses throughout the engine. The RPS engine concept can be configured as a high pressure ratio simple-cycle design for propulsion applications, or as a low pressure ratio recuperated engine either as a standalone component or combined with a hybrid fuel cell for stationary power applications. The anticipated compression and expansion efficiencies, decreased footprint, and reduced part count of the RPS technologies promise revolutionary new power generation and propulsion systems with decreased heat signatures resulting from lower exhaust temperatures. These unique aerodynamic features will open new options for engine designers and package integrators. This report documents research and development of the RAMGEN technology and potential applications toward military operations including warfighter applications.

DTIC

*Gas Turbines; Hybrid Propulsion; Military Technology; Propulsion System Configurations; Propulsion System Performance*

**20080023803** General Accounting Office, Washington, DC USA

**Defense Management. Overarching Organizational Framework Needed to Guide and Oversee Energy Reduction Efforts for Military Operations**

Solis, William M; Gosling, Thomas; Angulo, Karyn; Czyz, Alissa; Mak, Marie; Mar 2008; 50 pp.; In English  
Report No.(s): AD-A478318; GAO-08-426; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478318>

The Department of Defense (DOD) relies heavily on petroleum-based fuel for mobility energy the energy required for moving and sustaining its forces and weapons platforms for military operations. Dependence on foreign oil, projected increases in worldwide demand, and rising oil costs, as well as the significant logistics burden associated with moving fuel on the battlefield, will likely require DOD to address its mobility energy demand. GAO was asked to (1) identify key efforts under way to reduce mobility energy demand and (2) assess the extent to which DOD has established an overarching organizational framework to guide and oversee these efforts. GAO reviewed DOD documents, policies, and studies, and interviewed agency officials. GAO is recommending that DOD establish an overarching organizational framework for mobility energy to improve the department's ability to guide and oversee mobility energy reduction efforts. To establish such a framework, DOD should designate an executive-level Office of the Secretary of Defense (OSD) official to be accountable for mobility energy matters, develop a comprehensive strategic plan, and improve DOD's business processes. In addition, the military services should designate executive-level focal points to establish effective communication and coordination among OSD and the military services. DOD partially concurred with the recommendations.

DTIC

*Military Operations; Petroleum Products*

**20080023805** General Accounting Office, Washington, DC USA

**Defense Management: Overarching Organizational Framework Could Improve DoD's Management of Energy Reduction Efforts for Military Operations**

Solis, William M; Mar 13, 2008; 20 pp.; In English

Report No.(s): AD-A478332; GAO-08-523T; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478332>

Several issues, such as rising fuel costs, worldwide energy demand, and the high fuel burden during operations, underscore the importance of energy to DOD. Fuel costs for DOD are substantial and the volatility of world oil prices will likely continue to affect the department which may require DOD to make difficult trade-offs, such as redirecting funds from ongoing programs to pay for needed fuel. In addition, both the Army and Marine Corps have plans to grow their forces over the next several years, which will inevitably require larger amounts of fuel to sustain these forces and their weapons systems. Other energy issues that are likely to affect DOD in the future are the increased U.S. dependence on foreign oil, projected increases in the worldwide demand for oil, and uncertainties about world oil supplies. Furthermore, DOD's high fuel requirements on the battlefield can place a significant logistics burden on military forces; limit the range and pace of operations; and add to mission risks, including exposing supply convoys to attack. Given these issues, DOD must be well positioned to effectively manage energy demands for military operations. DOD and the military services have several initiatives under way to reduce demand for mobility energy. At the department level, the Office of the Secretary of Defense

(OSD) created a task force in 2006 to address energy security concerns. Moreover, in 2007, the Deputy Secretary of Defense included energy in DOD's list of the top 25 transformational priorities for the department as part of its initiative to pursue targeted acquisition reforms. Each of the military services also has its own initiatives under way to reduce mobility energy demand. The Army is addressing fuel consumption at forward-deployed locations by developing foam-insulated tents and temporary dome structures that are more efficient to heat and cool, reducing the demand for fuel-powered generators.

DTIC

*Costs; Fuel Consumption; Management Planning; Military Operations*

**20080025494** Defence Research and Development Canada, Valcartier, Quebec Canada

**Parametric Study on the Interior Ballistics of 105 and 155 mm Artillery Guns**

Tanguay, Vincent; Mar 2008; 62 pp.; In English

Report No.(s): AD-A479307; DRDC-V-TM-2007-350; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The interior ballistics code IBHVG2 was used to calculate the muzzle velocity and peak acceleration of projectiles ranging in mass from 10 to 50 kg. The simulations were performed with both 105 and 155 mm guns. These were the C3 and LG1 (105 mm and 52-calibre M777 were also considered. Three propellants were investigated: the triple base M31, and two composite propellants, JA2 and the developmental propellant LCT. For every gun-propellant-projectile combination, the propelling charge mass and grain geometry (web) were optimized. The web was optimized to match the maximum breech pressure of the gun while the charge mass was optimized according to two different criteria: projectile travel at burn-out and peak muzzle velocity. The results provide a good overview of the performance of conventional artillery systems.

DTIC

*Artillery; Composite Propellants; Interior Ballistics; Projectiles*

**20080025559** Army Tank-Automotive Research and Development Command, Warren, MI USA

**JP8 Reformation for Combat Vehicles**

Aug 7, 2007; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479581; TARDEC-17517; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Objectives: Reduce sulfur content in raw JP8 fuel to less than 1 ppmw; Demonstrate successful system integration by reforming desulfurized product to generate hydrogen at 10 kWe rate. Key technology development: 1. Hydrodesulfurization (HDS) system- reduce sulfur content to < 10 ppmw. 2. Sulfur Polishing- reduce sulfur content to < 1 ppmw. 3. Fuel Reformer-sustained, stable operation using HDS product.

DTIC

*Combat; Desulfurizing; Jet Engine Fuels; Refining*

**20080026086** Dayton Univ., Dayton, OH, USA

**Intelligent Engine Systems: Alternate Fuels Evaluation**

Ballal, Dilip; June 2008; 41 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-01135; WBS 983754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215237; E-16496; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026086>

The performance and gaseous emissions were measured for a well-stirred reactor operating under lean conditions for two fuels: JP8 and a synthetic Fisher-Tropsch fuel over a range of equivalence ratios from 0.6 down to the lean blowout. The lean blowout characteristics were determined in LBO experiments at loading parameter values from 0.7 to 1.4. The lean blowout characteristics were then explored under higher loading conditions by simulating higher altitude operation with the use of nitrogen as a dilution gas for the air stream. The experiments showed that: (1) The lean blowout characteristics for the two fuels were close under both low loading and high loading conditions. (2) The combustion temperatures and observed combustion efficiencies were similar for the two fuels. (3) The gaseous emissions were similar for the two fuels and the differences in the H<sub>2</sub>O and CO<sub>2</sub> emissions appear to be directly relatable to the C/H ratio for the fuels.

Author

*Synthetic Fuels; Gas Turbine Engines; Exhaust Gases; Exhaust Emission; JP-8 Jet Fuel; Fuel Systems*

**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*.

**20080023780** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**IR DirectFET Extreme Environments Evaluation**

Burmeister, Martin; Motiwala, Amin; June 2008; 57 pp.; In English; Original contains color and black and white illustrations  
Contract(s)/Grant(s): NAS703001; WBS 939904.01.11.20; JPL Proj. 1-2107

Report No.(s): JPL Publication 08-23; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023780>

In 2007, International Rectifier (IR) introduced a new version of its DirectFET metal oxide semiconductor field effect transistor (MOSFET) packaging. The new version (referred to as 'Version 2') enhances device moisture resistance, makes surface mount (SMT) assembly of these devices to printed wiring boards (PWBs) more repeatable, and subsequent assembly inspection simpler. In the present study, the National Aeronautics Space Administration (NASA) Jet Propulsion Laboratory (JPL), in collaboration with Stellar Microelectronics (Stellar), continued an evaluation of the DirectFET that they started together in 2006. The present study focused on comparing the two versions of the DirectFET and examining the suitability of the DirectFET devices for space applications. This study evaluated both versions of two DirectFET packaged devices that had both been shown in the 2006 study to have the best electrical and thermal properties: the IRF6635 and IRF6644.

Author

*Metal Oxide Semiconductors; Field Effect Transistors; Moisture Resistance; Rectifiers; Printed Circuits; Microelectronics*

**20080023801** Science Applications International Corp., Cary, NC USA

**Feature-based Detection and Discrimination at DuPont's Lake Success Business Park, Connecticut**

Keiswetter, Dean A; Jan 2007; 57 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA72-02-C-0033; Proj-MM-0210

Report No.(s): AD-A478316; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478316>

The objective of this demonstration was to determine if laser-positioned, high-density EM61 data acquired in a moving survey mode could support feature-based discrimination decisions for a canopied site in Bridgeport Connecticut. Inversion results were benchmarked using cued data acquired in a controlled, gridded approach over 40 targets. The site was seeded with inert UXO, ranging in size from 37mm to 105mm projectiles. We inverted the measured EM61 field data assuming a point dipole source and performed classification using a support vector machine classifier. We compared parameter estimates derived from both data sets and evaluated overall discrimination performances. Results indicated that the laser-positioned EM61 data were not of sufficient quality to discriminate UXO from non-UXO. Of the 58 seeded items that were surveyed, 41 were ranked as high confidence ordnance, 10 were ranked as high confidence clutter, and 7 remained unclassified.

DTIC

*Ammunition; Commerce; Explosives Detection; Lakes; Magnetic Anomalies*

**20080023987** Woods Hole Oceanographic Inst., MA USA

**Tracking the Weathering of an Oil Spill with Comprehensive Two-Dimensional Gas Chromatography**

Nelson, Robert K; Kile, Brian M; Plata, Desiree L; Sylva, Sean P; Xu, Li; Reddy, Christopher M; Gaines, Richard B; Frysinger, Glenn S; Reichenbach, Stephen E; Jan 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-01-0029

Report No.(s): AD-A478677; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Comprehensive two-dimensional gas chromatography (GC x GC) was used to investigate the Bouchard 120 oil spill. The latter occurred on April 25, 2003, when the barge Bouchard 120 spilled <375,000 liters of No. 6 fuel oil into Buzzards Bay, Massachusetts. In order to gain a better understanding of the natural processes affecting the fate of the spilled product, we collected and analyzed oil-covered rocks from Nyes Neck beach in North Falmouth, Massachusetts. Here we discuss the data from samples collected on May 9, 2003, and six months later, on November 23, 2003. Along with standard two-dimensional gas chromatographic analysis, we employed unique data-visualization techniques such as difference, ratio, and addition

chromatograms to highlight how evaporation, water washing, and biodegradation weathered the spilled oil. These approaches provide a new perspective to studying oil spills and aid attempts to remediate them.

DTIC

*Gas Chromatography; Oil Slicks; Weathering*

**20080024184** Condition Monitoring and Diagnostic Engineering Management International, Birmingham, UK  
**International Journal of COMADEM, Volume 10, No. 4**

Rao, Raj B. K. N., Editor; October 2007; ISSN 1363-7681; 56 pp.; In English; See also 20080024185 - 20080024189; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: A Survey of Spark Plug Production Testing Tools and Techniques; Operational Reliability Assessment of Lube Oil Using Graph Theory and Matrix Approach; A Desk-top Tutorial Demonstration of Model-based Fault Detection and Diagnosis; Simulation of Pressure Pulsation In Piping System of a Reciprocating Compressor; Qualitative and Quantitative Monitoring of Amputee Gait Cycle to Aid in Prostheses Fit Assessment.

Derived from text

*Compressors; Fault Detection; Spark Plugs; Reciprocation; Lubricants; Diagnosis; Graph Theory*

**20080024185** Brighton Univ., Brighton, UK

**A Survey of Spark Plug Production Testing Tools and Techniques**

Walters, S. D.; Howson, P. A.; Howlett, R. J.; International Journal of COMADEM, Volume 10, No. 4; October 2007, pp. 1-12; In English; See also [20080024184](#); Copyright; Avail.: Other Sources

Despite 150 years' spark plug design and production testing methods have remained largely unchanged since their invention. spark plug production is a complex process and there are many opportunities for faults to be manifested. During most of the history of spark plugs, an ingenious yet relatively simple 'go/no go' batch test has been the test of choice, as it is rapid and well-proven for a variety of the most common faults. However, in recent years, some major disadvantages with this test have come to light. This paper describes the existing state of the art of spark plug testing tools and techniques, discovered during a comprehensive literature review. The predominant production spark plug testing system is evaluated, with a view to devising a more advanced method of spark plug testing. The work concludes that there is a need for a new production spark plug test, ideally offering: further increased reliability of fault detection, capacity for diagnosis of faults, high speed, and easier compliance with Health and Safety legislation.

Author

*Production Engineering; Spark Plugs; Surveys; Mechanical Engineering*

**20080024186** Bournemouth Univ., Bournemouth, Dorset, UK

**Qualitative and Quantitative Monitoring of Amputee Gait Cycle to Aid in Prostheses Fit Assessment**

Sewell, Philip; Vinney, John; Noroozi, Siamak; Amali, Ramin; Andrews, Stephen; International Journal of COMADEM, Volume 10, No. 4; October 2007, pp. 39-47; In English; See also [20080024184](#); Copyright; Avail.: Other Sources

An investigation has been carried out by the authors to assess two novel techniques in the field of prosthetics (photoelasticity and electrical resistance strain gauges) for use as alternative tools for the qualitative and quantitative monitoring of the amputee gait cycle together with the distribution of pressures at the residual limb/socket interface to aid in the assessment of prostheses fit. This paper presents qualitative and quantitative data gathered during several prosthesis fitting sessions for a male trans-tibial amputee. The results have shown that the photoelastic technique can accurately and reliably visualize, simulate, identify, and map interface interactions between the residual limb and the socket and the transducer can be used to monitor the gait cycle repeatability/efficiency for the subject used on this trial. Further development of the techniques is expected to provide a new tool that has the potential to advance knowledge in the area of limb/socket biomechanics. The tool will also lead to the identification of the dynamic visual and numerical relationship between socket fit and gait cycle quality/efficiency. This will provide the prosthetist with qualitative and quantitative tools for immediate assessment of socket fit and gait analysis at the fitting stage without the need for a gait analysis laboratory.

Author

*Biodynamics; Gait; Prosthetic Devices; Joints (Junctions); Limbs (Anatomy); Joints (Anatomy)*

**20080024187** Devi Ahilya Univ., India

**Simulation of Pressure Pulsation In Piping System of a Reciprocating Compressor**

Tiwari, Ashesh; Manepatil, Smita S.; International Journal of COMADEM, Volume 10, No. 4; October 2007, pp. 32-38; In English; See also [20080024184](#); Copyright; Avail.: Other Sources

Pressure pulsations and mechanical vibrations in pipe systems may cause excessive noise and may even lead to damage

of piping or machinery. They may also cause a number of problems, such as severe vibration, fatigue failures, reduction in efficiency, hammering of valves and error in flow measurement. The excitation mechanism can be hydraulic or mechanical. In fluid filled pipe systems pulsations and vibrations are strongly coupled. In the present study a model has been developed for the analysis of pulsations in the piping system of a reciprocating piping system. The model consist of the fundamental equation of thermodynamics, heat transfer, valve motion, mass flow and kinematics equation. Transfer equation approach has been suggested for solving the equation for finding pressure pulsations. The model will help us in predicting the pressure pulsations of any reciprocating compressor.

Author

*Compressors; Pipes (Tubes); Reciprocation; Simulation; Mechanical Engineering; Unsteady Flow*

**20080024188** Huddersfield Univ., Huddersfield, UK

**A Desk-top Tutorial Demonstration of Model-based Fault Detection and Diagnosis**

Shi, John Z.; Elshanti, Ali Hassan; Gu, Fengshou; Ball, Andrew; International Journal of COMADEM, Volume 10, No. 4; October 2007, pp. 23-31; In English; See also [20080024184](#); Copyright; Avail.: Other Sources

In this paper, a demonstration on the model-based approach for fault detection has been presented. The aim of this demo is to provide students a desk-top tool to start learning model-based approach. The demo works on a traditional three-tank system. After a short review of the model-based approach, this paper emphasizes on two difficulties often asked by students when they start learning model-based approach: how to develop a system model and how to generate residual for fault detection. The demo represents the three-tank system in the Simulink environment so that no hardware is really needed. Faults such as tank leakages, connecting pipe blockage and sensor failure are also simulated in the virtual way by means of different switches. Different residual generation approaches are implemented using this desk-top demonstration. Consequently, students will gain an objective view and practical understanding of the model-based approach works and its procedure in industrial implementation.

Author

*Fault Detection; Mathematical Models; Tanks (Containers); Computer Programs*

**20080024189** Govind Ballabh Pant Engineering Coll., Uttaranchal, India

**Operational Reliability Assessment of Lube Oil Using Graph Theory and Matrix Approach**

Sharma, B. C.; Gandhi, O. P.; International Journal of COMADEM, Volume 10, No. 4; October 2007, pp. 13-22; In English; See also [20080024184](#); Copyright; Avail.: Other Sources

This paper deals with reliability assessment of lube oil during its operation to guide plant personnel in taking planned and timely maintenance action using 'Graph Theory and Matrix Approach'. Oil reliability attributes pertaining to the reliability assessment of lube oil during operation are identified. Identification of lube oil attributes is based on operational/functional requirements of the oil for a given application. The reliability attributes at a given operation time are modeled in terms of a digraph called 'oil reliability digraph', in which the nodes represents the oil reliability attributes and the edges in the digraph represent interrelationship among the reliability attributes. For evaluation of lube oil reliability, equivalent matrices of the digraph are defined. An expression characteristic of the lube oil reliability is obtained from permanent of the matrix. The oil reliability index is obtained by substituting the numerical values of oil reliability attributes obtained from the experimental/field results and their interrelationship as degree of reliability. Operational reliability of oil at any instant of time is evaluated by comparing the 'oil reliability index' at any instant of time with the fresh oil. An example of engine oil is illustrated to demonstrate the approach.

Author

*Graph Theory; Reliability; Mathematical Models; Matrix Methods; Lubricating Oils*

**20080024209** Condition Monitoring and Diagnostic Engineering Management International, Birmingham, UK

**International Journal of COMADEM, Volume 11, No. 1**

Rao, Raj B. K. N., Editor; January 2008; ISSN 1363-7681; 52 pp.; In English; See also 20080024210 - 20080024214; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Modeling of the Viscoelastic Properties of PVDF through the Fractional Differential Model; Structural Health Monitoring of Ribbon Reinforced Composite Laminate using Piezoelectric Sensing Layer; Development of Micromachined Silicon Accelerometers with Improved Off-Axis Sensitivity; Remote Structural Health Monitoring of Civil



Infrastructures - Recent Trends; A Process Approach to Maintenance Related Hazard Identification.

Derived from text

*Accelerometers; Viscoelasticity; Piezoelectricity; Detection; Laminates; Micromachining*

**20080024210** Driftsakerhet i Lulea AB, Lulea, Sweden

**A Process Approach to Maintenance-Related Hazard Identification**

Holmgren, Mattias; Soderholm, Peter; International Journal of COMADEM, Volume 11, No. 1; January 2008, pp. 36-46; In English; See also [20080024209](#); Copyright; Avail.: Other Sources

History has shown that maintenance contributes to incidents and accidents with extensive losses. The purpose of this paper is to describe a process approach for maintenance-related hazard identification in order to support continuous risk reduction in maintenance activities. The proposed maintenance process model has been applied within a study of maintenance execution of DC-motors in paper-mills. However, both the model and the findings from its application are believed to be transferable to the maintenance of other critical technical systems. A recurring hazard is insufficient feedback. Hence, proper feedback may help to reduce risk. Further findings indicate that incidents manifested during execution may be due to hazards in other process phases. The maintenance of complex and critical systems is also affected by the work environment and knowledge of technicians, whose requirements should be fulfilled through appropriate organizational and technical support.

Author

*Preventive Maintenance; Hazards; Risk Management; Industrial Safety*

**20080024263** Army War Coll., Carlisle Barracks, PA USA

**Effects Based Operations in Iraq - A Case for Army Acceptance**

Pasquarette, Jim; Mar 3, 2008; 37 pp.; In English

Report No.(s): AD-A478414; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478414>

The application of effects base operations (EBO) concepts have become the norm in Iraq. In command posts from Multi-National Force - Iraq through battalion level, commanders have taken a systems analysis approach to the problems they face. They are striving to attain desired effects that have attached measures of effectiveness and indicators. Joint Doctrine has recently adopted these concepts while current and emerging U.S. Army doctrine continues to reject the applicability of EBO concepts at the operational and tactical levels. This paper reviews the development of effects based concepts and doctrine, outlines the theoretical foundations of U.S. Army doctrine, establishes the unique challenges of counterinsurgency, assesses units' application of effects based operations in Iraq, and provides observations and recommendations with regard to the U.S. Army and effects based operations. The purpose of this paper is to (1) determine if units in Iraq are applying EBO concepts in consonance with joint doctrine and (2) consider the direction of U.S. Army doctrine reference EBO.

DTIC

*Iraq; Systems Analysis; Military Operations*

**20080024680** National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

**An Empirical Approach to Determine Peak Air Pressure within the 2-Pipe Vertical Drainage Stack**

Cheng, Cheng-Li; Yen, Chia-Ju; Lu, Wen-Hung; He, Juen-Chi; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 199-213; In English; See also [20080024669](#); Copyright; Avail.: Other Sources

Following the massive outbreak of SARS (Severe Acute Respiratory Syndrome) in early 2003, the drainage systems in high-rise residential buildings have become a major concern. Inappropriate drainage system design may cause pressure fluctuations and depletion of the water trap seal. In Taiwan, most vertical drainage stack pipes serving medium-height apartment blocks are designed as 2 or more vertical pipe systems. A prediction method to determine the air pressure distribution within the single-stack vertical drainage system with a single discharge has already been established. This paper expands this prediction method to allow the air pressure distribution of the 2-pipe vertical drainage and \*vent system, which is widely used in Taiwan, to be predicted. Comparisons between the measured data and calculated values reveal that the prediction method can reproduce the negative and positive peak air pressure values within the 2-pipe vertical drainage stack given single point discharge and steady flow conditions. A prediction model based on empirical parameters offers a reference for drainage system designers designing and maintaining water trap functions in buildings. This prediction method can be easily applied to drainage system design.

Author

*Pipes (Tubes); Buildings; Atmospheric Pressure; Gas Pressure; Prediction Analysis Techniques; Pressure Oscillations; Systems Engineering; Drainage; Pressure Distribution*

**20080025055** Condition Monitoring and Diagnostic Engineering Management International, Birmingham, UK  
**International Journal of COMADEM, Volume 10, No. 3**

Rao, Raj B. K. N., Editor; July 2007; ISSN 1363-7681; 60 pp.; In English; See also 20080025056 - 20080025060; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Rotor Dynamics without Equations; An Experimental Investigation to Analyze the Effect of Unbalance in a Horizontal Rotor; System Using Coast-Down Factor; Noninvasive Rotor Case Fault Diagnostics in Three-Phase Induction Motors Using the Alpha, Beta Instantaneous Active Power Approach; Diagnosis of Localized Defects in Tapered Roller Bearings. Part I - Time Domain Analysis; Diagnosis of Localized Defects in Tapered Roller Bearings. Part II - Frequency Domain Analysis.

Derived from text

*Diagnosis; Time Domain Analysis; Frequency Domain Analysis; Induction Motors; Roller Bearings; Rotor Dynamics*

**20080025060** Coimbra Univ., Coimbra, Portugal

**Noninvasive Rotor Case Fault Diagnostics in Three-Phase Induction Motors Using the Alpha, Beta Instantaneous Active Power Approach**

Drif, M'hamed; Cordoso, A. J. Marques; International Journal of COMADEM, Volume 10, No. 3; July 2007, pp. 19-28; In English; See also [20080025055](#); Original contains black and white illustrations

Contract(s)/Grant(s): SFRH/BD/7592/2004; Copyright; Avail.: Other Sources

Detection of broken rotor bars has been an important but difficult job in the detection area of induction motor faults. The characteristic frequency component of a faulty rotor in the stator current spectrum is very close to the power frequency component but by far less in amplitude, which brings about great difficulty for accurate detection. In this paper a new detection technique based on the alpha, beta instantaneous active power signature analysis is proposed for the diagnosis of rotor cage faults in operating squirrel cage three-phase induction motors (IMs). Experimental results are presented to show the merits of this novel approach.

Author

*Induction Motors; Fault Detection; Rotors; Mechanical Engineering*

**20080025102** Impact Technologies, Inc., State College, PA USA

**Very High Frequency Monitoring System for Engine Gearbox and Generator Health Management (Postprint)**

Watson, Matthew J; Byington, Carl S; Behbahani, Alireza; Sep 18, 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-06-M-2649; Proj-3005

Report No.(s): AD-A478622; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In cooperation with the major propulsion engine manufacturers, the authors are developing and demonstrating a unique very high frequency (VHF) vibration monitoring system that integrates various vibro-acoustic data with intelligent feature extraction and fault isolation algorithms to effectively assess engine gearbox and generator health. The system is capable of reporting on the early detection and progression of faults by utilizing piezoelectric, optical, and acoustic frequency measurements for improved, incipient anomaly detection. These gas turbine engine vibration monitoring technologies will address existing operation and maintenance goals for current military system and prognostics health management algorithms for advanced engines. These system features will be integrated in a state-of-the-art vibration monitoring system that will not only identify faults more confidently and at an earlier stage, but also enable the prediction of the time-to-failure or a degraded condition worthy of maintenance action.

DTIC

*Fault Detection; Health; High Frequencies; Maintenance; Transmissions (Machine Elements); Vibration*

**20080025121** Purdue Univ., West Lafayette, IN USA

**Measurements of NO and OH Concentrations in Vitiated Air Using Diode Laser-Based Ultraviolet Absorption Sensors (Postprint)**

Anderson, Thomas N; Lucht, Robert P; Meyer, Terrence R; Mathur, Tarun; Grinstead, Jr, Keith D; Gord, James R; Gruber, Mark; Carter, Campbell D; Dec 2006; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A478683; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Diode-laser-based sensors were implemented to measure the concentrations of nitric oxide (NO) and hydroxyl (OH)

radicals in the vitiated inlet airflow of a model scramjet combustor. The sensors utilized sum-frequency-mixed sources consisting of a fixed frequency 532-nm laser and a tunable diode laser to generate ultraviolet radiation for absorption spectroscopy with electronic transitions of OH and NO. Sensitive, interference-free, absolute measurements were possible, enabling the first measurements of both species in a model scramjet combustor using diode-laser-based sensors. With wavelength-modulation spectroscopy, no absorption by OH was evident in the vitiated airflow, verifying that the OH concentration was below the 0.2-ppm detection limit of the sensor.

DTIC

*Diodes; Hydroxyl Radicals; Lasers; Nitric Oxide; Supersonic Combustion; Ultraviolet Absorption*

**20080025282** Naval Observatory, Flagstaff, AZ USA

**A Comparison of SDSS Standard Star Catalog for Stripe 82 With Stetson's Photometric Standards**

Ivezic, Z; Smith, J A; Miknaitis, G; Lin, H; Tucker, D L; Lupton, R; Knapp, G R; Gunn, J E; Strauss, M; Holtzman, J; Jan 2007; 12 pp.; In English

Report No.(s): AD-A478874; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478874>

We compare Stetson's photometric standards with measurements listed in a standard star catalog constructed using repeated SDSS imaging observations. The SDSS catalog includes over 700,000 candidate standard stars from the equatorial stripe 82 ( $|\text{DEC}| < 1.266$ ) in the RA range 20h 34m to 4h 00m, and with the r band magnitudes in the range 14{21. The distributions of measurements for individual sources demonstrate that the SDSS photometric pipeline correctly estimates random photometric errors, which are below 0: 01 for stars brighter than (19.5, 20.5, 20.5, 20, 18.5) in ugriz, respectively (about twice as good as for individual SDSS runs). We derive mean photometric transformations between the SDSS gri and the BV RI system using 1165 Stetson stars found in the equatorial stripe 82, and then study the spatial variation of the difference in zeropoints between the two catalogs. Using third-order polynomials to describe the color terms, we find that photometric measurements for main sequence stars can be transformed between the two systems with systematic errors smaller than a few millimagnitudes. The spatial variation of photometric zeropoints in the two catalogs typically does not exceed 0: 01. Consequently, the SDSS Standard Star Catalog for Stripe 82 can be used to calibrate new data in both the SDSS ugriz and the BV RI systems with a similar accuracy.

DTIC

*Astronomical Catalogs; Photometry; Polarimetry*

**20080025453** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Electronic Oil Level Detection and Replacement System**

Chopra, Kewal K, Inventor; Dec 5, 2006; 5 pp.; In English

Report No.(s): AD-D020345; PATENT-7 143 867 B2; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020345>

An oil level monitoring and replenishment system for use with an internal combustion engine having an oil sump. The system as a sensor which continuously measures the sump level in the reservoir for holding a quantity of oil to be used in replenishment of the sump. A sensor monitors the oil level in the sump and causes replenishment from the reservoir when needed. The reservoir has warning circuit interactive with a reservoir sensor to signal from the reservoir has reached a lower level of oil and requires the filling. The sensor also provides means to signal when the reservoir has been filled to the desired level to prevent overfilling.

DTIC

*Detection; Electron Energy; Energy Levels; Liquid Levels; Measuring Instruments; Oils; Patents; Replacing*

**20080025491** Defence Research and Development Canada, Valcartier, Quebec Canada

**Joint Biological Standoff Detection System increment II: Field Demonstration - SINBAHD Performances**

Buteau, Sylvie; Simard, Jean-Robert; Lahaie, Pierre; Roy, Gilles; Mathieu, Pierre; McFee, John; Ho, Jim; Dec 2007; 106 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479297; DRDC-V-TM-2006-140; No Copyright; Avail.: Defense Technical Information Center (DTIC)

By the end of the 90s, Defence Research and Development Canada (DRDC) initiated the investigation of a novel LIDAR concept which open the possibility of collecting all at once the detailed spectral information contained in the return signals. This 3-year project called SINBAHD (Stand-off INtegrated Bioaerosol Active Hyperspectral Detection) aimed at evaluating the capability of using UV LIF with intensified range-gated spectrometry to detect and characterize bioaerosol from stand-off

position. Essentially, the LIDAR system monitors atmospheric volumes in which specific spectrally wide fluorescence signal can be generated from inelastic interactions with complex molecules forming the building blocks of most bioaerosols. This LIF signal is collected by the combination of a dispersive element and a range-gated ICCD that limits the spectral information within the selected volume. This technique has showed an important potential of detecting and discriminating different bioaerosol agent simulants in real time. Through the Standoff Biodefense Working Group (SBWG) under the CANUKUS CBR MOU, SINBAHD was invited to participate in the Joint Biological Standoff Detection System (JBSDS) increment II field demonstration trial. The purpose of this international trial, which took place at Dugway Proving Ground (DPG), Utah in June 2005, was to determine the benchmark sensitivity of different technologies to various biological simulants and interferents. SINBAHD demonstrated its high level of performance and the results made it possible to obtain new spectral signatures.

DTIC

*Aerosols; Biological Effects; Detection*

**20080025513** Defence Research and Development Canada, Valcartier, Quebec Canada

**FIRST trial: Lemay park collection plan**

Turcotte, Caroline S; Puckrin, E; Levesque, J; Dec 2007; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479358; DRDC-V-TN-2007-435; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The company Telops has performed studies that indicate their FIRST system is capable of providing long-wave infrared (LWIR) airborne hyperspectral images. Defence R&D Canada Valcartier (DRDC Valcartier), being interested in evaluating a possible Canadian high performance airborne hyperspectral imager, has started a collaborative effort with Telops with the goal to perform two field trials with the FIRST hyperspectral imaging system in airborne mode in order to determine its current capability as an airborne hyperspectral imager. The plan for the first trial is presented in this technical note. The trial will take place at Valcartier between December 3rd and 14th, 2007. During this trial, Telops FIRST hyperspectral long-wave infrared imager will be operated on an aircraft in a push-broom configuration to obtain hyperspectral imagery of the DRDC Valcartier Lemay park and a variety of installed targets. The ground experiments and ground truth are organized by DRDC Valcartier. Telops has the responsibility for the airborne instrumentation and the platform. During this trial, DRDC Valcartier will setup four small experiments: a gas plume detection experiment, a plastic plume experiment, a powdered chemical sensing experiment and an unexploded ordnance detection experiment. The main objective of this trial is to investigate the possibilities of detection and identification by the FIRST hyperspectral imager.

DTIC

*Collection; Imagery; Procedures*

**20080025552** Kansas Univ., Lawrence, KS USA

**Hydraulic Tomography and High-Resolution Slug Testing to Determine Hydraulic Conductivity Distributions - Year 1**

Engard, Brett R; McElwee, Carl D; Healey, John; Devlin, Rick; Dec 2005; 82 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ER1367

Report No.(s): AD-A479546; KGS-2005-36; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A considerable body of research has shown that the major control on the transport and fate of a pollutant as it moves through an aquifer is the spatial distribution of hydraulic conductivity. A number of theories have been developed to quantify, in a generic sense, the influence of the subsurface variations in hydraulic conductivity. It is becoming increasingly apparent, however, that site specific features of the hydraulic conductivity distribution (such as high conductivity zones) need to be quantified in order to reliably predict contaminant movement. Since spatial changes in hydraulic conductivity are a major factor governing the transport and fate of a pollutant as it moves through an aquifer, we have focused on the development of new innovative methods to delineate these spatial changes. The objective of the research proposed here is to build on our previous research to develop and improve field techniques for better definition of the three-dimensional spatial distribution of hydraulic conductivity by using hydraulic tomography coupled with high resolution slug testing. The research proposed here is directed at developing techniques with the ability to map 3-D hydraulic conductivity distributions.

DTIC

*Aquifers; High Resolution; Mapping; Tomography*

**20080025806** Seagull Technologies Center, Los Gatos, CA, USA

**Prototype HSR Accurate Low-Cost GPS Locomotive Location System IDEA Program Final Report**

Mueller, K. T.; Sep. 2003; 44 pp.; In English

Report No.(s): PB2007-109639; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This was a project to develop a high-speed rail train navigation system to accurately determine train location, including determining on which of two or more parallel tracks a locomotive is located. The system includes a three-receiver, three-antenna GPS heading reference system and parallel-track resolution software. The system also includes a heading rate sensor and a Doppler radar system to determine position, velocity, and heading when GPS satellite coverage is interrupted. Tasks included development of prototype hardware and software specifications and design to interface the GPS system, a radar speed sensor, and a track database. The software for sensor calibration and parallel track resolution, developed in a previous HSR-IDEA project, was refined and a prototype fabricated and lab tested. The system was installed on a UP GE C44 AC locomotive and tests run to determine if RF interference from AC traction would affect the performance of the GPS receiver. Tests included accelerations up to 70 mph, dynamic braking, and under full load conditions. Seagull Technology has identified software and hardware improvements that should enable the system to meet all performance requirements.

NTIS

*Global Positioning System; High Speed; Locomotives; Low Cost; Navigation; Position (Location); Positioning; Prototypes; Rail Transportation; Rails*

**20080025807** Illinois Univ., Urbana-Champaign, IL, USA

**High-Precision GPS for Continuous Monitoring of Rail**

Munson, D. C.; Feb. 2004; 40 pp.; In English

Report No.(s): PB2007-109642; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Estimation of rail position and geometry using high-precision differential global positioning system (GPS) can be used to monitor the movement of rail. Because rail naturally expands and contracts during temperature changes, lack of movement during severe temperature change would indicate significant rail stress. Point-specific monitoring can detect slippage of rail down a mountainside or other longitudinal rail movement. High-accuracy measurements might be useful for a variety of future rail applications, including identifying buckle precursors and predicting rail failure. Measurements collected from a moving platform would be most practical for mapping long sections of rail. In this study we compared raw and post-processed GPS trajectory measurements, collected from a high-railer, to stationary benchmark points. This report presents a buckle detection model that takes as input a rail trajectory corrupted by measurement noise and computes the probability that a low amplitude sinusoidal mode can be identified in the measurement data.

NTIS

*Buckling; Global Positioning System; Positioning; Rail Transportation; Rails*

## 32

### COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 *Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see 03 *Air Transportation and Safety*; and 16 *Space Transportation and Safety*.

**20080023724** Rule of Law Foundation, Unknown

**Building the Rule of Law Information Network Infrastructure in Moldova: Content Development**

Jan. 30, 2002; 17 pp.; In English

Contract(s)/Grant(s): NCJRS-99-IJ-CX-0065

Report No.(s): PB2007-113136; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Through this project Internet studios were installed at ten organizations connected with criminal justice in Moldova selected for funding, with five computer workstations each, an NT server, network equipment, a printer, high-speed dedicated access to the Internet, technical support, and training. In addition, a 12-workstation Interagency Internet Training Center intended for training representatives from the participating agencies on the use of the Internet also was created. These studios formed the basis for the content development activities covered in this project. These activities included developing Web sites describing the host institutions structures, missions, policies, functional activities, and public outreach; creating collections of legal materials, official government documents, statistics and other non-classified information and making them available for

public access through the Internet; and providing training on general Internet use and publishing.  
NTIS

*Computer Networks; Information; Internets; Moldova*

**20080023736** Pacific Northwest National Lab., Richland, WA, USA

**Visual Analysis of Weblog Content**

Gregory, M. L.; Payne, D.; McColgin, D.; Cramer, N.; Love, D.; January 2007; 4 pp.; In English  
Report No.(s): DE2007-909479; No Copyright; Avail.: National Technical Information Service (NTIS)

In recent years, one of the advances of the World Wide Web is social media and one of the fastest growing aspects of social media is the blogosphere. Blogs make content creation easy and are highly accessible through web pages and syndication. With their growing influence, a need has arisen to be able to monitor the opinions and insight revealed within their content. In this paper we describe a technical approach for analyzing the content of blog data using a visual analytic tool, IN-SPIRE, developed by Pacific Northwest National Laboratory. We highlight the capabilities of this tool that are particularly useful for information gathering from blog data.

NTIS

*World Wide Web; Information Retrieval; Computer Networks*

**20080023792** NASA Langley Research Center, Hampton, VA, USA

**Progress of 2-micron Detectors for Application to Lidar Remote Sensing**

Abedin, M. N.; Refaat, Tamer F.; Ismail, Syed; Koch, Grady; Singh, Upendra N.; June 24, 2008; 6 pp.; In English; Earth Science Technology Office Conference, 24-26 Jun. 2008, Adelphi, MD, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.14; Copyright; Avail.: CASI: [A02](#), Hardcopy

AlGaAsSb/InGaAsSb heterojunction phototransistors were developed at Astropower, Inc under Laser Risk Reduction Program (LRRP) for operation in the 2-micron region. These phototransistors were optimized for 2-micron detection and have high quantum efficiency (>60%), high gain (>10(exp 3)) and low noise-equivalent- power (<5x10(exp -14) W/Hz), while operating at low bias voltage. One of these phototransistors was tested in lidar mode using the 2-micron CO2 Differential Absorption Lidar (DIAL) system currently under development under the Instrument Incubator Program (IIP) at NASA Langley. Lidar measurements included detecting atmospheric structures consisting of thin clouds in the mid-altitude and near-field boundary layer. These test results are very promising for the application of phototransistors for the two-micron lidar remote sensing. In addition, HgCdTe avalanche photodiodes (APD) acquired from Raytheon were used in atmospheric testing at 2-microns. A discussion of these measurements is also presented in this paper.

Author

*Optical Radar; Differential Absorption Lidar; Boundary Layers; Remote Sensing; Radar Measurement; Infrared Radar; Heterojunctions*

**20080023822** Army Research Lab., Aberdeen Proving Ground, MD USA

**Comparison of Acoustic Properties of Two USMC Helmets**

Henry, Paula; Faughn, Jim A; Mermagen, Timothy J; Feb 2008; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-622716.AH70

Report No.(s): AD-A478385; ARL-TR-4383; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478385>

The USA Marine Corps (USMC) has recently replaced an older Combat Vehicle Crewman (CVC) communications headset (the MK1697/G) with a newer version (Enhanced CVC headset [ECVCH]) manufactured by the same company (Sonetronics). A communications headset consists of two earphones and a microphone with the capability to receive and transmit communications across a radio or intercom. The ECVCH headset provides improvements in situational awareness through the addition of a talk-through microphone, in hearing protection through thicker ear pads, and in greater field ruggedness. A set of evaluations was conducted to determine if the ECVCH showed improvements in attenuation and speech intelligibility over the MK1697/G headset. There was no improvement in sound attenuation with the ECVCH. The ECVCH showed a decrement in speech intelligibility, although this decrement was not large enough to impact operational performance. The difference in performance can be explained by the differences in frequency responses between the two headsets.

DTIC

*Acoustic Attenuation; Acoustic Properties; Combat; Communication Equipment; Crews; Ear Protectors; Earphones; Helmets; Intelligibility*

**20080023837** Army Research Lab., Aberdeen Proving Ground, MD USA

**The Case for Using the Spherical Model to Calculate the Interpolated Points in the Connectivity Software Deployment Module**

Still, G W; Nealon, James F; Feb 2008; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478462; ARL-TR-4373; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478462>

A new software package undergoing development through joint efforts by the Missile Defense Branch at Aberdeen Proving Ground, Maryland, and the Communications Electronic Warfare Branch at Fort Monmouth, New Jersey, of the U.S. Army Research Laboratory's (ARL) Survivability/Lethality Analysis Directorate models and predicts the viability of communications links between moving nodes. Interpolation calculations will be needed to predict the location of the moving nodes between user-provided way points. The developers must decide which model of the earth to use as the basis of the calculations. Thus, a comparison was made between the National Geodetic Survey-provided computer programs Forward an Inverse based on the WGS84 Oblate Spheroid (OS) model, and a newly constructed program based on a Perfect Sphere (PS). The basis of the comparison was computational accuracy and speed. For a way point separation of 100 km or less, the maximum PS and WGS84 OS discrepancy was 1 meter -- accurate enough for link budget applications. When Forward and Inverse were kept intact and ran from a batch file, it took 30 times longer to do the same calculations as the PS model. When Forward and Inverse were modified to compute efficiently, it took 1.5 times longer. To modify the OS codes took 2.5 times as long as it did to write the PS code. Based on these results, it is recommended that the PS model for the earth be used.

DTIC

*Computer Programs; Deployment; Interpolation*

**20080023850** NASA Langley Research Center, Hampton, VA, USA

**Revised Calibration Strategy for the CALIOP 532 nm Channel, Part II, Daytime**

Powell, Kathleen A.; Vaughan, Mark A.; Kuehn, Ralph; Hunt, William H.; Pee, Kam-Pui; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, CO, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 653967.04.13.01; Copyright; Avail.: CASI: [A01](#), Hardcopy

The CALIPSO lidar (CALIOP) makes backscatter measurements at 532 nm and 1064 nm and linear depolarization ratios at 532 nm. Accurate calibration of the backscatter measurements is essential in the retrieval of optical properties. An assessment of the nighttime 532 nm parallel channel calibration showed that the calibration strategy used for the initial release (Release 1) of the CALIOP lidar level 1B data was acceptable. In general, the nighttime calibration coefficients are relatively constant over the darkest segment of the orbit, but then change rapidly over a short period as the satellite enters sunlight. The daytime 532 nm parallel channel calibration scheme implemented in Release 1 derived the daytime calibration coefficients from the previous nighttime coefficients. A subsequent review of the daytime 532 nm parallel channel calibration revealed that the daytime calibration coefficients do not remain constant, but vary considerably over the course of the orbit, due to thermally-induced misalignment of the transmitter and receiver. A correction to the daytime calibration scheme is applied in Release 2 of the data. Results of both nighttime and daytime calibration performance are presented in this paper.

Author

*Optical Radar; Backscattering; Calibrating; Temperature Effects; Optical Properties; Coefficients*

**20080023929** Army War Coll., Carlisle Barracks, PA USA

**Improving the USA' Strategic Communication Strategy**

Risberg, Robert H; Mar 3, 2008; 39 pp.; In English

Report No.(s): AD-A478580; No Copyright; Avail.: Defense Technical Information Center (DTIC)

America's image in the world is faltering. Why is this the case and how can the USA regain its once held position of popularity among the peoples of the world? Much of the answer to this question is the failure of the USA Government to effectively use strategic communication to inform and influence populations to recognize the value of American efforts around the world, to understand and support American foreign policy objectives in the War on Terror, and in the broader development of the global society in this young century. Today, America leads the fight against rogue states, international terrorists, and religious extremists who willingly slaughter innocent civilians in pursuit of political and cultural agendas. Unfortunately much of the world resents and fears the USA because they do not understand American objectives and receive a distorted and negative view of American actions through propaganda, manipulated news, and America's own tunnel-visioned overreliance on the military aspect of national power. This paper will review the current USA Government strategy for using strategic

communication, will discuss the weaknesses and shortfalls of that strategy, and will recommend specific actions to strengthen the strategy and improve its effectiveness

DTIC

*Foreign Policy; Management Planning; United States*

**20080023957** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Composable Distributed Access Control and Integrity Policies for Query-Based Wireless Sensor Networks**

Marsh, David W; Mar 2008; 113 pp.; In English

Report No.(s): AD-A478636; AFIT/DEE/ENG/08-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An expected requirement of wireless sensor networks (WSN) is the support of a vast number of users while permitting limited access privileges. While WSN nodes have severe resource constraints, WSNs will need to restrict access to data, enforcing security policies to protect data within WSNs. To date, WSN security has largely been based on encryption and authentication schemes. WSN Authorization Specification Language (WASL) is specified and implemented using tools coded in Java™. WASL is a mechanism{independent policy language that can specify arbitrary, composable security policies. The construction, hybridization, and composition of well{known security models is demonstrated and shown to preserve security while providing for modifi- cations to permit inter{network accesses with no more impact on the WSN nodes than any other policy update. Using WASL and a na ve data compression scheme, a multi{level security policy for a 1000{node network requires 66 bytes of memory per node. This can reasonably be distributed throughout a WSN. The compilation of a a variety of policy compositions are shown to be feasible using a notebook{class computer like that expected to be performing typical WSN management responsibilities.

DTIC

*Access Control; Active Control; Communication Networks; Distributed Parameter Systems; Policies; Radiotelephones*

**20080024013** NASA Langley Research Center, Hampton, VA, USA

**Progress on the Use of Combined Analog and Photon Counting Detection for Raman Lidar**

Newsom, Rob; Turner, Dave; Clayton, Marian; Ferrare, Richard; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, Co, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 281945.02.20.01.22; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Atmospheric Radiation Measurement (ARM) program Raman Lidar (CARL) was upgraded in 2004 with a new data system that provides simultaneous measurements of both the photomultiplier analog output voltage and photon counts. The so-called merge value added procedure (VAP) was developed to combine the analog and count-rate signals into a single signal with improved dynamic range. Earlier versions of this VAP tended to cause unacceptably large biases in the water vapor mixing ratio during the daytime as a result of improper matching between the analog and count-rate signals in the presence of elevated solar background levels. We recently identified several problems and tested a modified version of the merge VAP by comparing profiles of water vapor mixing ratio derived from CARL with simultaneous sonde data over a six month period. We show that the modified merge VAP significantly reduces the daytime bias, and results in mean differences that are within approximately 1% for both nighttime and daytime measurements.

Author

*Atmospheric Radiation; Radar Measurement; Water Vapor; Optical Radar; Mixing Ratios; Analog Data; Dynamic Range*

**20080024052** Air Force Flight Test Center, Edwards AFB, CA USA

**Arc Segment Attitude Reference (ASAR) Head-Up Display (HUD) Symbology as a Primary Flight Reference Test and Evaluation**

Jenkins, Joseph C; Jan 2008; 70 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478772; AFFTC-TR-06-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This technical report presents the results of the arc segment attitude reference (ASAR) head-up display (HUD) symbology as a primary flight reference test and evaluation. Testing was requested by the Air Force Research Laboratory, Human Effectiveness Directorate, Wright-Patterson AFB, Ohio. The responsible test organization was the 412th Test Wing, Edwards AFB, California. The test execution organization was the ASAR HUD test team from the USAF Test Pilot School located at Edwards AFB. Testing was performed on the USAF NF-16D Variable-Stability In-Flight Simulator Test Aircraft serial number 86-0048, from 7 to 23 July 2004 and was comprised of 5 ground simulation familiarization and test sessions totaling 12.0 ground test hours, 2 calibration flights and 15 test sorties totaling 23.8 flight test hours. The overall test objective was to determine if the use of the ASAR in the MIL-STD- 1787C HUD symbology as the principal attitude reference, in place of



the climb-dive ladder, improved pilot performance during unusual attitude recoveries, vertical banked S-turn (S-B) and vertical dive S-turn (S-D) maneuvers, and precision ILS approaches. The vertical S-B maneuver was a continuous series of rate climbs and descents flown on an initial constant heading. The vertical S-D maneuver was similar except that the direction of turn was reversed simultaneously with each change of vertical direction. The overall test objective was met.

DTIC

*Attitude Indicators; Display Devices; Evaluation; Flight Tests; Head-Up Displays; System Effectiveness*

**20080024054** Budapest Univ. of Technology and Economics, Budapest, Hungary

**Efficient Information Dissemination in Wireless Sensor Networks using Mobile Sinks**

Vincze, Zoltan; Vidacs, Attila; Vida, Rolland; Oct 1, 2006; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478774; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Communication Networks; Information Dissemination; Sinks; Telecommunication; Wireless Communication*

**20080024056** Military Univ. of Technology, Warsaw, Poland

**Provision of QoS for Multimedia Services in IEEE 802.11 Wireless Network**

Lubkowski, Piotr; Krygier, Jaroslaw; Amanowicz, Marek; Oct 1, 2006; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478776; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Communication Networks; Multimedia; Telecommunication*

**20080024057** Budapest Univ. of Technology and Economics, Budapest, Hungary

**Universal Software Defined Radio Development Platform**

Eged, Bertalan; Babjak, Benjamin; Oct 1, 2006; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478777; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Communication Networks; Software Development Tools; Telecommunication*

**20080024058** Military Communication Inst., Zegrze, Poland

**Implementing User Mobility in a Tactical Network**

Malowidzki, M; Sliwka, M; Dalecki, T; Sobonski, P; Urban, R; Oct 1, 2006; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478778; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Communication Networks; Mobility; Telecommunication*

**20080024059** Military Communication Inst., Zegrze, Poland

**Simulation of Routing Protocol with CoS/QoS Enhancements in Heterogeneous Communication Network**

Kubera, Emil; Sliwa, Joanna; Zubel, Krzysztof; Mroczo, Adrian; Oct 1, 2006; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478779; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Augmentation; Communication Networks; Heterogeneity; Protocol (Computers); Simulation; Telecommunication*

**20080024060** Ljubljana Univ., Ljubljana, Slovenia

**Security Policies in Military Environments**

Ciglaric, Mojca; Krevl, Andrej; Pancur, Matjaz; Vidmar, Tone; Tomazic, Saso; Zavec, Ales; Ciglaric, Stanko; Oct 1, 2006; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478780; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Military Technology; Policies; Security*

**20080024070** Ljubljana Univ., Ljubljana, Slovenia

**A Framework for Developing Mobile Location Based Applications**

Krevl, Andrej; Vidmar, Tone; Pancur, Matjaz; Ciglaric, Mojca; Tomazic, Saso; Zavec, Ales; Ciglaric, Stanko; Oct 1, 2006; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478797; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Communication Networks; Portable Equipment; Position (Location); Telecommunication*

**20080024074** Thales Communications, Colombes, France

**Dynamic Control of Service Delivery for Ad Hoc Systems**

Schutz, Roland; Oct 1, 2006; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Dynamic Control; Telecommunication*

**20080024075** Thales Communications, Colombes, France

**Management Architecture and Solutions for French Tactical Systems**

Cottignies, Vincent; Oct 1, 2006; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478815; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Management Planning; Telecommunication*

**20080024079** Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

**Frequency Dependent Quality of HF-Communication Channels Estimated by Superresolution Direction Finding**

Hawlitshka, Stefan; Oct 1, 2006; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478825; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Channels (Data Transmission); Direction Finding; Estimating; Frequencies; High Frequencies; Quality; Telecommunication*

**20080024195** Meteorological Satellite Center, Tokyo, Japan

**New Approach to Intercalibration Using High Spectral Resolution Sounder**

Tahara, Yoshihiko; Meteorological Satellite Center Technical Note No. 50; January 2008, pp. 1-14; In English; See also [20080024192](#); Copyright; Avail.: Other Sources

This paper describes how a new intercalibration technique between a broadband sensor and a high spectral resolution sounder (a hyper sounder) is developed. To compare the two sensors, the new technique generates a super channel cloning the broad channel from the hyper sounder by minimizing the spectral response difference. The comparison technique is reviewed by examining that technique to compare brightness temperatures and radiances between the NITSAT-1R imager and the hyper sounder AIRS aboard AQUA. The simulated brightness temperature and radiance of the AIRS super channel for the NITSAT-1R channel IR2 (12 microns) are almost to the same as those of IR2, since ATRS fully covers the IR2 observing band, and the spectral response of the AIRS super channel is nearly the same as that of IR2. Real data comparison is also examined. The residual recognized in the comparison between IR2 and AIRS corresponds well to the comparisons between IR2 and the channel 3B of AVHRR aboard NOAA-18, even though many AIRS channels are missing. The comparisons of the MISAT-1R channel IRI(10.8 micron) and IR4 (3.8 microns) with AIRS also show a similarity to the comparisons between MTSAT-1R and AVHRR, even though the AIRS spectral gaps within the IRI and IR4 bands prevent the generation of the spectral response functions of the AIRS super channels that are exactly the same as those of IRI and IR4. These results indicate that this intercalibration technique is effective.

Author

*Spectral Resolution; Advanced Very High Resolution Radiometer; Intercalibration; Brightness Temperature; Radiance*

**20080024674** Da-Yeh Univ., Chang-Hua, Taiwan, Province of China

**Applying Likelihood on Hopfield Neural Network for Radar Tracking**

Chung, Yi-Nung; Yang, Maw-Rong; Juang, Dend-Jyi; Hsu, Tsung-Chun; Hsu, Shun-Peng; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 339-342; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 95-2221-E-212-021; Copyright; Avail.: Other Sources

The multiple-target tracking (MTT) algorithm plays an important role in radar systems. Data association is the most important technique to solve the tracking problems associating dense measurements with existing tracks. A new approach applying Likelihood to measurements and existing tracks in a radar system based on Neural Network computation is investigated in this paper. The proposed algorithm will solve both the data association and the target tracking problems simultaneously. With this approach, the matching between radar measurements and existing target tracks can achieve global relevance. Computer simulation results indicate the ability of this algorithm to keep track of targets under various conditions.

Author

*Radar Tracking; Neural Nets; Likelihood Ratio; Multiple Target Tracking; Tracking (Position); Algorithms; Tracking Problem*

**20080025044** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Spaceborne Doppler Radar Measurements of Rainfall: Correction of Errors Induced by Pointing Uncertainties**

Tanelli, Simone; Im, Eastwood; Kobayashi, Satoru; Mascelloni, Roberto; Facheris, Luca; Journal of Atmospheric and Oceanic Technology; March 2005; Volume 22, Issue 11, pp. 1676-1690; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1175/JTECH1797.1>; <http://hdl.handle.net/2014/40839>

In this paper a sea surface radar echo spectral analysis technique to correct for the rainfall velocity error caused by radar-pointing uncertainty is presented. The correction procedure is quite straightforward when the radar is observing a homogeneous rainfall field. When nonuniform beam filling (NUBF) occurs and attenuating frequencies are used, however, additional steps are necessary in order to correctly estimate the antenna-pointing direction. This new technique relies on the application of the combined frequency-time (CFT) algorithm to correct for uneven attenuation effects on the observed sea surface Doppler spectrum. The performance of this correction technique was evaluated by a Monte Carlo simulation of the Doppler precipitation radar backscatter from high-resolution 3D rain fields (either generated by a cloud resolving numerical model or retrieved from airborne radar measurements). The results show that the antenna-pointing-induced error can, indeed, be reduced by the proposed technique in order to achieve 1 m s(exp -1) accuracy on rainfall vertical velocity estimates.

Author

*Doppler Radar; Space Based Radar; Satellite Doppler Positioning; Radar Antennas; Geodetic Accuracy; Radar Targets; Rain; Precipitation Measurement*

**20080025076** Odyssey Research Associates, Inc., Ithaca, NY USA

**Hot Diffusion - Tactical Information Management Substrate**

Stillerman, Matt; Jan 2008; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0066; Proj-ICED

Report No.(s): AD-A478331; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478331>

To summarize our results, ATC-NY developed a new suite of algorithms for information dispersion in HotDiffusion. Our testing indicates that, in comparison with more conventional approaches, HotDiffusion should excel under very sparse network conditions, especially if there is enough dynamism in connectivity. We expect its performance to degrade gracefully as conditions worsen. We measured performance using a full implementation of HotDiffusion, as well as simulation. The implementation runs on a testbed of handheld wireless nodes. It also runs on a conventional wired network with emulated wireless links.

DTIC

*Data Systems; Diffusion; Information Management; Substrates*

**20080025107** PAMAM-Human Factors Engineering (1989) Ltd., Hod Hasharon, Israel

**Better Decision Making Through Representation and Reduction of Uncertainty in C3I Information System**

Brickner, Michael S; Sheffer, Dganit; Alef, Yishai; Brickner, Ido; Sirkis, Amit; Nov 2007; 82 pp.; In English

Contract(s)/Grant(s): FA8650-04-D-6405; Proj-7184

Report No.(s): AD-A478785; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research program deals with ways by which the representation of battlefield information in general and information

about uncertainty in particular, may enhance Decision Making, Situation Awareness (SW) and Sensemaking in battlespace environments. Previous stages of research were based on observations by the research team in a company-level simulation experiment and a brigade-level field experiment. The present stage included observation and analysis of controlled experimental research that took place in the Israel Defense Forces Battlefield Laboratory (BatLab). A Battle Management System (BMS) was conceptually designed by PAMAM and developed for the experiment by the BatLab.

DTIC

*Command and Control; Decision Making; Information Systems*

**20080025227** Motorola, Inc., Schaumburg, IL, USA

**Method and Apparatus Providing Improved Mixer Performance for Radio Receivers**

Heck, J. P., Inventor; 4 Jun 04; 11 pp.; In English

Patent Info.: Filed 4 Jun 04; US-Patent-Appl-SN-10-860-837

Report No.(s): PB2007-109309; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A mixer circuit includes a first switching mixer with a first desired signal input (RF+ and RF-), a first switching signal input (LO+& LO-), and a first output (IF+ and IF-), a second switching mixer, and a third switching mixer with corresponding desired signal inputs, switching signal inputs, and outputs. An overall input signal to the mixer circuit is fed to an input port of the first switching mixer, an output from an output port of the first switching mixer is fed to an input port of the second switching mixer, the output from an output port of the second switching mixer is fed to an input port of the third switching mixer, and an overall output of the mixer circuit can be an output from an output port of the third switching mixer.

NTIS

*Mixers; Patent Applications; Radio Receivers*

**20080025253** National Inst. of Information and Communications Technology, Tokyo, Japan

**Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4**

Kuroiwa, Hiroshi, Editor; Tawara, Yasuo, Editor; Wakana, Hiromitsu, Editor; Fukanaga, Kaori, Editor; December 2007; ISSN 1349-3205; 139 pp.; In English; See also 20080025254 - 20080025271; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics discussed include: Overview of the Wideband InterNetworking 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; Plan of Experiments; Concluding Remarks; Program and Related Device Based on Conductor Model for Analyzing Molecules and Othericles Adsorbed on Metal Surfaces.

Derived from text

*Antenna Arrays; Engineering Test Satellites; Information Systems; Microwave Antennas; Multibeam Antennas; Phased Arrays; Antenna Design; Broadband; Extremely High Frequencies*

**20080025254** National Inst. of Information and Communications Technology, Tokyo, Japan

**Concluding Remarks**

Tanaka, Masato; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 127-128; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

In anticipation of trends and needs in satellite communications, the National Institute of Information and Communications Technology (NICT) has put forth many proposals for satellite missions. At the same time, NICT has been involved in developing experimental communication satellites and constructing the foundations of communication satellite technologies in Japan. In particular, with the Wideband InterNetworking engineering test and Demonstration Satellite (WINDS), NICT began with studies of the concept of a communication satellite aiming at providing a 1-Gbps-class data transmission rate, the fastest in the world, to a third of the earth within the satellite's field of view. Based on the results of these studies, including the establishment of a Ka-band large-scale active phased array antenna prototype and investigations of the onboard switch, NICT has pursued the development of WINDS as a joint project with the Japan Aerospace Exploration Agency (JAXA).

WINDS is capable of 1.2-Gbps transmission, representing the world's fastest satellite communications. Past examples shed light on its potential: on the occasion of an earthquake in Taiwan, the optical fiber links connecting Taiwan with other countries, including Japan, were disrupted. Financial transactions were impossible for several days, and the stock market was in turmoil. Based on such scenario, WINDS is expected to establish the technologies for providing a high-speed satellite link as a backup when the ground communication network is unavailable in the event of natural disasters or other calamities. As another feature, WINDS can provide broadband communications at 155 Mbps to an earth station with an antenna of only 45 cm in diameter, easily installed on the balcony of a home. Moreover, it is estimated that approximately five percent of the homes in Japan are on isolated islands and in mountainous areas lacking ground broadband environments. Satellite broadcasting has largely reduced areas with poor reception in terms of television, and satellites are now anticipated to provide internet broadband environments to these areas, with WINDS positioned on the leading edge. WINDS will also provide fixed beams to major cities in the Asia/Pacific region, as well as beams available for scanning freely over the Asia/Pacific region. Other than providing 1.2-Gbps high-speed communication links between major cities, the satellite will thus also provide broadband environments to areas, including islands, in the Asia/Pacific region in which broadband environments have not been established. As such, expectations are high that WINDS will prove extremely useful in providing ultra-high-speed communication links and bridging the digital divide in areas both in Japan and in the Asia/Pacific region.

Derived from text

*Broadband; Communication Satellites; Communication Networks; Wireless Communication*

**20080025255** Japan Aerospace Exploration Agency, Tokyo, Japan

#### **Communications System**

Shimada, Masaaki; Yajima, Masanobu; Ogawa, Yasuo; Kuroda, Tomonori; Takahashi, Takashi; Kuroda, Tomonori; Ozawa, Satoru; Yokoyama, Mikio; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 19-26; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

WINDS (Wideband InterNetworking engineering test and Demonstration Satellite) is an experimental satellite enables 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; Satellite Communication; Phased Arrays; Systems Engineering; Multibeam Antennas*

**20080025256** National Inst. of Information and Communications Technology, Tokyo, Japan

#### **On-Board Baseband Switch**

Yoshimura, Naoko; Takahashi, Takashi; Hashimoto, Yukio; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 27-33; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

NICT and JAXA had developed 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; Switches; Onboard Equipment; Wireless Communication; Communication Networks*

**20080025257** Japan Aerospace Exploration Agency, Tokyo, Japan

#### **Multibeam Antenna System**

Ozawa, Satoru; Shimada, Masaaki; Koishi, Yoichi; Hasegawa, Takumi; Hirayama, Katsunori; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and

Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 35-43; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

A multibeam antenna system is being developed for mounting on WINDS, the GIGA bit class communication satellite, slated for launch in 2008 by JAXA. This paper describes the RF characteristics of this antenna system.

Author

*Antenna Design; Communication Satellites; Multibeam Antennas; Radio Frequencies*

**20080025258** National Inst. of Information and Communications Technology, Tokyo, Japan

**Overview of the Wideband InterNetworking Engineering Test and Demonstration Satellite Project**

Kadowaki, Naoto; Suzuki, Ryutaro; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 3-10; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) is an experimental satellite aiming at research and development of broadband satellite communications system which takes part in construction of worldwide broadband networks. Its origin is the Gigabit Satellite R&D started in Communications Research Laboratory (CRL, one of former bodies of NICT) in 1992, and fundamental technologies such as Ka-band active phased array antenna, satellite onboard modem and high speed baseband switch were developed in the project. Full scale experimental satellite project as WINDS started in 2001 and the satellite will be launched in early 2008. This paper describes the overview of WINDS project such as circumstances, key technologies and experimental plan.

Author

*Broadband; Engineering Test Satellites; Satellite Communication; Antenna Design; General Overviews*

**20080025259** Japan Aerospace Exploration Agency, Tokyo, Japan

**Overview of WINDS Satellite**

Shimada, Masaaki; Kuroda, Tomonori; Yajima, Masanobu; Ozawa, Satoru; Ogawa, Yasuo; Yokoyama, Mikio; Takahashi, Takashi; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 11-18; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

The Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) aims at developing and verifying the key technologies for future ultra high speed satellite communications such as: (1) Ka-band multi-beam antenna with high power multi-port amplifier; (2) Ka-band active phased array antenna; and (3) an on-board Asynchronous Transfer Mode switch. It also aims to create and demonstrate new utilizations for satellite communications through various experiments. The development of WINDS has been conducted by JAXA and NICT and WINDS is scheduled to be launched by H-IIA launch vehicle in 2007 (fiscal year).

Author

*Broadband; Satellite Communication; General Overviews; Attitude Control; Antenna Design*

**20080025260** Japan Aerospace Exploration Agency, Tokyo, Japan

**Ka-Band High Power Multi-Port Amplifier (MPA)**

Kuroda, Tomonori; Ogawa, Yasuo; Katakami, Kanji; Nakazawa, Minoru; Shimada, Masaaki; Hosoda, Ikuo; Motohashi, Yasuo; Kitahara, Masaki; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 45-52; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

Ka-band High Power Multi-Port Amplifier (MPA) is developed and will be demonstrated through the communication experiments for the future satellite communication systems by multi-beams in the WINDS program. IN the conventional satellite communication systems by multibeam, it is designed that transponder configuration set for each transmit power amplifier that is connected to its exclusive antenna beam, so if a port's power condition for communication have some margin, its surplus power can't be distributed to other port's. On the other hand, WINDS has MPA and its control system by ground terminal, total output power of the MPA is shared among all communication ports, and it is possible to assign required output power in several antenna beam efficiently within total output power. MPA for WINDS have 8 input/output ports, frequency band is 17.7-18.8 GHz, and total output power is more than 280 W.

Author

*Extremely High Frequencies; Power Amplifiers; Satellite Communication; Multibeam Antennas*

**20080025261** Japan Aerospace Exploration Agency, Tokyo, Japan

**Ka-Band Active Phased Array Antenna**

Yajima, Masanobu; Maeda, Tsuyoshi; Hasegawa, Takumi; Hariu, Ken-ichi; Kuroda, Tomonori; Shimada, Masaaki; Kitao, Shiro; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 53-59; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

Active Phased Array Antenna (APAA) is one of mission equipment on WINDS and the frequency band is Ka band, and maximum data rate 1.2 Gbps communication will be realized by APAA. It consists of 128 element antennas and many extremely miniaturized RF modules. It can scan two beams of a transmitting antenna and a receiving antenna electronically and independently. WINDS service area covers almost all of the world which is a visible region from the satellite by APAA. This paper introduces APAA role, background, functions, key technologies, and major specifications, and describes development results.

Author

*Antenna Arrays; Extremely High Frequencies; Phased Arrays; Antenna Design; Miniaturization*

**20080025262** Japan Aerospace Exploration Agency, Tokyo, Japan

**Earth Stations for WINDS Regenerative Communication Mode**

Ogawa, Yasuo; Yokoyama, Mikio; Fujiwara, Yuuichi; Shimada, Masaaki; Kuroda, Tomonori; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 101-106; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

WINDS has two communications modes. One of them is a regenerative communication mode. JAXA is developing USAT and VSAT for this mode. This paper describes the characteristics and functions of these earth stations for WINDS.

Author

*Ground Stations; Satellite Communication; Broadband; Modes*

**20080025263** National Inst. of Information and Communications Technology, Tokyo, Japan

**WINDS Satellite Networking Protocol for Regenerative Mode**

Yoshimura, Naoko; Takahashi, Takashi; Ogawa, Yasuo; Hashimoto, Yukio; Kuroda, Tomonori; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 107-111; In English; See also [20080025253](#); 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 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; Communication Satellites; Modes; Time Division Multiple Access*

**20080025264** National Inst. of Information and Communications Technology, Tokyo, Japan

**High-Speed Burst Modem for Bent-Pipe Relay Mode**

Hashimoto, Yukio; Yoshimura, Naoko; Takahashi, Takashi; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 71-83; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

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. SDRVSAT is used for high-speed communication of 622 Mbps and installed 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 is required the 1.1 GHz wideband transmitter and receiver as same as the on-board transponder of WINDS.

Author

*High Speed; Modems; Pipes (Tubes); Communication Networks; Space Communication*

**20080025265** Japan Aerospace Exploration Agency, Tokyo, Japan

**Development of Network Management Center for WINDS**

Ogawa, Yasuo; Kuroda, Tomonori; Shimada, Masaaki; Yokoyama, Mikio; Fujiwara, Yuuichi; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 89-99; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

JAXA is developing an earth station which has communication controller and circuit-switched capabilities for 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 the functions of this station.

Author

*Satellite Communication; Network Control; Switching Circuits; Control Equipment*

**20080025266** National Inst. of Information and Communications Technology, Tokyo, Japan

**Plan of Experiments**

Ohkawa, Mitsugu; Yoshimura, Naoko; Suzuki, Ryutaro; Takahashi, Takashi; Hashimoto, Yukio; Tomii, Naoya; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 117-125; In English; See also [20080025253](#); 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

*Communication Networks; Information Systems; Management Planning; Onboard Equipment*

**20080025267** National Inst. of Information and Communications Technology, Tokyo, Japan

**Earth Stations for WINDS High-Speed Network**

Hashimoto, Yukio; Yoshimura, Naoko; Takahashi, Takashi; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 65-70; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

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. SDRVSAT is used for high-speed communication of 622 Mbps and installed 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 is required the 1.1 GHz wideband transmitter and receiver as same as the on-board transponder of WINDS.

Author

*Ground Stations; High Speed; Communication Networks; Broadband*

**20080025268** National Inst. of Information and Communications Technology, Tokyo, Japan

**WINDS Satellite Networking Protocol for Bent-Bipe Mode**

Takahashi, Takashi; Hashimoto, Yukio; Kuroda, Tomonori; Yoshimura, Naoko; Ogawa, Yasuo; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 113-116; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

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 mode in the bent-pipe mode. One is the bent-pipe continuous wave mode, which is used at traditional communication satellite. Another is the bent-pipe TDMA mode, which can communicate at the same time with the regenerative mode.

Author

*Communication Satellites; Pipes (Tubes); Protocol (Computers); Communication Networks*



**20080025269** National Inst. of Information and Communications Technology, Tokyo, Japan

**Overview of Earth Stations for WINDS Experiments**

Takahashi, Takashi; Ogawa, Yasuo; Hashimoto, Yukio; Kuroda, Tomonori; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 61-63; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

WINDS has been developed assuming the four types of user earth stations. Those earth stations have been developed by JAXA and NICT. WINDS satellite communication system is very complex, then it needs the satellite network control station, WINDS network management station, which developed by JAXA. The overviews of those earth stations for WINDS experiments are described.

Author

*Satellite Communication; Satellite Networks; General Overviews; Broadband*

**20080025270** National Inst. of Information and Communications Technology, Tokyo, Japan

**WINDS Network Data Gathering System**

Takahashi, Takashi; Hashimoto, Yukio; Yoshimura, Naoko; Ohkawa, Mitsugu; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 85-88; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

WINDS network data gathering system is received the several kinds of network data such as the telemetry from the satellite, the network configuration data, and so on. Those data are sent from the WINDS network management center in JAXA Tsukuba Space Center through the leased line. WINDS network data gathering system has several functions, such as a display function of the trend graph, data search function, and so on.

Author

*Data Systems; Satellite Networks; Telemetry; Systems Engineering*

**20080025271** National Inst. of Information and Communications Technology, Tokyo, Japan

**Program and Related Device Based on Conductor Model for Analyzing Molecules and Other Particles Adsorbed on Metal Surfaces**

Okuno, Yoshishige, Inventor; Mashiko, Shinro, Inventor; Sawada, Fumitake; Journal of the National Institute of Information and Communications Technology. Special Issue on Wideband InterNetworking Engineering Test and Demonstration Satellite (WINDS); Volume 54, No. 4; December 2007, pp. 129-131; In English; See also [20080025253](#); Copyright; Avail.: Other Sources

This invention provides a method of numerical analysis that is more rational and more applicable than conventional methods. To summarize, the invention solves problems in conventional methods and provides a more rational, accurate, and applicable method of computer analysis for clarifying characteristic values and stable structures of molecules or clusters of molecules adsorbed on metal surfaces. Specifically, when evaluating the interactions induced between the adsorbed molecules and the metal surface, this method treats the metal as a conductor and approximates the charges induced on the surface of the conductor by the adsorbates as a collection of point charges, each situated within each microscopic region dividing the conductor surface. By combining quantum chemical calculation in the presence of the determined point charges and calculation of the empirical inter-atomic potential function expressing the repulsive and the dispersion interactions, the invention enables practical evaluation of various characteristic values and the stable structure of a molecule or a cluster of molecules adsorbed on the metal surface. Accordingly, this invention enables analysis of molecules and other particles adsorbed on rough surfaces, a difficult task using conventional methods; moreover, it can provide more accurate results for characteristic values and structural stability for molecules and other particles adsorbed on flat metal surfaces.

Author

*Adsorption; Conductors; Metal Surfaces; Molecules; Numerical Analysis; Molecular Clusters*

**20080025285** Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

**Implementation of a Priority Service for SMTP**

Schmeing, Michael; Oct 1, 2006; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478880; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478880>

No abstract available

*Electronic Mail; Priorities; Protocol (Computers)*

**20080025345** Army War Coll., Carlisle Barracks, PA USA

**The U.S. Army Corps of Engineers Support of Combatant Commands**

Alexander, Michael A; Mar 15, 2008; 33 pp.; In English

Report No.(s): AD-A479072; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479072>

In January 2005, the Chief of Staff of the Army established Task Force Stability Operations to assess Army-wide capability gaps in planning for and conducting stability operations, now known as Stability, Security, Transition, & Reconstruction Operations (SSTR). Also in 2005, the Department of Defense published DOD Directive 3000.5 which requires that the Army develop specific programs, engineering capabilities, and personnel to ensure success in future SSTR environments worldwide. The US Army Corps of Engineers (USACE), through the development of its Field Force Engineering (FFE) program in late 2003 has been providing technical engineering support to the Combatant Commands (COCOMs) during military contingencies and catastrophic natural disasters. This paper assesses the current USACE FFE program, its support of the COCOMs, Army Service Component Commands (ASCCs), and U.S. Joint Task Forces (JTFs) during contingencies and natural disasters, and its proposed expansion to facilitate successful future SSTR operations. Recommendations are provided to enhance the USACE's overall SSTR engineering effectiveness allowing improvements

DTIC

*Command and Control; Engineers; Military Operations*

**20080025477** Sensimetrics Corp., Somerville, MA USA

**Spoken Word Recognition by Humans: A Single- or a Multi-Layer Process**

Ghitza, Oded; Feb 2008; 9 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0426

Report No.(s): AD-A479257; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This 7-month-long project quantifies the role of brain rhythms in speech perception by measuring intelligibility of spoken sentences with judiciously manipulated changes in syllabic rhythm. Speech was time-compressed by a factor of three, resulting in a signal with a syllabic rate three times faster than the original and with poor intelligibility (< 50% words correct). An artificial 'syllabic' rate was then introduced by segmenting the time-compressed speech signal into consecutive 40-ms intervals, each followed by a variable interval of silence. The parameters of interest were the length of the silent intervals inserted (ranging between 0-160 ms) and whether the intervals were equal in length (i.e., periodic) or not (i.e., aperiodic). The resulting performance curve is U-shaped, with best intelligibility measured at silence interval of 80 ms inserted periodically. This is also the condition in which there is a significant difference in intelligibility between periodic and aperiodic insertion (the error rate of the latter is nearly twice as high). The U-shaped performance curve may reflect the operation of cortical rhythms. Optimum intelligibility is associated with waveform-energy fluctuations in the core of the theta range of neural oscillations (3-8 Hz), which is also the core range of syllabic rate in naturally spoken utterances. Poor intelligibility may reflect the mismatch between waveform-energy fluctuations and theta rhythms in the brain.

DTIC

*Brain; Intelligibility; Oscillations; Speech; Syllables; Words (Language)*

**20080025557** Army War Coll., Carlisle Barracks, PA USA

**The Effects of Network-Centric Enabled Distributed Operations Forces on the Principles of War**

Callahan, William E; Mar 25, 2008; 29 pp.; In English

Report No.(s): AD-A479578; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study seeks to determine the effects of Network-Centric warfare on the principles of war. Has Network-Centric warfare truly enabled smaller formations such as those espoused by the U.S. Marine Corps concept of Distributed Operations?

If so, what are the key enablers of Network-Centric warfare that are necessary to enhance Distributed Operations? As the U.S. Military continues to adopt more Special Operations Force capabilities within its conventional forces, these are some of the important questions that must be answered. Also, as these key enablers are identified, they must be applied in a manner that reduces friction for the smaller formation and helps Distributed Operations forces better see through the fog of war. They must be applied in a manner that enhances survivability and lethality and should not be used strictly as a means to reduce the manpower footprint on the battlefield.

DTIC

*Decision Making; Warfare*

**20080025630** Sandia National Labs., Albuquerque, NM USA

**Experimental Uncertainty Estimation and Statistics for Data Having Interval Uncertainty**

Ferson, S.; Kreinovich, V.; Hajagos, J.; Oberkampf, W.; Ginzburg, L.; May 01, 2007; 162 pp.; In English

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

Report No.(s): DE2007-910198; SAND2007-0939; No Copyright; Avail.: Department of Energy Information Bridge

This report addresses the characterization of measurements that include epistemic uncertainties in the form of intervals. It reviews the application of basic descriptive statistics to data sets which contain intervals rather than exclusively point estimates. It describes algorithms to compute various means, the median and other percentiles, variance, interquartile range, moments, confidence limits, and other important statistics and summarizes the computability of these statistics as a function of sample size and characteristics of the intervals in the data (degree of overlap, size and regularity of widths, etc.). It also reviews the prospects for analyzing such data sets with the methods of inferential statistics such as outlier detection and regressions. The report explores the tradeoff between measurement precision and sample size in statistical results that are sensitive to both. It also argues that an approach based on interval statistics could be a reasonable alternative to current standard methods for evaluating, expressing and propagating measurement uncertainties.

NTIS

*Outliers (Statistics); Algorithms*

**20080025657** University of South Florida, Tampa, FL USA

**Dual-polarized feed antenna apparatus and method of use**

Sarehraz, Mohammad, Inventor; Buckle, Kenneth A., Inventor; Stefanakos, Elias, Inventor; Weller, Thomas, Inventor; Goswami, D. Yogi, Inventor; April 22, 2008; 9 pp.; In English

Patent Info.: Filed September 25, 2006; US-Patent-7,362,273; US-Patent-Appl-SN-11/534,781; No Copyright; Avail.:

CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025657>

An antenna apparatus and method for the interception of randomly polarized electromagnetic waves utilizing a dual polarized antenna which is excited through a cross-slot aperture using two well-isolated orthogonal feeds.

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

*Electromagnetic Radiation; Apertures; Interception; Slots*

**20080025693** NASA, Washington, DC USA

**Wideband radial power combiner/divider fed by a mode transducer**

Epp, Larry W., Inventor; Hoppe, Daniel J., Inventor; Kelley, Daniel, Inventor; Khan, Abdur R., Inventor; June 10, 2008; 15 pp.; In English

Patent Info.: Filed March 14, 2006; US-Patent-7,385,462; US-Patent-Appl-SN-11/376,638; No Copyright; Avail.: CASI:

[A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025693>

A radial power combiner/divider capable of a higher order (for example,  $N=24$ ) of power combining/dividing and a 15% bandwidth (31 to 36 GHz). The radial power combiner/divider generally comprises an axially-oriented mode transducer coupled to a radial base. The mode transducer transduces circular TE<sub>01</sub> waveguide into rectangular TE<sub>10</sub> waveguide, and the unique radial base combines/divides a plurality of peripheral rectangular waveguide ports into a single circular TE<sub>01</sub> waveguide end of the transducer. The radial base incorporates full-height waveguides that are stepped down to reduced-height waveguides to form a stepped-impedance configuration, thereby reducing the height of the waveguides inside the base and increasing the order  $N$  of combining/dividing. The reduced-height waveguides in the base converge radially to a matching post

at the bottom center of the radial base which matches the reduced height rectangular waveguides into the circular waveguide that feeds the mode transducer.

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

*Broadband; Transducers*

**20080025700** Defence Research and Development Canada, Ottawa, Ontario Canada

**Exploring Command and Control Concepts for an Integrated Effect Coordination Cell using an Enhanced Tabletop Experimentation Approach: Report on the Integrated Effects Coordination Cell Exploratory Experiment (IECCEX)**

Lam, Sylvia; Woodward, Wally; Dec 2007; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479296; DRDC-ONTARIO-TM-2007-286; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The first exploratory experiment of the Joint Fire Support (JFS) Technology Demonstration Project (TDP), namely the Integrated Effects Coordination Cell Exploratory Experiment (IECCEX), was conducted by the Canadian Forces Experimentation Center (CFEC) Effective Engagement Team (EET) and JFS TDP in the Joint Concept Laboratory and Training Center (JCLTC) located in CFEC, from 14th to 18th May 2007. The main objective of this experiment was to explore various Integrated Effects Coordination Cell (IECC) manning, process flow and control models in order to facilitate the identification of an appropriate model that best suits the requirements of providing optimal Integrated Effects (IE). In addition to the overall objective the scientific staff also gained valuable insight into: information requirements for each option; situational awareness requirements for each option; and areas best suited for automation. This report documents the approach used to conduct this experiment and captures the findings and lessons learned.

DTIC

*Command and Control; Control Theory; Coordination*

**20080025770** Air Force Research Lab., Rome, NY, USA

**Apparatus and Method for Providing a Data Interface to a Plurality of Radio Transceivers**

Kepler, D., Inventor; Lutchansky, N., Inventor; 8 Dec 04; 17 pp.; In English

Patent Info.: Filed 8 Dec 04; US-Patent-Appl-SN-11-007-774

Report No.(s): PB2007-110580; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Apparatus and method for providing a data interface to a plurality of radio transceivers such as between a personal computer or other information processing device to one or more radio transmitter/receiver systems having a serial data interface in a manner that provides control of the radio and means to send and receive data via the radio without regard to the characteristics of the radio or its serial interface. A common control protocol is employed that exposes the functionality necessary to control the radio transmitter/receiver device in a generic manner. The invention may communicate with the data terminal equipment via a widely-available data interface or network protocol, such as an asynchronous serial interface, the Universal Serial Bus (USB), or an Internet Protocol (IP) network. The invention also provides a means of implementing synchronous serial framing formats through software implementation, allowing compatibility with future data systems to be achieved without requiring hardware modifications.

NTIS

*Data Transmission; Patent Applications; Telecommunication; Transmitter Receivers*

**20080025798** Klauber and Jackson, Hackensack, NJ, USA

**Equal BER Power Control for Uplink MC-CDMA with MMSE Successive Interference Cancellation**

Bar-Ness, Y., Inventor; Tan, M., Inventor; 14 Jan 05; 8 pp.; In English

Patent Info.: Filed 14 Jan 05; US-Patent-Appl-SN-11-036-891

Report No.(s): PB2007-110620; No Copyright; Avail.: CASI: [A02](#), Hardcopy

For a given decision order, MMSE successive interference cancellation (MMSE-SIC) can simultaneously maximize SIRs of all users. To further increase its efficiency, a power control (PC) algorithm, under equal BER criterion, is disclosed for uplink MC-CDMA. In frequency-selective Rayleigh fading channels, the MMSE-SIC integrated with the equal BER PC suppresses multiple access interference (MAI) effectively, resulting in a performance very close to the single user bound (SUB).

NTIS

*Bit Error Rate; Cancellation; Code Division Multiple Access; Mean Square Values; Patent Applications; Uplinking*

**20080025818** Wilmer Cutler Pickering Hale and Dorr, LLP, New York, NY, USA; Columbia Univ., New York, NY, USA  
**Apparatus Method and Medium for Tracing the Origin of Network Transmissions Using N-Gram Distribution of Data**  
Stolfo, S. J., Inventor; 12 Nov 04; 42 pp.; In English  
Contract(s)/Grant(s): DARPA-F30602-02-2-0209  
Patent Info.: Filed 12 Nov 04; US-Patent-Appl-SN-10-986-467  
Report No.(s): PB2007-110621; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method, apparatus, and medium are provided for tracing the origin of network transmissions. Connection records are maintained at computer system for storing source and destination addresses. The connection records also maintain a statistical distribution of data corresponding to the data payload being transmitted. The statistical distribution can be compared to that of the connection records in order to identify the sender. The location of the sender can subsequently be determined from the source address stored in the connection record. The process can be repeated multiple times until the location of the original sender has been traced.

NTIS

*Communication Networks; Data Transmission; Patent Applications*

**20080026181** NASA Langley Research Center, Hampton, VA, USA  
**Linear FMCW Laser Radar for Precision Range and Vector Velocity Measurements**  
Pierrottet, Diego; Amzajerdian, Farzin; Petway, Larry; Barnes, Bruce; Lockhard, George; Rubio, Manuel; March 24, 2008; 9 pp.; In English; Material Research Society (MRS) 2008 Spring Meeting, 14-18 Mar. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations  
Contract(s)/Grant(s): WBS 699152.04.05.05.04; Copyright; Avail.: CASI: [A02](#), Hardcopy

An all fiber linear frequency modulated continuous wave (FMCW) coherent laser radar system is under development with a goal to aide NASA s new Space Exploration initiative for manned and robotic missions to the Moon and Mars. By employing a combination of optical heterodyne and linear frequency modulation techniques and utilizing state-of-the-art fiber optic technologies, highly efficient, compact and reliable laser radar suitable for operation in a space environment is being developed. Linear FMCW lidar has the capability of high-resolution range measurements, and when configured into a multi-channel receiver system it has the capability of obtaining high precision horizontal and vertical velocity measurements. Precision range and vector velocity data are beneficial to navigating planetary landing pods to the preselected site and achieving autonomous, safe soft-landing. The all-fiber coherent laser radar has several important advantages over more conventional pulsed laser altimeters or range finders. One of the advantages of the coherent laser radar is its ability to measure directly the platform velocity by extracting the Doppler shift generated from the motion, as opposed to time of flight range finders where terrain features such as hills, cliffs, or slopes add error to the velocity measurement. Doppler measurements are about two orders of magnitude more accurate than the velocity estimates obtained by pulsed laser altimeters. In addition, most of the components of the device are efficient and reliable commercial off-the-shelf fiber optic telecommunication components. This paper discusses the design and performance of a second-generation brassboard system under development at NASA Langley Research Center as part of the Autonomous Landing and Hazard Avoidance (ALHAT) project.

Author

*Coherent Radar; Continuous Wave Lasers; Frequency Modulation; Linearity; Precision; Fiber Optics; Velocity Measurement*

### 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*.

**20080023748** Brookhaven National Lab., Upton, NY USA; Fermi National Accelerator Lab., Batavia, IL, USA  
**Monolithic Active Pixel Matrix with Binary Counters in an SOI Process**  
Deptuch, G.; Yarema, R.; May 01, 2007; 6 pp.; In English  
Contract(s)/Grant(s): DE-AC02-98CH10886

Report No.(s): DE2007-909965; BNL-77972-2007-CP; No Copyright; Avail.: Department of Energy Information Bridge

The design of a Prototype monolithic active pixel substrate is shown in this document. The rectifying junctions are on matrix, designed in a 0.15 Pm CMOS SOI Process, is the BOX side and reverse voltage is applied using a presented. The process allowed connection between the bottom approx. 1 plate n+ contacts on the top side electronics and the silicon volume

under the layer of buried oxide (BOX). The small size vias traversing through the BOX and implantation of small p-type islands in the n-type bulk result in a monolithic imager. During the acquisition time, all pixels register individual radiation events incrementing the counters. The counting rate is up to 1 MHz per pixel. The contents of counters are shifted out during the readout phase. The designed prototype is an array of 64x64 pixels and the pixel size is 26x26 micrometers.

NTIS

*Counters; Pixels; Semiconductors (Materials); SOI (Semiconductors)*

**20080023804** Naval Research Lab., Washington, DC USA

**Emerging Power/Energy Technologies for Portable Electronics for SOCOM**

Lyons, Karen S; Feb 29, 2008; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N653607-WX-0-0137

Report No.(s): AD-A478329; NRL/MR/6110--08-9115; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478329>

SOCOM is seeking more capability for SOF teams to operate advanced portable electronics over 72-h missions, but is limited by the energy of present battery systems, the BA5590 battery. Batteries with only modest improvements in specific energy over the BA5590 have only a small impact on 72-h missions at 200W. An improved battery, the BA5390 UHC, will become available in 2008. It will provide about 40% more endurance at 20 W over 72 h, and thus should be adopted should it meet military standard. Many different types of fuel cell systems are in development for 20 W operation, but, as battery technology improves, such as in the case of the BA5390 UHC batteries, they will compete with proposed fuel cell and other fuel conversion technologies.

DTIC

*Electric Batteries; Energy Technology; Fuel Cells*

**20080023939** Missouri Univ., Columbia, MO USA

**High-Efficiency Helical Coil Electromagnetic Launcher and High Power Hall-Effect Switch**

Engel, Thomas G; Nunnally, William C; Gahl, John M; Feb 29, 2008; 41 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0448

Report No.(s): AD-A478598; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Efficiency and scaling relationships for DC (i.e., non-induction) constant inductance gradient electromagnetic launchers are presented and discussed. Expressions for electromagnetic force, efficiency, back-voltage, and kinetic power are derived and given in terms of electrical circuit parameters. Launcher efficiency is shown to be a simple function of armature velocity and the launcher's characteristic velocity. The characteristic velocity characterizes the launcher and is the product of two new parameters; the mode constant and launcher constant. Mathematically, the launcher must operate at its characteristic velocity for 50% maximum efficiency. The mode constant reflects the manner in which the launcher is powered and its maximum efficiency. The launcher constant reflects the geometry of the launcher. The two modes of operation presented in this investigation include constant current and zero exit current operation. The ideal electromagnetic launcher concept is developed and defined by operation at 100% maximum efficiency at all velocities. The concept of same-scale comparisons is developed and states that electromagnetic launcher comparisons should be done with equal bore diameter, launcher length, projectile mass, and velocity. A comparative analysis using experimental data of same-scale constant gradient electromagnetic launchers is performed with conventional railgun, augmented railgun, and helical gun launchers and is presented in terms of the launcher constant, inductance gradient, bore diameter, bore length, system resistance, and armature (i.e., projectile) velocity. A theoretical analysis is also presented to design a helical electromagnetic launcher for a specific volt-amp characteristic. Experimentally measured performance is reported for a 40 millimeter bore helical electromagnetic launcher which is subsequently compared to a one-turn augmented railgun and a conventional railgun operating at comparable scale.

DTIC

*Electric Coils; Electromagnetic Propulsion; Gun Launchers; Hall Effect; Launchers; Switches*

**20080024008** California Univ., Los Angeles, CA USA

**A Joint Meeting of the US-Korea Workshop on Nanostructured Materials and Nanomanufacturing (5th) and the US-Korea Workshop on Nanoelectronics (3rd). Held in Los Angeles, California on August 8-9, 2006**

Hahn, H T; Sep 10, 2007; 12 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0440

Report No.(s): AD-A478704; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Joint Meeting of the 3rd US-Korea Workshop on Nanoelectronics and the 5th US-Korea Workshop Nanostructured

Materials and Nanomanufacturing was held at the University of California, Los Angeles on 8-9 August 2006. The Meeting started with 6 overview presentations on research programs in the subject areas supported by the AFOSR and the Center for Nanostructured Materials Technology, Korea, respectively. The Nanoelectronics Workshop included 10 U.S. papers and 14 Korean papers while the Nanostructured Materials Workshop included 15 U.S. papers and 9 Korean papers. CDs containing copies of presentations are available from AFOSR.

DTIC

*Korea; Nanostructures (Devices); Nanotechnology*

**20080024019** Wayne State Univ., Detroit, MI USA

**Nonlinear Stochastic Flutter of a Cantilever Wing with Joint Relaxation and Random Loading**

Ibrahim, Raouf A; Gibson, Ronald F; Feb 21, 2008; 152 pp.; In English

Contract(s)/Grant(s): FA9550-041-1-0042

Report No.(s): AD-A478724; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research project has generated a number of problems addressing the uncertainties and relaxation problems in aeroelastic structures. Specifically, three main problems that are of important concern to the aerospace industry and the Air Force technology have been addressed. These are: (1) The influence of structure uncertainties of the flutter of an aircraft wing. (2) Stabilization of wing flutter via parametric excitation. (3) Influence of joint relaxation on the flutter of aeroelastic structures. These problems are addressed in the next three chapters.

DTIC

*Cantilever Beams; Flutter; Nonlinearity; Relaxation Oscillators; Stochastic Processes; Wings*

**20080024084** Dow Chemical Co., Midland, MI USA

**Q2 Known Good Substrates**

Loboda, Mark; Carlson, Eric; Chung, Gilyong; Russell, Brian; Mar 27, 2008; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-07-C-0918

Report No.(s): AD-A478838; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Known Good Substrates (KGS) Phase II program was initiated 29 August 2007. Wafer, epitaxy, modeling and metrology work has been the main focus of efforts in Q2. This technical report summarizes the progress by all team members against the tasks and milestones.

DTIC

*Metrology; Silicon Carbides; Substrates*

**20080024164** Department of the Army, Washington, DC USA

**Method of Making a Power Electronics Capacitor**

Mandelcorn, Lyon, Inventor; Bowers, John, Inventor; Danielson, Eugene R, Inventor; Gurkovich, Stephen R, Inventor; Radford, Kenneth C, Inventor; Jan 25, 2005; 11 pp.; In English

Report No.(s): AD-D020329; PATENT-6 845 551 B2; No Copyright; Avail.: US Patent and Trademark Office

There is disclosed herein a high voltage and high temperature power electronics capacitor which comprises one or more insulator layers of mica paper, and one or more metal conductor layers, all dispersed in a pressurized environment of a nonreactive and high voltage strength gas maintained at near ambient to about 405.2 kPa of pressure. The insulator and conductor layers are isolated and separated from one another by the alternating placement of conductor layers between said insulator layers. These capacitors are readily packaged for commercial use in containers or housings of almost any geometric form and any material of construction. Moreover, low inductance ceramic bushings can be employed on these containers for establishing external electrical contacts. These capacitors can be economically manufactured and used in large commercial volumes with currently available materials and production methods.

DTIC

*Capacitors; Patents*

**20080024165** Department of the Army, Washington, DC USA

**Conductive Rivet For Circuit Card**

Hansen, David N, Inventor; Oct 4, 2005; 5 pp.; In English

Report No.(s): AD-D020330; PATENT-6 951 467 B1; No Copyright; Avail.: US Patent and Trademark Office

The conductive rivet designed to connect the first and second conducting surfaces of circuit board through an aperture in

the board. The rivet includes a conical member with an associated insulating washer associated on one side of circuit board. A T-shaped rivet and cooperating insulating sleeve are designed to contact the opposite side of the circuit board and provide a thermal conduction path via tail on the T-shaped rivet to the conical member on the opposing side.

DTIC

*Circuit Boards; Patents; Rivets*

**20080024220** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Commercial Sensory Survey Radiation Testing Progress Report**

Becker, Heidi N.; Dolphic, Michael D.; Thorbourn, Dennis O.; Alexander, James W.; Salomon, Phil M.; April 2008; 32 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 939904.01.11.30; JPL Proj. 102197

Report No.(s): JPL Publication 08-22; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40825>

The NASA Electronic Parts and Packaging (NEPP) Program Sensor Technology Commercial Sensor Survey task is geared toward benefiting future NASA space missions with low-cost, short-duty-cycle, visible imaging needs. Such applications could include imaging for educational outreach purposes or short surveys of spacecraft, planetary, or lunar surfaces. Under the task, inexpensive commercial grade CMOS sensors were surveyed in fiscal year 2007 (FY07) and three sensors were selected for total ionizing dose (TID) and displacement damage dose (DDD) tolerance testing. The selected sensors had to meet selection criteria chosen to support small, low-mass cameras that produce good resolution color images. These criteria are discussed in detail in [1]. This document discusses the progress of radiation testing on the Micron and OmniVision sensors selected in FY07 for radiation tolerance testing.

Author

*Electronic Packaging; Radiation Tolerance; Radiation Dosage; Irradiation*

**20080024668** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Tightly-Coupled INS, GPS, and Imaging Sensors for Precision Geolocation**

Veth, Mike; Anderson, Robert C; Webber, Fred; Nielsen, Mike; Jan 2008; 12 pp.; In English

Report No.(s): AD-A478300; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478300>

Recent technological advances have significantly improved the capabilities of micro-air vehicles (MAV). This is evidenced by their expanding use by government, police, and military forces. A MAV can provide a real-time surveillance capability to even the smallest units, which provides commanders with a significant advantage. This capability is a result of the availability of miniaturized autopilot systems which typically combine inertial, pitot-static, and GPS sensors into a feedback flight-control system. While these autopilots can provide an autonomous flight capability, they have some limitations which impact their operational effectiveness. One of the primary issues is poor image geolocation performance, which limits the use of these systems for direct measurements of target locations. This poor geolocation performance is primarily a consequence of the relatively large attitude errors characteristic of low-performance inertial sensors. In previous efforts, we have developed a tightly-coupled image-aided inertial navigation system to operate in areas not serviced by GPS. This system extracts navigation information by automatically detecting and tracking stationary optical features of opportunity in the environment. One characteristic of this system is vastly reduced attitude errors, even with consumer-grade inertial sensors. In this paper, the benefits of incorporating image-based navigation techniques with inertial and GPS measurements is explored. After properly integrating GPS with the image-aided inertial architecture, the system is tested using a combination of Monte-Carlo simulation and flight test data. The flight test data was flown over Edwards AFB using representative hardware. The experimental results are compared with validated truth data.

DTIC

*Detectors; Global Positioning System; Images; Imaging Techniques; Inertial Navigation; Position (Location); Positioning; Precision*

**20080024669** Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

**Journal of the Chinese Institute of Engineers, Volume 31, No. 2**

Chen, Shi-Shuenn, Editor; Tsai, Hsien-Lung, Editor; Cern, Ming-Jyh, Editor; Lee, Liang-Sun, Editor; Young, Der-Lian, Editor; Lu, Chan-Nan, Editor; Lee, San-Lian, Editor; Shieh, Ce-Kuen, Editor; Chao, Ching-Kong, Editor; March 2008; ISSN



0253-3839; 172 pp.; In English; See also 20080024670 - 20080024687; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Using Electrical Current to Determine the Non-Steady-State Migration Coefficient from Accelerated Chloride Migration Test; An Empirical Approach to Determine Peak Air Pressure within the 2-Pipe Vertical Drainage Stack; Flexural Analysis and Design Methods for SRC Beam Sections with Complete Composite Action; Copper Distribution for Contaminated Soils and Acid Wash Efficiency; Experimental Study on Seismic Performance of Steel Beam to SRC Column Connections; The Annealing Effect on the Improvement of Hermetically Carbon-Coated Optical Fibers Prepared by Plasma Enhanced Chemical Vapor Deposition Method With Methane and Argon as Precursor Gases; A New Noninvasive Assessment for Measuring the Instantaneous Intra-Arterial Blood Pressure via Tissue Control Method; Thermal Analysis and Optimal Design of Lamp Type Light-Emitting Diodes; Time-Domain Rotational Angle Identification of a Beam Structure Utilizing the Dynamic Transverse Deflection Signal; Influences of Thermal Annealing and Indium Content on Mechanical Stresses and Optoelectronic Characteristics of Light Emitter Diodes; Effect of Heterogeneity on Static Load Balance Algorithm Performance in DHT Systems; Improved Estimation of Residual Capacity of Batteries for Electric Vehicles; A Passivity-Based Controller Design for Three-Phase Active Rectifiers without Dynamic Feedback; Performance Analysis of Service Differentiation in Wireless Local Area Networks with Poisson Frame Arrivals; Classification of Modulated Signals Using Multifractal Features; Applying Likelihood on Hopfield Neural Network for Radar Tracking; A Study on the Relationship between Material and Electrical Properties of ZnO-Based Varistors; Entropy Generation of Forged Convection Film Condensation from Downward Flowing Vapors onto a Horizontal Tube.

Derived from text

*Electrical Properties; Accelerated Life Tests; Classifications; Diodes; Controllers; Electric Batteries; Gas Pressure; Light Emitting Diodes; Rectifiers; Radar Tracking*

**20080024672** College of Electronic Engineering, Chengdu, China

#### **Classification of Modulated Signals Using Multifractal Features**

He, Tao; Zhou, Zheng-Ou; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 335-338; In English; See also [20080024669](#); Copyright; Avail.: Other Sources

In this paper we develop a novel modulation classification scheme based on multifractal dimensions. Theoretic analysis demonstrates that these features are robust to noise interference, and simulation results indicate the proposed scheme can classify modulated types accurately in a large range of SNR variation.

Author

*Frequency Modulation; Acoustic Simulation; Classifications; Discrimination; Extraction*

**20080024673** National Kaohsiung Univ. of Applied Sciences, Kaohsiung, Taiwan, Province of China

#### **Entropy Generation of Forged Convection Film Condensation from Downward Flowing Vapors onto a Horizontal Tube**

Chen, Bo-Cong; Wu, Jia-Ruei; Yang, Sheng-An; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 349-354; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 95-2221-E-151-064; Copyright; Avail.: Other Sources

This study aims at analyzing entropy generation rate of saturated vapor flowing onto and condensing on an isothermal horizontal tube. The present paper uses a numerical approach to study the effects of various working parameters, including Reynold and Brinkman numbers on the entropy generation rate. Although dimensionless heat transfer coefficient is enhanced with an increase in Reynold group parameters, entropy generation number is augmented. Owing to an increase in gravity-driven film velocity, the flow friction irreversibility enhances enough so that it dominates over heat transfer irreversibility around the rear lower half of the tube perimeter.

Author

*Forced Convection; Heat Transfer Coefficients; Film Condensation; Heat Transfer; Entropy*

**20080024675** National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

#### **Improved Estimation of Residual Capacity of Batteries for Electric Vehicles**

Yang, Yee-Pien; Liu, Jien-Jang; Tsai, Chia-Hao; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 313-322; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 90-2212-E002-218; Copyright; Avail.: Other Sources

This paper proposes an improved means of estimation for the residual capacity of lead-acid batteries used in electric

vehicles. The residual capacity of batteries in commercial products is usually indicated by the state of charge (SOC) of the battery set, in terms of the measurement of amp-hours, or roughly an instant voltage. More practical and accurate SOC in the operation of electric vehicles must consider the original capacity when the battery is first installed, capacity deficiency due to high discharge rate, capacity dissipated in internal resistance, and correcting parameters for the battery aging process. The proposed estimation techniques include the amp-hours measurement weighted by a correction function of various discharge rates, the transient open-circuit voltage measurement to compensate for the energy dissipation from internal resistance, and the reset of parameters in the linear function of SOC and open-circuit voltage for the aging effect. A monitoring circuit with a programmable logic chip is implemented, and the experimental results show that a more accurate indication of SOC is achieved using the modified estimation techniques, namely a weighted ampere-hour measurement with transient open-circuit voltage combined with the aging effect.

Author

*Electric Batteries; Electric Potential; Capacitance; Lead Acid Batteries; Estimating; Electrical Measurement; Energy Dissipation*

**20080024677** National Defense Univ., Taiwan, Province of China

### **A Study on the Relationship between Material and Electrical Properties of ZnO-Based Varistors**

Chen, Hai-Lin; Lin, Chiung-Chih; Lee, Woei-Shyong; Whu, Wen-Hwa; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 343-347; In English; See also [20080024669](#); Copyright; Avail.: Other Sources

The relationship between the electrical parameters and the intrinsic material parameters of ZnO-based varistors derived from E-J and C-V measurements is discussed. The conventional mixed oxides method and the polymerized complex method were used to fabricate ZnO-based varistors with different additive and dopant contents. The intrinsic material parameters are the donor density  $N_d$ , the barrier height  $f_b$ , the surface state density  $N_s$ , and the final additives content and dopant/additive ratio. The electrical properties are the breakdown field  $E_{bk}$ , the nonlinear coefficient  $a$  and the leakage current density  $J_L$ . This work shows that the larger the surface state density, the larger the nonlinear coefficient will be. The larger the barrier height, the larger the breakdown field will be. The highest nonlinear coefficient was measured for the highest additive-content and the lowest dopant/additive ratio and vice versa.

Author

*Current Density; Zinc Oxides; Mixed Oxides; Electrical Properties; Polymerization; Varistors; Additives*

**20080024678** National United Univ., Taiwan

### **A Passivity-Based Controller Design for Three-Phase Active Rectifiers without Dynamic Feedback**

Lee, Tzann-Shin; Tzeng, Kune-Shiang; Chiang, Hsuang-Chang; Chong, Mai-Shiang; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 323-328; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 91-2213-E-239-014; Copyright; Avail.: Other Sources

In this paper, a new passivity-based design which does not employ dynamical state feedback is developed to achieve dc-bus voltage regulation and unity-power factor control for a three-phase boost-type PWM active rectifier. The results may be considered as an improvement to the previously published scheme of Lee using the passivity-based control theory of Euler-Lagrange (EL) systems. The proposed controller can retain the advantages of dynamic state-feedback controller, which yields fast dynamic response, near unity power factor, low harmonic distortion in line currents, decoupled current-loop dynamics and guaranteed zero steady-state error. Since the passivity-based methodology is a nonlinear approach, good tracking response and global stability can be assured under large perturbations in parameters and loads. Experimental results are given. Comparison of the performance of the proposed design with classical linear proportional-integral and passivity-based dynamic state-feedback controllers are also discussed.

Author

*Passivity; Controllers; Control Theory; Rectifiers; Feedback; Euler-Lagrange Equation; Dynamic Response; Steady State*

**20080024681** National Taiwan Ocean Univ., Keelung, Taiwan, Province of China

### **Using Electrical Current to Determine the Non-Steady-State Migration Coefficient from Accelerated Chloride Migration Test**

Chiang, Shih-Che; Yang, Chung-Chia; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 189-197; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 94-2211-E-019-018; Copyright; Avail.: Other Sources

In this study, the migration coefficient of concrete was measured by the accelerated chloride migration test (ACMT).

Concrete specimens (100 mm diameter and 200 mm height) made with different w/c (ranging from 0.3 to 0.65) were used. The steady-state migration coefficient was obtained by the chloride flux in the anode cell, and the non-steady-state migration coefficients were obtained by both the chloride concentration and the electrical current methods. The migration coefficients from steady-state migration, non-steady-state migration, and electrical current measurements were compared. Good correlations between all these migration coefficients were obtained. In order to avoid sampling and analyzing chlorides during the test, the new method for determining the non-steady-state migration coefficient in concrete by measuring the electrical current can be used in the ACMT method.

Author

*Migration; Electric Current; Electrical Measurement; Steady State; Accelerated Life Tests; Concretes; Chlorides*

**20080024682** National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

**Flexural Analysis and Design Methods for SRC Beam Sections with Complete Composite Action**

Chen, Cheng-Cheng; Cheng, Chao-Lin; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 215-229; In English; See also [20080024669](#); Copyright; Avail.: Other Sources

Section analysis, that complies with complete composite and strain compatibility conditions of 810 SRC beam sections, was carried out to investigate the flexural behavior of SRC beam sections. As well, a correlation between the curvature ductility ratio and the depth of the neutral axis was established with fairly good agreement. A section analysis procedure, that fulfills all composite conditions with plastic stress distribution, is introduced for the calculation of moment capacity and the curvature ductility ratio of SRC beam sections. In addition, a design method, based on complete composite and plastic stress distribution, is proposed for the design of SRC beam sections to meet both the moment and curvature ductility requirements. The analysis and design methods proposed here are able to provide tools for more economical and rational SRC beam design, and are superior to the strength superposition design method

Author

*Beams (Supports); Correlation Coefficients; Curvature; Stress Distribution; Compatibility*

**20080024686** National Tsing Hua Univ., Hsinchu, Taiwan, Province of China

**Thermal Analysis and Optimal Design of Lamp Type Light-Emitting Diodes**

Yeh, Meng-Kao; Huang, Yi-Liang; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 271-278; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 95-2221-E-015; Copyright; Avail.: Other Sources

The steady-state temperature distribution and the corresponding thermal stresses of packaged light-emitting diodes (LEDs) were investigated numerically via three-dimensional finite element analysis. An LED lamp mounted on a FR-4 printed circuit board was simulated under a natural convection environment. The junction-to-ambient thermal resistance ( $R_{(ub\ ja)}$ ) was found to be 335K/W. The maximum thermal stress due to mismatch of thermal expansion coefficients occurred in the interface between silver epoxy and encapsulation. By response surface methodology, 13 design points were established and a regressive model was obtained using the least squares method. The optimal variables, which can effectively reduce the junction-to-ambient thermal resistance, can be determined by increasing the thermal conductivity of lead frame material, by increasing the height of encapsulation, and by widening the cathode by no more than a critical value. The results obtained from the Taguchi method are also discussed.

Author

*Thermal Analysis; Light Emitting Diodes; Thermal Resistance; Thermal Stresses; Free Convection; Finite Element Method; Least Squares Method*

**20080024687** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**Influences of Thermal Annealing and Indium Content on Mechanical Stresses and Optoelectronic Characteristics of Light Emitter Diodes**

Chen, Tei-Chen; Lee, Yuh-Ju; Wu, Hsiang-Chi; Ho, Chang-Hsien; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 291-299; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 93-2212-E-006-004; Copyright; Avail.: Other Sources

Light emitter diodes (LEDs) are typical layered structures composed of different film materials. During the fabrication of LEDs, the mechanical stresses induced in the thin films due to misfit in lattice constants and difference in thermal expansion coefficients between adjacent layers will lead to dislocations and defects in structures such as hillocks, cracks and voids, which will not only significantly reduce the strength of structures but also reduce the efficiency and stability of LEDs. In this article,

the influences of misfit strain, dislocation and thermal stresses due to difference in thermal expansion coefficients on total mechanical stresses of multilayered heterostructures are considered. A simple and powerful modified shear lag method is proposed to evaluate the mechanical stresses in LEDs subjected to thermal annealing treatment. Moreover, the influences of quantum-well structure and indium content on the mechanical stresses and optoelectronic characteristics of LEDs are also evaluated and discussed.

Author

*Annealing; Thermal Expansion; Mechanical Properties; Quantum Wells; Thermal Stresses; Thermal Energy; Emitters; Cracks*

**20080025037** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**IR DirectFET Extreme Environments Evaluation Final Report**

Burmeister, Martin; Mottiwala, Amin; June 2008; 55 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 949904.01.11.20

Report No.(s): JPL Publication 08-2; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40854>

In 2007, International Rectifier (IR) introduced a new version of its DirectFET metal oxide semiconductor field effect transistor (MOSFET) packaging. The new version (referred to as 'Version 2') enhances device moisture resistance, makes surface mount (SMT) assembly of these devices to printed wiring boards (PWBs) more repeatable, and subsequent assembly inspection simpler. In the present study, the National Aeronautics Space Administration (NASA) Jet Propulsion Laboratory (JPL), in collaboration with Stellar Microelectronics (Stellar), continued an evaluation of the DirectFET that they started together in 2006. The present study focused on comparing the two versions of the DirectFET and examining the suitability of the DirectFET devices for space applications. This study evaluated both versions of two DirectFET packaged devices that had both been shown in the 2006 study to have the best electrical and thermal properties: the IRF6635 and IRF6644. The present study evaluated (1) the relative electrical and thermal performance of both versions of each device, (2) the performance through high reliability testing, and (3) the performance of these devices in combination with a range of alternate solder alloys in the extreme thermal environments of deep space....

Author

*Metal Oxide Semiconductors; Field Effect Transistors; Temperature Effects; Microelectronics; Electrical Properties; Moisture Resistance; Printed Circuits; Rectifiers*

**20080025080** Army Research Lab., Adelphi, MD USA

**Photon Counting Chirped Amplitude Modulation Ladar**

Redman, Brian C; Stann, Barry L; Mar 2008; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478348; ARL-TN-305; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478348>

This work developed a method using Geiger-mode avalanche photodiode (GM-APD) photon counting detectors in the U.S. Army Research Laboratory's chirped amplitude modulation (AM) ladar receiver to yield sensitivities approaching the shot noise limit. Such sensitivities represent about four orders-of-magnitude improvement over the sensitivities of the currently used unity-gain, opto-electronic mixing metal-semiconductor-metal detectors. These sensitivity improvements may enable very compact, low power, eye-safe, and/or long-range ladars with low cost, low bandwidth readout integrated circuits for foliage and camouflage penetration, target ID, manned and unmanned ground and air vehicle navigation, three-dimensional face recognition, battle damage assessment, and change detection. Variants of the chirped AM ladar using a GM-APD that is experimentally assembled and tested and the benefits of new single photon counting detector products to the chirped AM ladar architecture are discussed.

DTIC

*Amplitude Modulation; Avalanche Diodes; Counting; Laser Range Finders; Optical Radar; Photons*

**20080025081** Army Research Lab., Adelphi, MD USA

**Thermal Characterization of Thin Films for MEMS Applications**

Howe, David J; Morgan, Brian; Feb 2008; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478358; ARL-TR-4378; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478358>

Thin film dielectrics play an important role in the fabrication and processes involved with microelectromechanical

systems (MEMS). Two such dielectrics that are used widely are silicon dioxide (SiO<sub>2</sub>) and photoresist. As a large portion of these systems use the conduction of heat through SiO<sub>2</sub> and photoresist layers, the thermal conductivity of these materials is crucial. In this work, the thermal conductivities of the above mentioned materials were determined using a micro-mesa test structure consisting of the dielectric to be measured sandwiched between two resistive temperature detectors, one acting as a heater. At near room temperature, the thermal conductivity of thin-film PECVD silicon dioxide was determined to be 1.06 Wm<sup>-1</sup>K<sup>-1</sup>, similar to known bulk values for SiO<sub>2</sub>. The thermal conductivity of photoresist measured around room temperature was determined to be 0.31 Wm<sup>-1</sup>K<sup>-1</sup>. Multiple film thicknesses were tested with these structures to account for interface effects.

DTIC

*Dielectrics; Microelectromechanical Systems; Thermal Conductivity; Thin Films*

**20080025101** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Status, Vision, and Challenges of an Intelligent Distributed Engine Control Architecture (Postprint)**

Behbahani, Alireza; Culley, Dennis; Carpenter, Sheldon; Mailander, Bill; Hegwood, Bobbie; Smith, Bert; Darouse, Christopher; Mahoney, Tim; Quinn, Ronald; Battestin, Gary; Sep 18, 2007; 41 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A478621; AFRL-RZ-WP-TP-2008-2042; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Distributed Engine Control Working Group (DECWG) consisting of the Department of Defense (DoD), the National Aeronautics and Space Administration (NASA)-Glenn Research Center (GRC) and industry has been formed to examine the current and future requirements of propulsion engine systems. The scope of this study will include an assessment of the paradigm shift from centralized engine control architecture to an architecture based on distributed control utilizing open system standards. Included will be a description of the work begun in the 1990's, which continues today, followed by the identification of the remaining technical challenges which present barriers to on-engine distributed control.

DTIC

*Active Control; Aircraft Engines; Control; Distributed Parameter Systems; Engine Control*

**20080025284** Naval Postgraduate School, Monterey, CA USA

**Multifractal Thermal Characteristics of the Western Philippine Sea Upper Layer**

Chu, Peter C; Hsieh, Chung-Ping; Jun 2007; 12 pp.; In English

Report No.(s): AD-A478878; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478878>

Multifractal characteristics of the upper layer (above 140 m depth) thermal structure in the western Philippine Sea near Taiwan are analyzed using high-resolution, digital thermistor chain data. The power spectra at all the depths have multi-scale characteristics with the spectral exponent beta in the range of (1, 2), which indicates nonstationary with stationary increments. The graph dimension varies from higher values such as 1.71 (in sublayer: 60 m), to lower values such as 1.59 (in second thermocline: 120 m). However, the information dimension varies slightly from 0.929 to 0.941. The multi-dimensional structure is stronger in nonstationary (graph dimension) than in intermittency (information dimension). These results provide useful information for investigating turbulence structure in the upper layer of the western Philippine Sea.

DTIC

*Seas; Thermistors; Thermodynamic Properties*

**20080025365** ICX Technologies, Inc., Arlington, VA USA

**Utilization of Chemical Vapor Detection of Explosives as a Means of Rapid Minefield Area Reduction**

Fisher, Mark; laGrone, Marcus; Cumming, Colin; Towers, Eric; Apr 2002; 16 pp.; In English

Report No.(s): AD-A479171; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479171>

Clearing large areas that are suspected of containing landmines is an expensive and time-consuming task. Upon the completion of demining operations, few, if any, landmines may be found. Technologies that can locate individual landmines in a minefield exist, but most of these methods are relatively slow and expensive. In addition, these technologies are not generally suitable for rapid screening of an area for the presence of landmines. Hence, technologies that can quickly ascertain whether there is an actual landmine threat in an area are needed. The explosive contained in landmines produces a bouquet

of chemical vapors that can contaminate the environment near a mine. Under the DARPA Dog's Nose Program, Nomadics developed a sensor (known as Fido) that utilizes novel fluorescent polymers to detect ultra-trace concentrations of nitroaromatic compounds emanating from landmines. Evidence currently available indicates that it may be possible to quickly deduce mine locations to within an area of a few square meters. Field data supporting this conclusion have been obtained using our sensor, and the conclusions drawn are supported by other accepted laboratory analysis methods. These results are driving development of sampling and sensing equipment that may be suitable for rapidly isolating mined areas within large minefields. Preliminary data from field tests using prototype soil and vapor samplers with Fido sensors will be presented.

DTIC

*Chemical Explosions; Detection; Detectors; Explosives; Mines (Ordnance); Vapors*

**20080025368** Naval Surface Warfare Center, Panama City, FL USA

**Object Detection Using a Background Anomaly Approach for Electro-Optic Identification Sensors**

Nevis, Andrew; Bryan, James; Taylor, J S; Cordes, Brett; Apr 2002; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A479176; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479176>

Electro-optic identification (EOID) sensors are transitioning to the fleet and will be used as a short-range identification tool for mine-like contacts from long-range sensors. The present operation of the EOID sensors uses an operator for identification. Whereas the human operator is unparalleled in detecting and recognizing objects of interest, there are still some limitations which may be needed to distinguish between mine types, such as differentiating a 68 inch object from a 72 inch object in a still image or moving waterfall display. To help overcome some of these weaknesses and improve the mine identification process, computer aided identification (CAI) and automatic target recognition (ATR) algorithms are being developed. In addition to building a foundation towards the long-term goal of fully autonomous operation, these algorithms can be used to queue operators of potential mine-like objects within the data as well as to segment and compute vital geometric information on manually flagged objects of interest. The operator can then use this supplementary information for a more accurate identification. The near-term objective is to develop and implement these CAI/ATR algorithms into a real-time console and/or a post mission analysis (PMA) tool that can be used in the FY05 Organic Mine Warfare future naval capability (FNC) demonstration.

DTIC

*Anomalies; Detection; Detectors; Electro-Optics*

**20080025373** Naval Surface Warfare Center, Panama City, FL USA

**Electro-Optic Identification Research Program**

Taylor, Jr , James S; Hulgán, Mary C; Apr 2002; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A479189; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479189>

Electro-optic identification (EOID) sensors provide photographic quality images that can be used to identify mine-like contacts provided by long-range sensors, such as sonar systems. To help support the transition of these sensors to the Fleet as well as to aid in the development of future EOID sensors, the Office of Naval Research (322-OP) has funded a five-year research program to investigate the performance properties of existing EOID sensors as a function of ocean environment. This paper describes the EOID research program and its objectives along with a brief discussion of supporting tasks such as validating existing electro-optic models, development of performance metrics, and development of computer aided identification and automatic target recognition algorithms. In addition, data from the recent field test will be presented.

DTIC

*Electro-Optics; Marine Environments*

**20080025459** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Electrical Outlet Box With Secure Quick Connect and Release Features**

Chopra, Kewal K, Inventor; Sep 7, 2004; 9 pp.; In English

Report No.(s): AD-D020351; PATENT-6 786 766 B1; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020351>

An electrical outlet or junction box is provided herein for interiorly accommodating at least one electrical device and at least one cable furnished to said box by a manual source. A secure, quick connect and release capability for electrically connecting said cable and electrical device is supplied by one or more terminal blocks that are mounted to an interior wall

of said box. These blocks carry at least one receiving means and at least one releasing means along an exterior surface. The box itself, comprises a rear wall which is perimetrically bounded by an outer wall that extends outwardly from said rear wall to define an integral structure with an open front opposite of the rear wall. The electrical device is then energized by supplying said cable with electricity from an external power source.

DTIC

*Electric Equipment; Patents; Supplying*

**20080025460** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Two Position Mounting Bracket for Computer Display**

Manceor, Michael J, Inventor; Sep 28, 2004; 8 pp.; In English

Report No.(s): AD-D020352; PATENT-6 796 540 B1; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020352>

A bracket for mounting a view screen fixes the screen in a retracted or a deployed position. The bracket has a base plate fixed to an upright panel. A carrier plate both swings and vertically translates on the base plate. Hinged between the base plate and the carrier plate is a bridge plate. The carrier plate holds the screen, whereby swinging the carrier plate away from the base plate will tilt the screen. A latch subassembly disposed on the carrier plate has a finger that locks to either a tang of the bridge plate or a projection of the base plate to hold the bracket respectively in the deployed or the retracted position. The latch subassembly includes a grip-squeeze actuator to release the finger from the bridge plate or the base plate.

DTIC

*Brackets; Computers; Display Devices; Mounting; Patents*

**20080025468** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**Microdischarges for Phased Arrays of Low Coherence Emitters, and Microchip and Microsphere Lasers**

Eden, J G; Feb 2008; 24 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0391

Report No.(s): AD-A479241; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Arrays as large as 250,000 Si microcavity plasma devices have been fabricated and tested extensively. Exciting a phosphor with VUV emission from these arrays yields values of the luminous efficacy  $> 7$  lumens/W, considerably higher than that available from conventional plasma displays. A new microplasma technology based on nanoporous Al<sub>2</sub>O<sub>3</sub> grown on Al has been developed, and arrays with emitting areas  $> 20$  cm<sup>2</sup> have been demonstrated. Successfully sealed in plastic sheets, or with a thin glass or quartz window, these arrays are quite inexpensive and manufacturable by roll-to-roll processing. Shaping of the electric field within a microplasma has been achieved by engineering the plasma/dielectric interface.

DTIC

*Chips (Electronics); Electric Fields; Emitters; Lasers; Microparticles; Phased Arrays; Plasmas (Physics)*

**20080025508** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Integrated Thermal Modules for Cooling Silicon and Silicon Carbide Power Modules**

Roderick, G L; Burke, Terence; Khalil, Ghassan; Jun 11, 2007; 32 pp.; In English

Report No.(s): AD-A479347; TARDEC-17102; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Integrated Thermal Modules (ITMs) are being developed to cool power modules with high-temperature fluids. Three dimensional finite element method analyses, bench tests, and motor tests comprise the program. The ITMs, in place of standard heatsinks, use a highly conductive pyrolytic graphite to passively cool power modules. Initial results show that even simple ITMs can lower chip temperatures by 20 deg. C and 10 deg. C with engine oil and propylene glycol coolants respectively. Motor tests record real-time IGBT temperatures. Two converters, one using Silicon (Si) diodes and the other using Silicon Carbide (SiC) diodes, are being used for testing the ITMs. Initial Motor tests with the baseline heatsink have shown that the SiC diodes lower IGBT temperatures by 8% as compared to Si diodes.

DTIC

*Cooling; Diodes; Modules; Silicon Carbides*

**20080025529** Alabama Univ., University, AL USA

**Determination of Semiconductor Junction Vulnerability to Second Breakdown**

Raburn, Wilford D; Causey, Wayne H; Jun 1977; 201 pp.; In English

Contract(s)/Grant(s): DAAH01-74-C-0789

Report No.(s): AD-A479406; BER-200-93; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A comprehensive numerical diode model for simulation of thermal second breakdown is developed. The model features

one-dimensional electrical effects and simplified two-dimensional thermal conduction along with thermally dependent semiconductor parameters. Four, coupled, nonlinear, partial differential equations which consist of the hole and electron continuity equations, the Poisson equation and the energy balance equation characterize the model. These equations are solved simultaneously for mobile hole and electron concentrations, electric field, and temperature as functions of time and position. A contact-to-contact transient simulation with realistic terminal boundary conditions and a constant temperature substrate is performed. Investigations with the numerical model have led to several conclusions with respect to thermal second breakdown. First, it is observed that junction inhomogeneities, current constrictions and variable perturbations, through various mechanisms, are not required to initiate and support thermal second breakdown. Second, the simulation results support the theory that thermal second breakdown is primarily a consequence of the diode leakage current temperature dependence. Third, under appropriate conditions the thermal second breakdown transition results in all but a total collapse of the junction voltage without the benefit of a melt filament.

DTIC

*Diodes; Electric Fields; Semiconductor Junctions; Vulnerability*

**20080025546** California Univ., Los Angeles, CA USA

**Carrier and Timing Synchronization of BPSK via LDPC Code Feedback**

Valles, Esteban L; Wesel, Richard D; Villasenor, John D; Jones, Christopher R; Nov 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0253

Report No.(s): AD-A479472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In traditional receiver architectures, symbol acquisition and tracking are performed using phase lock techniques that are independent of the channel-code decoding process. In previous research [Lee, Valles, Villasenor & Jones, 2006], feedback from the constraint-node side of a bi-partite graph is used to estimate symbol frequency and timing offset in a baseband pilotless transmission. Soft information feedback from an LDPC decoder is used to recover carrier phase information under the assumption of perfect symbol timing in [Simon, Valles, Jones, Wesel, & Villasenor, 2006]. In this paper we address the problem of joint carrier-phase and symbol timing recovery. The proposed system is able to perform within 0.3 [dB] of the code performance with perfect knowledge of carrier phase and symbol timing.

DTIC

*Binary Phase Shift Keying; Feedback; Signal Processing; Synchronism; Time Measurement*

**20080025640** NASA, Washington, DC USA

**Ferroelectric Light Control Device**

Park, Yeonjoon, Inventor; Choi, Sang H., Inventor; King, Glen C., Inventor; Kim, Jae-Woo, Inventor; Elliott, Jr., James R., Inventor; May 27, 2008; 10 pp.; In English

Patent Info.: Filed September 7, 2006; US-Patent-7,379,231; US-Patent-Appl-SN-11/470,771; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025640>

A light control device is formed by ferroelectric material and N electrodes positioned adjacent thereto to define an N-sided regular polygonal region or circular region there between where N is a multiple of four.

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

*Control Equipment; Ferroelectric Materials; Electrodes*

**20080025652** International Business Machines Corp., Armonk, NY USA

**Apparatus and methods for packaging integrated circuit chips with antenna modules providing closed electromagnetic environment for integrated antennas**

Gaucher, Brian P., Inventor; Grzyb, Janusz, Inventor; Liu, Duixian, Inventor; Pfeiffer, Ullrich R., Inventor; May 13, 2008; 14 pp.; In English

Contract(s)/Grant(s): NAS3-03070

Patent Info.: Filed January 13, 2006; US-Patent-7,372,408; US-Patent-Appl-SN-11/332,737; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025652>

Apparatus and methods are provided for packaging IC chips together with integrated antenna modules designed to provide



a closed EM (electromagnetic) environment for antenna radiators, thereby allowing antennas to be designed independent from the packaging technology.

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

*Closed Ecological Systems; Integrated Circuits; Modules; Chips*

**20080025690** NASA, Washington, DC USA

**Hybrid electromechanical actuator and actuation system**

Su, Ji, Inventor; Xu, Tian-Bing, Inventor; July 1, 2008; 10 pp.; In English

Patent Info.: Filed March 4, 2005; US-Patent-7,394,181; US-Patent-Appl-SN-11/076,824; No Copyright; Avail.: CASI:

A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025690>

A hybrid electromechanical actuator has two different types of electromechanical elements, one that expands in a transverse direction when electric power is applied thereto and one that contracts in a transverse direction when electric power is applied thereto. The two electromechanical elements are (i) disposed in relation to one another such that the transverse directions thereof are parallel to one another, and (ii) mechanically coupled to one another at least at two opposing edges thereof. Electric power is applied simultaneously to the elements.

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

*Actuators; Electromechanical Devices*

**20080025694** California Inst. of Tech., Pasadena, CA USA

**Fabrication of nano-gap electrode arrays by the construction and selective chemical etching of nano-crosswire stacks**

Son, Kyung-Ah, Inventor; Prokopuk, Nicholas, Inventor; June 10, 2008; 20 pp.; In English

Patent Info.: Filed May 31, 2005; US-Patent-7,385,295; US-Patent-Appl-SN-11/141,486; No Copyright; Avail.: CASI:

A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025694>

Methods of fabricating nano-gap electrode structures in array configurations, and the structures so produced. The fabrication method involves depositing first and second pluralities of electrodes comprising nanowires using processes such as lithography, deposition of metals, lift-off processes, and chemical etching that can be performed using conventional processing tools applicable to electronic materials processing. The gap spacing in the nano-gap electrode array is defined by the thickness of a sacrificial spacer layer that is deposited between the first and second pluralities of electrodes. The sacrificial spacer layer is removed by etching, thereby leaving a structure in which the distance between pairs of electrodes is substantially equal to the thickness of the sacrificial spacer layer. Electrode arrays with gaps measured in units of nanometers are produced. In one embodiment, the first and second pluralities of electrodes are aligned in mutually orthogonal orientations.

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

*Etching; Fabrication; Nanowires*

**20080025695** Rice Univ., Houston, TX USA

**Process for attaching molecular wires and devices to carbon nanotubes and compositions thereof**

Tour, James M., Inventor; Bahr, Jeffrey L., Inventor; Yang, Jiping, Inventor; June 10, 2008; 25 pp.; In English

Contract(s)/Grant(s): NCC9-77

Patent Info.: Filed August 1, 2003; US-Patent-7,384,815; US-Patent-Appl-SN-10/632,948; No Copyright; Avail.: CASI:

A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025695>

The present invention is directed towards processes for covalently attaching molecular wires and molecular electronic devices to carbon nanotubes and compositions thereof. Such processes utilize diazonium chemistry to bring about this marriage of wire-like nanotubes with molecular wires and molecular electronic devices.

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

*Carbon Nanotubes; Nanotubes; Wire*

**20080025767** Burr and Brown, Syracuse, NY, USA

**Line-Replaceable Transmit/Receive Unit for Multi-Band Active Arrays**

Edward, B. J., Inventor; Marziale, J. M., Inventor; Ruzicka, P. J., Inventor; 23 Jul 04; 16 pp.; In English

Patent Info.: Filed Filed 23 Jul 04; US-Patent-Appl-SN-10-897-450

Report No.(s): PB2007-109103; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A line-replaceable unit for a phased array antenna including a thermally conductive housing having a front face and an opposed rear face, at least one open-ended waveguide extending through the housing from the front face to the rear face, at least one first radiating element including the waveguide and adapted to emit energy in a first frequency band; and at least one second radiating element positioned on the front face of the housing and adapted to emit energy in a second frequency band distinct from the first frequency band. The waveguide is dimensioned to pass energy in the first frequency band and is exposed to the environment outside the housing at the front and rear faces to define a cooling duct passing through the housing.

NTIS

*Antenna Arrays; Cooling Systems; Phased Arrays; Signal Reception; Transmission*

**20080025769** Texas Univ. System, Austin, TX, USA

**Light-Emitting Nanoparticles and Method of Making Same**

Korgel, B. A., Inventor; Johnston, K. P., Inventor; 7 Oct 04; 57 pp.; In English

Contract(s)/Grant(s): NSF-26-1122-20XX

Patent Info.: Filed Filed 7 Oct 04; US-Patent-Appl-SN-10-959-247

Report No.(s): PB2007-110577; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A method for the production of a robust, chemically stable, crystalline, passivated nanoparticle and composition containing the same, that emit light with high efficiencies and size-tunable and excitation energy tunable color. The methods include the thermal degradation of a precursor molecule in the presence of a capping agent at high temperature and elevated pressure. A particular composition prepared by the methods is a passivated silicon nanoparticle composition displaying discrete optical transitions.

NTIS

*Light Emitting Diodes; Nanoparticles; Patent Applications*

**20080025788** Schwegman Lundberg Woessner and Kluth, PA, Minneapolis, MN, USA

**Multi-Current Elements for Magnetic Resonance Radio Frequency Coils**

Vaughan, J. T., Inventor; Adrian, G., Inventor; Snyder, C., Inventor; Akgun, C. E., Inventor; Tiam, J., Inventor; 6 May 05; 15 pp.; In English

Contract(s)/Grant(s): NIH-P41-RR0808079; NIH-R01-CA94200

Patent Info.: Filed Filed 6 May 05; US-Patent-Appl-SN-11-124-421

Report No.(s): PB2007-110613; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A current unit having two or more current paths allows control of magnitude, phase, time, frequency and position of each of element in a radio frequency coil. For each current element, the current can be adjusted as to a phase angle, frequency and magnitude. Multiple current paths of a current unit can be used for targeting multiple spatial domains or strategic combinations of the fields generated/detected by combination of elements for targeting a single domain in magnitude, phase, time, space and frequency.

NTIS

*Magnetic Resonance; Nuclear Magnetic Resonance; Radio Frequencies; Resonant Frequencies; Coils*

**20080025789** Honeywell International, Inc., Morristown, NJ, USA

**High Density 3-D Integrated Circuit Package**

Sullivan, G. J., Inventor; Rau, J. R., Inventor; Adkins, L. R., Inventor; Hughes, A. J., Inventor; 12 Jul 05; 7 pp.; In English

Contract(s)/Grant(s): DASG-60-90-C-0136

Patent Info.: Filed Filed 12 Jul 05; US-Patent-Appl-SN-11-179-377

Report No.(s): PB2007-110607; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A slotted file is created by connecting two side walls and a back wall. The side walls have etched grooves facing directly across from each other. The platelet has flanges that fit into the grooves. In one embodiment, a completed cube is formed when the platelets fill the slotted file.

NTIS

*Electronic Packaging; Integrated Circuits; Three Dimensional Bodies*

**20080025792** Ladas and Parry, Los Angeles, CA, USA

**Integrated MMIC Modules for Millimeter and Submillimeter Wave System Applications**

Choudhury, D., Inventor; Schmitz, A. E., Inventor; 28 May 04; 25 pp.; In English

Contract(s)/Grant(s): F336-15-99-C-1512

Patent Info.: Filed Filed 28 May 04; US-Patent-Appl-SN-10-856-106

Report No.(s): PB2007-110615; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An integrated circuit module comprising integrated coupling transmission structures protruding from the main body of the integrated circuit with extra substrate material removed around and/or under the coupling transmission structures.

NTIS

*Integrated Circuits; Microwave Circuits; Microwaves; Millimeter Waves; Modules; Patent Applications; Submillimeter Waves*

**20080025802** Wells Saint John, P.S, Spokane, WA, USA

**Methods of Forming a Base Plate for a Field Emission Display (FED) Device, Methods of Forming a Field Emission Display (FED) Device, Base Plates for Field Emission Display (FED) Devices, and Field Emission Display (FED) Devices**

Derraa, A., Inventor; 17 Aug 05; 7 pp.; In English

Contract(s)/Grant(s): DARPA-DABT6397-C-0001

Patent Info.: Filed Filed 17 Aug 05; US-Patent-Appl-SN-11-207-010

Report No.(s): PB2007-110021; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Methods of forming base plates for field emission display (FED) devices, methods of forming field emission display (FED) devices, and resultant FED base plate and device constructions are described. In one embodiment, a substrate is provided and is configurable into a base plate for a field emission display. A plurality of discrete, segmented regions of field emitter tips are formed by at least removing portions of the substrate. The regions are electrically isolated into separately-addressable regions. In another embodiment, a plurality of field emitters are formed from material of the substrate and arranged into more than one demarcated, independently-addressable region of emitters. Address circuitry is provided and is operably coupled with the field emitters and configured to independently address individual regions of the emitters. In yet another embodiment, a monolithic addressable matrix of rows and columns of field emitters is provided and has a perimetral edge defining length and width dimensions of the matrix. The matrix is partitioned into a plurality of discretely-addressable sub-matrices of field emitters. Row and column address lines are provided and are operably coupled with the matrix and collectively configured to address the field emitters. At least one of the row or column address lines has a length within the matrix which is sufficient to address less than all of the field emitters which lie in the direction along which the address line extends within the matrix.

NTIS

*Display Devices; Field Emission; Helmet Mounted Displays; Patent Applications*

**20080025804** Sparkman (Klarquist), LLP, Portland, OR, USA

**Electrical Injury Protection System**

Zeng, S., Inventor; Powers, J. R., Inventor; Jackson, L. L., Inventor; Conover, D. L., Inventor; Stout, N. A., Inventor; 9 May 05; 39 pp.; In English

Patent Info.: Filed Filed 9 May 05; US-Patent-Appl-SN-11-126-009

Report No.(s): PB2007-110614; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present disclosure concerns an electrical injury protection system for protecting individuals working on or near a power circuit. In one embodiment, the system comprises a controller that is electrically connected to a power circuit and a detector that is carried by a user working. The detector has three or more electrodes mounted on the user's body which detect the electric field induced on the body by the power circuit. The detector is operable to detect the voltage between each pair of electrodes and activate an alarm if the voltage between any electrode pair exceeds a predetermined proximity threshold. If the voltage between an electrode pair exceeds a predetermined electrical-contact threshold, the detector transmits a tripping signal to the controller to activate a tripping mechanism, which de-energizes the power circuit. In certain embodiments, the controller can be used to monitor the de-energized condition of a de-energized circuit.

NTIS

*Electric Power Transmission; Injuries; Protection; Warning Systems; Safety Devices*

**20080025815** Fletcher Yoder, Houston, TX, USA

**System and Method for Regulating Resonant Inverters**

Stevanovic, L. D., Inventor; Zane, R. A., Inventor; 25 May 04; 9 pp.; In English

Contract(s)/Grant(s): DE-FC26-02NT41252

Patent Info.: Filed Filed 25 May 04; US-Patent-Appl-SN-10-853-695

Report No.(s): PB2007-110618; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A technique is provided for direct digital phase control of resonant inverters based on sensing of one or more parameters of the resonant inverter. The resonant inverter control system includes a switching circuit for applying power signals to the resonant inverter and a sensor for sensing one or more parameters of the resonant inverter. The one or more parameters are representative of a phase angle. The resonant inverter control system also includes a comparator for comparing the one or more parameters to a reference value and a digital controller for determining timing of the one or more parameters and for regulating operation of the switching circuit based upon the timing of the one or more parameters.

NTIS

*Inverters; Patent Applications*

**20080025817** Defense Advanced Research Projects Agency, Arlington, VA, USA

**Apparatus to Control Displacement of a Body Spaced-Apart from a Surface**

Choi, B. J., Inventor; Sreenivasan, S. V., Inventor; Johnson, S. C., Inventor; 29 Apr 05; 21 pp.; In English

Contract(s)/Grant(s): DARPA-N66001-98-1-8914

Patent Info.: Filed Filed 29 Apr 05; US-Patent-Appl-SN-11-118-070

Report No.(s): PB2007-110611; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus to control displacement of a body spaced-apart from a surface includes a flexure system having a first flexure member defining a first axis of rotation and a second flexure member defining a second axis of rotation. A body is coupled to the flexure system to move about a plurality of axes. An actuation system is coupled to the flexure system to selectively constrain movement of the body along a subset of the plurality of axes.

NTIS

*Displacement; Lithography; Manufacturing; Axes of Rotation*

**20080025819** Needle and Rosenberg, P.C., Atlanta, GA, USA

**Non-Magnetic Semiconductor Spin Transistor**

Hall, K. C., Inventor; Lau, W. H., Inventor; Gundogdu, K., Inventor; Flatte, M. E., Inventor; Boggess, T. F., Inventor; 28 Feb 05; 16 pp.; In English

Contract(s)/Grant(s): DARPA-MDA972-01-C-0002

Patent Info.: Filed Filed 28 Feb 05; US-Patent-Appl-SN-11-068-562

Report No.(s): PB2007-110606; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A nonmagnetic semiconductor device which may be utilized as a spin resonant tunnel diode (spin RTD) and spin transistor, in which low applied voltages and/or magnetic fields are used to control the characteristics of spin-polarized current flow. The nonmagnetic semiconductor device exploits the properties of bulk inversion asymmetry (BIA) in (110)-oriented quantum wells. The nonmagnetic semiconductor device may also be used as a nonmagnetic semiconductor spin valve and a magnetic field sensor. The spin transistor and spin valve may be applied to low-power and/or high-density and/or high-speed logic technologies. The magnetic field sensor may be applied to high-speed hard disk read heads. The spin RTD of the present invention would be useful for a plurality of semiconductor spintronic devices for spin injection and/or spin detection.

NTIS

*Semiconductor Devices; Semiconductors (Materials); Transistors; Spin; Tunnel Diodes*

**20080025830** Plevy, Howard, and Dracy, P.C., Fort Washington, PA, USA

**Compact Semiconductor-Based Chirped-Pulse Amplifier System and Method**

Braun, A. M., Inventor; Delfyett, P. J., Inventor; 16 May 05; 10 pp.; In English

Contract(s)/Grant(s): DARPA-MDA-972-03-C-0043

Patent Info.: Filed Filed 16 May 05; US-Patent-Appl-SN-11-130-038

Report No.(s): PB2007-110623; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A compact signal source including: a semiconductor-based, pulsed optical energy source for providing a series of pulses at a given frequency; a selector being optical fiber coupled to the pulsed optical energy source and for down-selecting the

pulses to a lower frequency; a stretcher being optical fiber coupled to the selector and for temporally stretching the selected pulses; at least one semiconductor-based optical amplifier being optical fiber coupled to the stretcher and for amplifying the selected pulses; a compressor being optical fiber coupled to the at least one semiconductor-based amplifier and for temporally compressing the amplified, stretched, selected pulses; and, a portable housing containing the pulsed optical energy source, stretcher, at least one semiconductor-based optical amplifier and compressor.

NTIS

*Light Amplifiers; Patent Applications; Semiconductors (Materials)*

**20080025835** Grossman, Tucker, Perreault and Pflieger, PLLC, Manchester, MN, USA

**Magnetic Bearing Using Displacement Winding Techniques**

Carroll, D., Inventor; Salwen, J., Inventor; 10 May 05; 14 pp.; In English

Contract(s)/Grant(s): DOD-29601-01-C-0174

Patent Info.: Filed Filed 10 May 05; US-Patent-Appl-SN-11-125-917

Report No.(s): PB2007-110610; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides a linear, rotary spherical motor with an integrated magnetic bearing. The motor can be a toothless permanent magnet, BLDC design composed of a permanent magnet rotor and a Zigzag stator winding containing at least two-phase windings, where each phase is constructed of at least two circuits. Other exemplary embodiments include a trapezoidal winding configuration. The individual circuits of a phase are displaced away from each other along a line that is at right angles to the direction of the alternating polarity magnet array. The circuits forming a phase share the same 'slot', and each circuit resembles a complete phase winding, however each circuit contains a proportion of the total number of turns of the phase. Controllable axial bearing force is developed through the differential balance of the currents in the circuits, while required motor torque is generated by the sum of the individual currents in a given phase. The relative motion in the rotor can produce back EMF which can provide positional information; (1) in the direction parallel to the magnet array via the sum of the voltages in a phase; (2) in the direction normal to the magnet array via the difference in circuit voltages.

NTIS

*Displacement; Magnetic Bearings; Winding; Circuits; Electric Motors*

**20080025913** Lober (T. A.) Patent Services, Concord, MA, USA

**Suspended Carbon Nanotube Field Effect Transistor**

Golovchenko, J. A., Inventor; Peng, H., Inventor; 6 Jun 05; 24 pp.; In English

Contract(s)/Grant(s): DARPA-F49620-01-1-0467; DMR-0073590

Patent Info.: Filed Filed 6 Jun 05; US-Patent-Appl-SN-11-145-650

Report No.(s): PB2007-111584; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The invention provides a carbon nanotube field effect transistor including a nanotube having a length suspended between source and drain electrodes. A gate dielectric material coaxially coats the suspended nanotube length and at least a portion of the source and drain electrodes. A gate metal layer coaxially coats the gate dielectric material along the suspended nanotube length and overlaps a portion of the source and drain electrodes, and is separated from those electrode portions by the gate dielectric material. The nanotube field effect transistor is fabricated by coating substantially the full suspended nanotube length and a portion of the source and drain electrodes with a gate dielectric material. Then the gate dielectric material along the suspended nanotube length and at least a portion of the gate dielectric material on the source and drain electrodes are coated with a gate metal layer.

NTIS

*Carbon Nanotubes; Field Effect Transistors; Patent Applications*

**20080025930** DTE Energy, MI, USA; Electrical Distribution Design, Inc., Blacksburg, VA, USA; Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

**Modeling and Testing of Unbalanced Loading and Voltage Regulation**

Davis, M. W.; Broadwater, R.; Hambrick, J.; Jul. 2007; 363 pp.; In English

Contract(s)/Grant(s): DE-AC36-99-GO10337

Report No.(s): DE2007-912489; No Copyright; Avail.: National Technical Information Service (NTIS)

This report covers work to (1) develop and validate distribution circuit models, (2) determine optimum distributed generator operating conditions, and (3) determine distributed generation penetration limits.

NTIS

*Voltage Regulators; Models; Circuits*

**20080025939** Summa, Allan and Addition, P.A., Charlotte, NC, USA

**Silicon-Rich Nickel-Silicide Ohmic Contacts for SiC Semiconductor Devices**

Ward, A., Inventor; Henning, J. P., Inventor; Hagleitner, H., Inventor; Wieber, K. D., Inventor; 6 Jul 04; 10 pp.; In English  
Contract(s)/Grant(s): ONR-N00014-02-C-0250

Patent Info.: Filed Filed 6 Jul 04; US-Patent-Appl-SN-10-884-930

Report No.(s): PB2007-111585; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method of producing an ohmic contact and a resulting ohmic contact structure are disclosed. The method includes the steps of forming a deposited film of nickel and silicon on a silicon carbide surface at a temperature below which either element will react with silicon carbide and in respective proportions so that the atomic fraction of silicon in the deposited film is greater than the atomic fraction of nickel, and heating the deposited film of nickel and silicon to a temperature at which nickel-silicon compounds will form with an atomic fraction of silicon greater than the atomic fraction of nickel but below the temperature at which either element will react with silicon carbide. The method can further include the step of annealing the nickel-silicon compound to a temperature higher than the heating temperature for the deposited film, and within a region of the phase diagram at which free carbon does not exist.

NTIS

*Nickel; Patent Applications; Semiconductor Devices; Silicides; Silicon*

**20080025955** Bozicevic, Field and Francis, LLP, Palo Alto, CA, USA

**Organo Luminescent Semiconductor Nanocrystal Probes for Biological Applications and Process for Making and Using Such Probes**

Weiss, S., Inventor; Bruchez, M., Inventor; Alivisatos, P., Inventor; 12 Aug 04; 11 pp.; In English

Contract(s)/Grant(s): DE-AC03-SF00098

Patent Info.: Filed Filed 12 Aug 04; US-Patent-Appl-SN-10-918 622

Report No.(s): PB2007-113854; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A semiconductor nanocrystal compound is described capable of linking to an affinity molecule. The compound comprises (1) a semiconductor nanocrystal capable of emitting electromagnetic radiation and/or absorbing energy, and/or scattering or diffracting electromagnetic radiation--when excited by an electromagnetic radiation source or a particle beam; and (2) at least one linking agent, having a first portion linked to the semiconductor nanocrystal and a second portion capable of linking to an affinity molecule. The compound is linked to an affinity molecule to form a semiconductor nanocrystal probe capable of bonding with a detectable substance. Subsequent exposure to excitation energy will excite the semiconductor nanocrystal in the probe causing the emission of electromagnetic radiation. Further described are processes for respectively: making the luminescent semiconductor nanocrystal compound; making the semiconductor nanocrystal probe; and using the probe to determine the presence of a detectable substance in a material.

NTIS

*Electromagnetic Radiation; Luminescence; Molecules; Nanocrystals; Patent Applications; Semiconductors (Materials)*

**20080025968** Johns Hopkins Univ., Laurel, MD, USA

**Variable Damping Induction Coil for Metal Detection**

Nelson, C. V., Inventor; 16 Sep 04; 9 pp.; In English

Contract(s)/Grant(s): NV-N00024-98-D-8124

Patent Info.: Filed Filed 16 Sep 04; US-Patent-Appl-SN-10-942-150

Report No.(s): PB2007-111586; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A pulse inductive metal detector that includes a variable resistor for controlling coil characteristics for both transmitter and receiver modes of operation. A coil coupled with an electronic switch is charged with current from the power source in a transmitter mode such that when the electronic switch is abruptly switched closed the coil emits a magnetic field that induces eddy currents in a metal target. Once the transmitter magnetic fields have decayed enough, the coil can be operated in a

receiver mode to detect a magnetic field resulting from eddy currents in the metal target. The variable resistor is coupled across the coil for varying the resistance across the coil to optimize the pulse inductive metal detector sensitivity to the metal target.  
NTIS

*Damping; Detection; Metals; Patent Applications; Receivers; Transmitters*

**20080025988** NASA Glenn Research Center, Cleveland, OH, USA

**Comparison of Nonlinear Filtering Techniques for Lunar Surface Roving Navigation**

Kimber, Lemon; Welch, Bryan W.; May 2008; 20 pp.; In English; Original contains color and black and white illustrations

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

Report No.(s): NASA/TM-2008-215152; E-16352; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025988>

Leading up to the Apollo missions the Extended Kalman Filter, a modified version of the Kalman Filter, was developed to estimate the state of a nonlinear system. Throughout the Apollo missions, Potter's Square Root Filter was used for lunar navigation. Now that NASA is returning to the Moon, the filters used during the Apollo missions must be compared to the filters that have been developed since that time, the Bierman-Thornton Filter (UD) and the Unscented Kalman Filter (UKF). The UD Filter involves factoring the covariance matrix into UDUT and has similar accuracy to the Square Root Filter; however it requires less computation time. Conversely, the UKF, which uses sigma points, is much more computationally intensive than any of the filters; however it produces the most accurate results. The Extended Kalman Filter, Potter's Square Root Filter, the Bierman-Thornton UD Filter, and the Unscented Kalman Filter each prove to be the most accurate filter depending on the specific conditions of the navigation system.

Author

*Kalman Filters; Nonlinear Filters; Space Navigation; Lunar Roving Vehicles; Lunar Surface*

**20080026217** Ingersoll (Buchanan) LLP, San Diego, CA, USA

**Electrical Passivation of Silicon-Containing Surfaces Using Organic Layers**

Lewis, N. S., Inventor; Royea, W., Inventor; 2 Sep 05; 24 pp.; In English

Contract(s)/Grant(s): NSF-CHE-9974562

Patent Info.: Filed Filed 2 Sep 05; US-Patent-Appl-SN-11-219-172

Report No.(s): PB2007-111560; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Electrical structures and devices may be formed and include an organic passivating layer that is chemically bonded to a silicon-containing semiconductor material to improve the electrical properties of electrical devices. In different embodiments, the organic passivating layer may remain within finished devices to reduce dangling bonds, improve carrier lifetimes, decrease surface recombination velocities, increase electronic efficiencies, or the like. In other embodiments, the organic passivating layer may be used as a protective sacrificial layer and reduce contact resistance or reduce resistance of doped regions. The organic passivation layer may be formed without the need for high-temperature processing.

NTIS

*Passivity; Silicon; Semiconductors (Materials)*

**20080026218** Haynes and Boone, LLP, Dallas, TX, USA

**Calibration for Automated Microassembly**

Tsui, K., Inventor; Geisberger, A., Inventor; 6 Jul 04; 19 pp.; In English

Contract(s)/Grant(s): NIST-70NANB1H3021

Patent Info.: Filed Filed 6 Jul 04; US-Patent-Appl-SN-10-884-904

Report No.(s): PB2007-111558; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus including a micro-mechanical calibration member having at least a portion that is elastically biasable away from a neutral position in response to mechanical contact. The apparatus may also include a fixed member proximate the micro-mechanical calibration member which may be referenced to automatically detect deflection of the micro-mechanical calibration member away from the neutral position. The micro-mechanical calibration member may also be configured to receive a micro-mechanical contacting member to provide the mechanical contact employed to bias the micro-mechanical calibration member away from the neutral position.

NTIS

*Calibrating; Microelectromechanical Systems; Micromechanics*

**20080026220** Koppel, Jacobs, Patrick and Heybl, Thousand Oaks, CA, USA

**Wide Bandgap HEMTs with Source Connected Field Plates**

Wu, Y., Inventor; Parikh, P., Inventor; Mishra, U., Inventor; Moore, M., Inventor; 4 Oct 04; 11 pp.; In English

Contract(s)/Grant(s): ONR/DARPA N00014-02-0306

Patent Info.: Filed 4 Oct 04; US-Patent-Appl-SN-10-958-970

Report No.(s): PB2007-111559; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A High Electron Mobility Transistor (HEMT) comprising a plurality of active semiconductor layers formed on a substrate. Source electrode, drain electrode, and gate are formed in electrical contact with the plurality of active layers. A spacer layer is formed on at least a portion of a surface of said plurality of active layers and covering the gate. A field plate is formed on the spacer layer and electrically connected to the source electrode, wherein the field plate reduces the peak operating electric field in the HEMT.

NTIS

*Energy Gaps (Solid State); High Electron Mobility Transistors; Semiconductor Devices; Substrates; Semiconductors (Materials)*

**20080026232** Lenart (Robert P.), Pittsburgh, PA, USA

**Transducer Assembly for Thermally Assisted Writing and Read Back in Data Storage Devices**

Rausch, T., Inventor; 30 Jun 04; 9 pp.; In English

Contract(s)/Grant(s): NIST-70NANB1H3056

Patent Info.: Filed 30 Jun 04; US-Patent-Appl-SN-10-881-609

Report No.(s): PB2007-111551; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A transducer assembly for a data storage system comprises a first transducer for directing electromagnetic radiation onto a storage medium adjacent to a write pole, and a second transducer for directing electromagnetic radiation onto a storage medium adjacent to a read sensor. A data storage apparatus that includes the transducer assembly is also included.

NTIS

*Data Storage; Magnetic Recording; Transducers; Data Recording; Recording Instruments*

**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*.

**20080023728** Savannah River National Lab., Aiken, SC, USA

**PORFLOW Testing and Verification Document**

Aleman, S. E.; Jun. 2007; 207 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2007-909355; WSRC-STI-2007-00150; No Copyright; Avail.: National Technical Information Service (NTIS)

The PORFLOW software package is a comprehensive mathematical model for simulation of multi-phase fluid flow, heat transfer and mass transport in variably saturated porous and fractured media. PORFLOW can simulate transient or steady-state problems in Cartesian or cylindrical geometry. The porous medium may be anisotropic and heterogeneous and may contain discrete fractures or boreholes with the porous matrix. The theoretical models within the code provide a unified treatment of concepts relevant to fluid flow and transport. The main features of PORFLOW that are relevant to Performance Assessment modeling at the Savannah River National Laboratory (SRNL) include variably saturated flow and transport of parent and progeny radionuclides. This document involves testing a relevant sample of problems in PORFLOW and comparing the outcome of the simulations to analytical solutions or other commercial codes.

NTIS

*Computer Programs; Ground Water; Mathematical Models; Multiphase Flow*



**20080023891** NASA Langley Research Center, Hampton, VA, USA

**Compressible Boundary Layer Predictions at High Reynolds Number using Hybrid LES/RANS Methods**

Choi, Jung-II; Edwards, Jack R.; Baurle, Robert A.; June 23, 2008; 17 pp.; In English; 38th AIAA Fluid Dynamics Conference and Exhibit, 23-26 Jun. 2008, Seattle, WA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNX07AC27A; WBS 599489.02.07.03.66

Report No.(s): AIAA Paper-2008-4175; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023891>

Simulations of compressible boundary layer flow at three different Reynolds numbers ( $Re(\text{sub } \delta) = 5.59 \times 10^4$ ,  $1.78 \times 10^5$ , and  $1.58 \times 10^6$ ) are performed using a hybrid large-eddy/Reynolds-averaged Navier-Stokes method. Variations in the recycling/rescaling method, the higher-order extension, the choice of primitive variables, the RANS/LES transition parameters, and the mesh resolution are considered in order to assess the model. The results indicate that the present model can provide good predictions of the mean flow properties and second-moment statistics of the boundary layers considered. Normalized Reynolds stresses in the outer layer are found to be independent of Reynolds number, similar to incompressible turbulent boundary layers.

Author

*Compressible Boundary Layer; High Reynolds Number; Reynolds Stress; Reynolds Averaging; Simulation; Recycling; Flow Characteristics*

**20080023921** NASA Langley Research Center, Hampton, VA, USA

**Deriving Lifetime Maps in the Time/Frequency Domain of Coherent Structures in the Turbulent Boundary Layer**

Palumbo, Dan; [2008]; 20 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.18.02; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023921>

The lifetimes of coherent structures are derived from data correlated over a 3 sensor array sampling streamwise sidewall pressure at high Reynolds number ( $> 10^8$ ). The data were acquired at subsonic, transonic and supersonic speeds aboard a Tupolev Tu-144. The lifetimes are computed from a variant of the correlation length termed the lifelength. Characteristic lifelengths are estimated by fitting a Gaussian distribution to the sensors cross spectra and are shown to compare favorably with Efimtsov's prediction of correlation space scales. Lifelength distributions are computed in the time/frequency domain using an interval correlation technique on the continuous wavelet transform of the original time data. The median values of the lifelength distributions are found to be very close to the frequency averaged result. The interval correlation technique is shown to allow the retrieval and inspection of the original time data of each event in the lifelength distributions, thus providing a means to locate and study the nature of the coherent structure in the turbulent boundary layer. The lifelength data are converted to lifetimes using the convection velocity. The lifetime of events in the time/frequency domain are displayed in Lifetime Maps. The primary purpose of the paper is to validate these new analysis techniques so that they can be used with confidence to further characterize the behavior of coherent structures in the turbulent boundary layer.

Author

*Turbulent Boundary Layer; Normal Density Functions; Wavelet Analysis; High Reynolds Number; Subsonic Speed; Supersonic Speed; Transonic Speed; Correlation*

**20080023963** Illinois Univ., Urbana, IL USA

**Understanding Micro-Ramp Control for Shock Boundary Layer Interactions**

Loth, Eric; Lee, Sang; Feb 7, 2008; 29 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0400

Report No.(s): AD-A478648; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Micro-vortex generators (micro-VGs) have the ability to alter the near-wall structure of compressible turbulent boundary layers in such a way that the flow becomes significantly less susceptible to separations and more stable to unsteady disturbances. Due to their extremely small size, micro-VGs are embedded in the boundary layer and may provide reduced viscous drag when compared to traditional vortex generators. Of several candidate micro-VGs, micro-ramps have been found to significantly impact shock boundary layer interaction flows, while being cost-effective, physically robust, and requiring no power sources. Thus detailed study of flow interactions with micro-ramps on a supersonic boundary layer at  $M=3.0$  was investigated using monotone integrated Large Eddy Simulations (MILES) and Reynolds Averaged Navier-Stokes (RANS). A rescale-recycle method was used to efficiently generate turbulent in-flow conditions. Studies showed that the vortical structure

generated from the micro-ramp flows through the separation region caused by the impinging shock, which helped to reduce the area of separation.

DTIC

*Boundary Layers; Compressible Flow; Shock Layers; Supersonic Flow; Vortex Generators*

**20080023964** Arizona Univ., Tucson, AZ USA

**Theoretical and Computational Studies of Stability, Transition and Flow Control in High-Speed Flows**

Tumin, Anatoli; Feb 14, 2008; 306 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0179

Report No.(s): AD-A478649; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A comprehensive study of stability and receptivity of hypersonic boundary layers has been carried out. The main results of the project: (1) Mathematical method of the multimode decomposition for three-dimensional perturbations in compressible boundary layers has been developed. The method provides analysis of experimental and computational results for modes of discrete and continuous spectra. (2) Theory of boundary-layer receptivity was developed for roughness-induced perturbations in incompressible and compressible boundary layers. (3) The transient growth phenomenon in compressible boundary layers over flat plate, sphere, and sharp cone has been studied. The work was accompanied by development of solvers for these geometries.

DTIC

*Compressible Flow; High Speed; Stability; Transition Flow*

**20080023999** Ohio State Univ., Columbus, OH USA

**Nonequilibrium Supersonic Magnetogasdynamics Wind Tunnel**

Adamovich, Igor V; Lempert, Walter R; Rich, J W; Dec 31, 2007; 77 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0085

Report No.(s): AD-A478694; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The report presents results of cold MHD flow deceleration experiments using repetitively pulsed, short pulse duration, high voltage discharge to produce ionization in  $M=3-4$  nitrogen and air flows in the presence of transverse DC electric field and transverse magnetic field. MHD effect on the flow is detected from the flow static pressure measurements. Retarding Lorentz force applied to the flow produces a static pressure increase of up to 20%, while accelerating force of the same magnitude results in static pressure increase of up to 10%. The measured static pressure changes are compared with modeling calculations using quasi-one-dimensional MHD flow equations and with predictions of a 3-D Navier-Stokes / MHD flow code, showing good agreement. Comparison of the experimental results with the modeling calculations shows that the retarding Lorentz force increases the static pressure rise produced by Joule heating of the flow, while the accelerating Lorentz force reduces the pressure rise. The effect is produced for two possible combinations of the magnetic field and transverse current directions producing the same Lorentz force direction (both for accelerating and retarding force).

DTIC

*Low Temperature; Magnetohydrodynamics; Supersonic Flow; Supersonic Wind Tunnels*

**20080024004** NASA Langley Research Center, Hampton, VA, USA

**Effects of Wall Cooling on Hypersonic Boundary Layer Receptivity Over a Cone**

Kara, K.; Balakumar, P.; Kandil, O. A.; June 21, 2008; 23 pp.; In English; 38th AIAA Fluid Dynamics Conference and Exhibit, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.14.04; Copyright; Avail.: CASI: A03, Hardcopy

Effects of wall cooling on the receptivity process induced by the interaction of slow acoustic disturbances in the free-stream are numerically investigated for a boundary layer flow over a 5-degree straight cone. The free-stream Mach number is 6.0 and the Reynolds number is  $7.8 \times 10^6$ /ft. Both the steady and unsteady solutions are obtained by solving the full Navier-Stokes equations using 5th-order accurate weighted essentially non-oscillatory (WENO) scheme for space discretization and using 3rd-order total variation diminishing (TVD) Runge-Kutta scheme for time integration. Computations are performed for a cone with nose radius of 0.001 inch for adiabatic wall temperature ( $T_{sub\ aw}$ ),  $0.75 * T_{sub\ aw}$ ,  $0.5 * T_{sub\ aw}$ ,  $0.40 * T_{sub\ aw}$ ,  $0.30 * T_{sub\ aw}$ , and  $0.20 * T_{sub\ aw}$ . Once the mean flow field is computed, disturbances are introduced at the upstream end of the computational domain. Generation of instability waves from leading edge region and receptivity of boundary layer to slow acoustic waves are investigated. Computations showed that wall cooling has strong stabilization effect on the first mode disturbances as was observed in the experiments. Transition location moved to upstream when wall

cooling was applied It is also found that the boundary layer is much more receptive to fast acoustic wave (by almost a factor of 50). When simulations performed using the same forcing frequency growth of the second mode disturbances are delayed with wall cooling and they attained values two times higher than that of adiabatic case. In  $0.20^*T(\text{sub aw})$  case the transition Reynolds number is doubled compared to adiabatic conditions. The receptivity coefficient for adiabatic wall case (804 R) is 1.5225 and for highly cooled cones (241, and 161 R); they are in the order of  $10(\text{exp } -3)$ .

Author

*Boundary Layer Flow; Wall Temperature; Free Flow; Sound Waves; Upstream; Hypersonic Boundary Layer; Flow Distribution; Essentially Non-Oscillatory Schemes; Cooling; TVD Schemes*

**20080024041** Naval Postgraduate School, Monterey, CA USA

### **Hydrodynamics of Falling Mine in Water Column**

Chu, Peter C; Gilles, Anthony F; Fan, Chenwu; Fleischer, Peter; Jan 15, 2002; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-W-R202-18; N62306-00-P-0000-05

Report No.(s): AD-A478757; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The hydrodynamic features of a falling mine into the water column is investigated experimentally. The experiment consisted of dropping three cylindrical model mines of various lengths into a pool where the trajectories were filmed from two angles. The controlled parameters were, mine parameters (length to diameter ratio, center of mass location), and initial conditions (initial velocity, and drop angle). Results indicate that center of mass position has the largest influence on the mines' trajectory and that accurate trajectory modeling requires the inclusion of both momentum and moment equations. A statistical-dynamic model has been established to predict the trajectories of the falling mines.

DTIC

*Hydrodynamics; Momentum*

**20080024047** NASA Langley Research Center, Hampton, VA, USA

### **Heating Augmentation for Short Hypersonic Protuberances**

Mazaheri, Ali R.; Wood, William A.; June 23, 2008; 11 pp.; In English; 40th AIAA Thermophysics Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNL06AC49T; WBS 37781606030308

Report No.(s): Paper 4255; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080024047>

Computational aeroheating analyses of the Space Shuttle Orbiter plug repair models are validated against data collected in the Calspan University of Buffalo Research Center (CUBRC) 48 inch shock tunnel. The comparison shows that the average difference between computed heat transfer results and the data is about 9.5%. Using CFD and Wind Tunnel (WT) data, an empirical correlation for estimating heating augmentation on short hypersonic protuberances ( $k/\delta$  less than 0.3) is proposed. This proposed correlation is compared with several computed flight simulation cases and good agreement is achieved. Accordingly, this correlation is proposed for further investigation on other short hypersonic protuberances for estimating heating augmentation.

Author

*Augmentation; Hypersonic Flight; Protuberances; Aerodynamic Heating; Space Shuttle Orbiters; Computational Fluid Dynamics; Wind Tunnel Tests*

**20080024221** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

### **Consistent Large-Eddy Simulation of a Temporal Mixing Layer Laden with Evaporating Drops, Part 2, A Posteriori Modelling**

Leboissertier, Anthony; Okong'O, Nora; Bellan, Josette; Journal of Fluid Mechanics; January 25, 2005; Volume 523, pp. 37-78; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1017/S0022112004002101>; <http://hdl.handle.net/2014/40835>

Large-eddy simulation (LES) is conducted of a three-dimensional temporal mixing layer whose lower stream is initially laden with liquid drops which may evaporate during the simulation. The gas-phase equations are written in an Eulerian frame for two perfect gas species (carrier gas and vapour emanating from the drops), while the liquid-phase equations are written in a Lagrangian frame. The effect of drop evaporation on the gas phase is considered through mass, species, momentum and energy source terms. The drop evolution is modelled using physical drops, or using computational drops to represent the

physical drops. Simulations are performed using various LES models previously assessed on a database obtained from direct numerical simulations (DNS). These LES models are for: (i) the subgrid-scale (SGS) fluxes and (ii) the filtered source terms (FSTs) based on computational drops. The LES, which are compared to filtered-and-coarsened (FC) DNS results at the coarser LES grid, are conducted with 64 times fewer grid points than the DNS, and up to 64 times fewer computational than physical drops. It is found that both constant-coefficient and dynamic Smagorinsky SGS-flux models, though numerically stable, are overly dissipative and damp generated small-resolved-scale (SRS) turbulent structures. Although the global growth and mixing predictions of LES using Smagorinsky models are in good agreement with the FC-DNS, the spatial distributions of the drops differ significantly. In contrast, the constant-coefficient scale-similarity model and the dynamic gradient model perform well in predicting most flow features, with the latter model having the advantage of not requiring a priori calibration of the model coefficient. The ability of the dynamic models to determine the model coefficient during LES is found to be essential since the constant-coefficient gradient model, although more accurate than the Smagorinsky model, is not consistently numerically stable despite using DNS-calibrated coefficients. With accurate SGS-flux models, namely scale-similarity and dynamic gradient, the FST model allows up to a 32-fold reduction in computational drops compared to the number of physical drops, without degradation of accuracy; a 64-fold reduction leads to a slight decrease in accuracy.

Author

*Evaporation; Large Eddy Simulation; Mixing Layers (Fluids); Direct Numerical Simulation; Drops (Liquids); Models*

**20080024224** NASA Langley Research Center, Hampton, VA, USA

**Identification of Instability Modes of Transition in Underexpanded Jets**

Inman, Jennifer A.; Danehy, Paul M.; Nowak, Robert J.; Alderfer, David W.; June 23, 2008; 17 pp.; In English; 38th AIAA Fluid Dynamics Conference and Exhibit, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 23-376-70-30-08

Report No.(s): AIAA Paper 2008-4389; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080024224>

A series of experiments into the behavior of underexpanded jet flows has been conducted at NASA Langley Research Center. Two nozzles supplied with high-pressure gas were used to generate axisymmetric underexpanded jets exhausting into a low-pressure chamber. These nozzles had exit Mach numbers of 1 and 2.6, though this paper will present cases involving only the supersonic nozzle. Reynolds numbers based on nozzle exit conditions ranged from about 300 to 22,000, and nozzle exit-to-ambient jet pressure ratios ranged from about 1 to 25. For the majority of cases, the jet fluid was a mixture of 99.5% nitrogen seeded with 0.5% nitric oxide (NO). Planar laser-induced fluorescence (PLIF) of NO is used to visualize the flow, visualizing planar slices of the flow rather than path integrated measurements. In addition to revealing the size and location of flow structures, PLIF images were also used to identify unsteady jet behavior in order to quantify the conditions governing the transition to turbulent flow. Flow structures that contribute to the growth of flow instabilities have been identified, and relationships between Reynolds number and transition location are presented. By highlighting deviations from mean flow properties, PLIF images are shown to aide in the identification and characterization of flow instabilities and the resulting process of transition to turbulence.

Author

*Jet Flow; Computational Fluid Dynamics; Wind Tunnel Tests; Unsteady Flow; Flow Stability; Supersonic Nozzles*

**20080025100** Innovative Scientific Solutions, Inc., Dayton, OH USA

**Experimental Study of Cavity-Strut Combustion in Supersonic Flow (Postprint)**

Hsu, K -Y; Carter, Campbell D; Gruber, M R; Barhorst, T; Jul 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-03-D-2327; Proj-2308

Report No.(s): AD-A478590; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experimental investigation of cavity-based flameholders with strut injectors in a supersonic flow is reported. In this ongoing research program, emphases are placed on understanding cavity-based flameholders and providing alternative methods for improving overall combustor performance in scramjet engines. Three different struts with fuel injectors are mounted near the cavity leading edge to study flame propagation and ignition of fuel in the core flow region. OH-PLIF is used to identify the flame zone around the cavity and strut-wake regions over a range of conditions. Shadowgraphy is used to capture the flow features around the strut and cavity. In-stream probing is conducted to characterize the flow features associated with the different strut configurations. Stagnation-temperature profiles are obtained for all struts operating over the same conditions in the combustor-flow study. Two cavity fueling schemes are used to compare flameholder performance.

Direct cavity air injection is found to improve combustion significantly. For each strut, upstream and downstream fueling schemes are compared over a range of conditions.

DTIC

*Cavities; Combustible Flow; Combustion; Flame Holders; Flame Propagation; Fuel Injection; Struts; Supersonic Combustion Ramjet Engines; Supersonic Flow*

**20080025103** Oklahoma State Univ., Stillwater, OK USA

**Spray Structure in Near-Injector Region Of Aerated Jet in Subsonic Crossflow (Postprint)**

Lee, J; Sallam, K A; Lin, K; Carter, Campbell D; Jan 2008; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NSF EPS-0132534

Report No.(s): AD-A478623; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experimental study of the breakup of aerated liquid jet in subsonic crossflow was carried out. The test conditions were as follows: jet exit diameter of 1 mm, GLR (gas to liquid ratio) of 8%, and jet-to-free stream momentum flux ratio of 0.74. Digital double-pulsed holograms were recorded at  $x/d_o = 0$  to 25 in the cross stream direction,  $y/d_o = 0$  to 27 in the stream wise (injection direction), and  $z/d_o = (-13)$  to 13 in the span-wise direction. Digital double-pulsed holographic microscopy (DHM) was utilized using double exposure 2048x2048 pixels CCD sensor. The field of view of all holograms was 9 mm x 9 mm, and the spatial resolution was 5  $\mu$ m. To overcome this small field of view, three-dimensional spray maps were constructed by patching several high resolution holograms. Measurements include droplets locations, drop sizes and sphericity, and three-dimensional velocities. The distributions of the drop sizes could be fully described by the SMD alone and followed Simmons' universal root-normal distribution.

DTIC

*Aeration; Cross Flow; Flow Visualization; Injectors; Sprayers; Subsonic Flow*

**20080025156** NASA Langley Research Center, Hampton, VA, USA

**Test Flow Calibration Study of the Langley Arc-Heated Scramjet Test Facility**

Thomas, Scott R.; Volland, Randall T.; Guy, Robert W.; June 29, 1987; 14 pp.; In English; AIAA/SAE/ASME/ASEE 23rd Joint Propulsion Conference, 29 Jun. - 2 Jul. 1987, San Diego, CA, USA; Original contains black and white illustrations

Report No.(s): AIAA Paper-87-2165; Copyright; Avail.: CASI: [A03](#), Hardcopy

An experimental research program to define the test flow at the exits of two square cross-section, contoured facility nozzles with nominal exit Mach numbers of 4.7 and 6 is described. This study provided detailed calibration data for the NASA-Langley Arc-Heated Scramjet Test Facility over a range of simulated flight conditions from Mach 5.5 (at altitudes from 98,600 to 128,000 ft.) to Mach 7 (at altitudes from 108,000 to 149,000 ft.). Distributions of pitot pressure, static pressure, and total temperature were measured at the nozzle exits over this range of test conditions. These distributions of thermodynamic properties were used to calculate the distributions of test flow Mach number and mass flow at the nozzle exits. Contour maps of the thermodynamic properties and the calculated quantities are presented, and an assessment is made of flow quality of square cross-section, contoured nozzles over a nozzle exit Mach number range from 3.5 to 6 (simulated flight Mach numbers from 4 to 7). Facility total mass flow, obtained by integration of the nozzle exit mass flow contours, compared favorably to measured facility total mass flow. The contour maps were also used to determine the mass flow approaching the inlets of various scramjet engines.

Author

*Arc Heating; Calibrating; Supersonic Combustion Ramjet Engines; Supersonic Speed; Test Facilities; Nozzle Design*

**20080025202** Westinghouse Savannah River Co., Aiken, SC, USA

**Derivations for Hoop Stresses Due to Shock Waves in a Tube**

Leishear, R. A.; Jul. 2007; 11 pp.; In English

Report No.(s): DE2007-909863; No Copyright; Avail.: Department of Energy Information Bridge

Equations describing the hoop stresses in a pipe due to water hammer have been presented in the literature in a series of papers, and this paper discusses the complete derivation of the pertinent equations. The derivation considers the pipe wall response to a water hammer induced shock wave moving along the inner wall of the pipe. Factors such as fluid properties, pipe wall materials, pipe dimensions, and damping are considered. These factors are combined to present a single, albeit rather complicated, equation to describe the pipe wall vibrations and hoop stresses as a function of time. This equation is also

compared to another theoretical prediction for hoop stresses, which is also derived herein. Specifically, the two theories predict different maximum stresses, and the differences between these predictions are graphically displayed.

NTIS

*Pipes (Tubes); Shock Waves; Stresses; Water Hammer*

**20080025309** George Washington Univ., Washington, DC USA

**Computational Study of Separation Control Using ZNMF Devices: Flow Physics and Scaling Laws**

Mittal, Rajat; Feb 26, 2008; 14 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0169

Report No.(s): AD-A478944; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478944>

The primary objective of the proposed research was to gain a fundamental understanding of strategies, mechanisms, and scaling laws for successful control of separation using zero-net mass-flux (ZNMF) actuators. The key issue that was systematically studied was the optimal excitation frequencies in separated flows characterized by convective and/or global instabilities. The study was a complementary experimental/ numerical effort that capitalized on previous collaborations and was aimed at leveraging the respective strengths of CFD and experiments. The numerical component employed two different solvers which allowed us to investigate chord Reynolds numbers  $Re(c)$  up to  $O(10^6)$ . The complementary experiments use a large flat plate model equipped with a two-dimensional ZNMF actuator slot. Both the experiments and computations employed nonlinear spectral analysis to quantify quadratic coupling between the various instability mechanisms in separated flows. Outcomes included fundamental insights into the non-linear dynamics of separated airfoil flows and their implications for ZNMF separation control as well as development of improved lumped element design tool for ZNMF actuators in separation control applications.

DTIC

*Actuators; Computational Fluid Dynamics; Fluid Dynamics; Scaling Laws*

**20080025313** Ohio State Univ., Columbus, OH USA

**Energy Transfer Processes Among Electrons and Vibrationally Excited Air Species in High Enthalpy Flows**

Rich, J W; Lempert, Walter R; Adamovich, Igor V; Feb 12, 2007; 6 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0024

Report No.(s): AD-A478948; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478948>

The Nonequilibrium Thermodynamics Laboratories (NETL) at the Ohio State University are conducting this research program into the physics of high energy air flows. The particular environments being studied are gas flows in which large amounts of energy are stored internally in the flow molecules, although the gas temperatures remain relatively cold. Such environments occur in hypervelocity aerospace vehicle flow fields, notably behind the bow shock wave in front of the vehicle, and in the after-body expansion and the rocket exhaust expansion flows behind the vehicle.

DTIC

*Air Flow; Electrons; Energy Transfer; Enthalpy*

**20080025314** Akron Univ., Akron, OH USA

**Modeling of Interactions of Ablated Plumes**

Povitsky, Alex; Feb 2008; 17 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0457

Report No.(s): AD-A478949; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478949>

Heat transfer modulation between the gas flow and the Thermal Protection Shield (TPS) that occurs because of ejection of under-expanded pyrolysis gases through the cracks in the TPS is studied by numerical modeling. The simulations are performed for an axisymmetric bluff body flying at Mach 7. The influence of the geometry of the TPS on heat transfer pattern was studied for two representative shapes. The results are presented for three different flight altitudes (low-ground level, moderate-20km and high-30km). At the low altitude the plume pressure is lower than the pressure behind the detached front shock wave and the plume propagates slowly along the wall surface. At high and moderate altitudes, the plume path and consequently, convective heat transfer between the TPS and the plume depends on the plume interaction with the bow shock wave. The effect of initial pressure of pyrolysis gas on the plume dynamics is significant. The presence of the blast wave

associated with under-expanded plume alters the heat transfer and increases mixing. Finally, the enhanced heat transfer caused by the emergence of multiple plumes is investigated.

DTIC

*Ablation; Heat Transfer; Plumes*

**20080025472** Naval Research Lab., Stennis Space Center, MS USA

**Estimation of Upstream Discharge in Data-Deprived Riverine Environments**

Brown, John E; Blain, Cheryl A; Jan 2008; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479249; NRL/PP/7320-07-8054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Rivers pose one of the most challenging environments to quantify as they contain elements of both land and water. Their dynamical scales are small in size relative to traditional ocean processes, and are ever-changing in their position and character. To compound the problem, many riverine environments of interest to the U.S. Navy are inaccessible or denied and typically have very little, if any, known information. To address the operational needs of the Navy in rivers, a River Simulation Tool (RST) is being developed that brings together satellite imagery and hydrodynamic and hydrological modeling. One component of the RST requires estimation of upstream discharge. To do this, the authors use NASA's Land Information System (LIS) to generate the surface runoff and subsurface base flow. They force the land surface model within LIS using satellite-derived precipitation. Finally, they generate the upstream discharge by routing the runoff and base flow using a river routing model from the University of Washington. While this approach has been demonstrated on a large scale (0.5 degrees resolution) for the combined Ganges/Brahmaputra River Basin on the Indian Sub-Continent (Brown, 2007), their challenge here is to apply these techniques to a small-scale regime (approx. 1 km). As a first test case, they chose the local Pearl River (Mississippi/Louisiana) watershed. Preliminary results are presented.

DTIC

*Base Flow; Drainage; Estimates; Hydrodynamics; Mathematical Models; Meteorological Satellites; Rivers; Satellite Observation; Upstream; Watersheds*

**20080025540** Second Inst. of Oceanography, Soa Hanghouz, China

**Mesoscale Eddies in the South China Sea Observed with Altimeter Data**

Wang, Guihua; Su, Jilan; Chu, Peter C; Jan 2003; 5 pp.; In English

Report No.(s): AD-A479454; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A composite time series (1993 2000) of sea surface height anomaly from several satellites is used to identify eddies in the South China Sea (SCS). The eddy lifetime, radius, strength, and straight-line travel distance are estimated. Altogether 58 anticyclonic eddies and 28 cyclonic eddies are identified for this period. They are grouped into four geographical zones according to known eddy generation mechanisms, and their statistics are discussed accordingly. Our geographical classification is a useful first step in gaining an overview of their generation.

DTIC

*Air Currents; Altimeters; China; Mesoscale Phenomena; Seas*

**20080025556** Washington Univ., Seattle, WA USA

**Vorticity and Turbulence in the Wake of a Bridge Pier**

Lien, R C; Sanford, Thomas B; Jan 2008; 29 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0967

Report No.(s): AD-A479575; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Dissipation rates of turbulence kinetic energy and enstrophy are reported in a high Reynolds number turbulent wake. Our results represent a set of rare field observations of vorticity and turbulence in a turbulent wake with a high Reynolds number. The turbulent wake was formed by an unsteady strong tidal current interacting with a bridge pier. Measurements were taken in the intermediate wake. Both energy and enstrophy show a similar downstream decay rate faster than that predicted by the self preservation similarity in the far wake. The theoretical relation for high Reynolds number flow is confirmed by field observations. The magnitudes of the vertical and horizontal components of enstrophy are not significantly different. Probability density functions of normalized vorticity components and of the dissipation rate of turbulence kinetic energy are nearly identical to each other. They are also nearly identical to the empirical function found in laboratory experiments. The turbulence internal intermittency is -0.2, estimated from autocorrelation coefficients of enstrophy; this value is close to that reported previously in turbulent wakes and jets.

DTIC

*Turbulence; Vorticity; Wakes; Wharves*

**20080025856** Naval Postgraduate School, Monterey, CA USA

**C-Vector for Identification of Oceanic Secondary Circulations Across Arctic Fronts in Fram Strait**

Chu, Peter C.; Jan 2002; 6 pp.; In English

Report No.(s): AD-A479562; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Secondary circulation, referring to the motion relative to a basic flow (geostrophic and hydrostatic balanced), occurs often in the ocean such as deep convection and circulations driven by fronts and eddies. It affects the general circulation and the mass, heat, salt, and energy balance. The oceanic secondary circulation is difficult to measure directly, but is easy to be identified by pseudovorticity using routine observations. A C-vector method, commonly used in atmospheric mesoscale moist frontogenesis, is applied to oceanography for identifying frontal secondary circulation in Fram Strait using Conductivity-Temperature-Depth data collected during a large-scale hydrographic survey on R/V Valdivia cruise-54 of the eastern Greenland Sea and Fram Strait from 16 March to 5 April 1987. Possible application of this method to large-scale motion is also discussed.

DTIC

*Arctic Regions; Greenland; Oceanography; Seas; Straits*

**20080025994** General Electric Aircraft Engines, Cincinnati, OH, USA

**Intelligent Engine Systems: Acoustics**

Wojno, John; Martens, Steve; Simpson, Benjamin; June 2008; 61 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-1135; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215235; E-16494; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025994>

An extensive study of new fan exhaust nozzle technologies was performed. Three new uniform chevron nozzles were designed, based on extensive CFD analysis. Two new azimuthally varying variants were defined. All five were tested, along with two existing nozzles, on a representative model-scale, medium BPR exhaust nozzle. Substantial acoustic benefits were obtained from the uniform chevron nozzle designs, the best benefit being provided by an existing design. However, one of the azimuthally varying nozzle designs exhibited even better performance than any of the uniform chevron nozzles. In addition to the fan chevron nozzles, a new technology was demonstrated, using devices that enhance mixing when applied to an exhaust nozzle. The acoustic benefits from these devices applied to medium BPR nozzles were similar, and in some cases superior to, those obtained from conventional uniform chevron nozzles. However, none of the low noise technologies provided equivalent acoustic benefits on a model-scale high BPR exhaust nozzle, similar to current large commercial applications. New technologies must be identified to improve the acoustics of state-of-the-art high BPR jet engines.

Author

*Acoustics; Computational Fluid Dynamics; Jet Engines; Fuel Systems; Aircraft Engines; Fabrication*

**20080026010** NASA Johnson Space Center, Houston, TX, USA

**Cleaning Surface Particle Contamination with Ultrapure Water (UPW) Megasonic Flow on Genesis Array Collectors**

Allton, J. H.; Calaway, Michael J.; Hittle, J. D.; Rodriguez, M. C.; Stansbery, E. K.; McNamara, K. M.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The hard landing experienced by the Genesis sample return capsule breached the science canister containing the solar wind collectors. This impact into the damp lakebed contaminated collector surfaces with pulverized collector and spacecraft materials and Utah sediment and brine residue. The gold foil, polished aluminum, and bulk metallic glass remained intact, but the solar wind bulk and regime-specific array collectors were jarred loose from their frames and fractured into greater than 10,000 specimens. After a year of investigation and cleaning experimentation, the Genesis Science Team determined that array collectors had 4 classes of contaminants: particles, molecular film, submicron inorganic particulate ('aerosol'), and pre-launch surface contamination. We discuss here use of megasonically energized ultrapure water (UPW) for removing particulate debris from array collector fragments.

Derived from text

*Cleaning; Contamination; Sample Return Missions; Water Flow; Accumulators*



**20080026063** Fish and Neave IP Group, Boston, MA, USA

**System and Method for Confining an Object to a Region of Fluid Flow Having a Stagnation Point**

Schroeder, C. M., Inventor; Shaqfeh, E. S. G., Inventor; Babcock, H. P., Inventor; Chu, S., Inventor; 7 May 04; 26 pp.; In English

Patent Info.: Filed Filed 7 May 04; US-Patent-Appl-SN-10-841-011

Report No.(s): PB2007-111579; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A device for confining an object to a region proximate to a fluid flow stagnation point includes one or more inlets for carrying the fluid into the region, one or more outlets for carrying the fluid out of the region, and a controller, in fluidic communication with the inlets and outlets, for adjusting the motion of the fluid to produce a stagnation point in the region, thereby confining the object to the region. Applications include, for example, prolonged observation of the object, manipulation of the object, etc. The device optionally may employ a feedback control mechanism, a sensing apparatus (e.g., for imaging), and a storage medium for storing, and a computer for analyzing and manipulating, data acquired from observing the object. The invention further provides methods of using such a device and system in a number of fields, including biology, chemistry, physics, material science, and medical science.

NTIS

*Fluid Flow; Patent Applications; Stagnation Point*

**20080026088** NASA White Sands Test Facility, NM, USA

**ISO 15859 Propellant and Fluid Specifications: A Review and Comparison with Military and NASA Specifications**

Greene, Ben; McClure, Mark B.; Baker, David L.; March 06, 2006; 57 pp.; In English; JANNAF 33rd PEDCS, 6-10 Mar. 2006, Sandestin Beach, FL, USA; Copyright; Avail.: CASI: [A04](#), Hardcopy

This work presents an overview of the International Organization for Standardization (ISO) 15859 International Standard for Space Systems Fluid Characteristics, Sampling and Test Methods Parts 1 through 13 issued in June 2004. These standards establish requirements for fluid characteristics, sampling, and test methods for 13 fluids of concern to the propellant community and propellant characterization laboratories: oxygen, hydrogen, nitrogen, helium, nitrogen tetroxide, monomethylhydrazine, hydrazine, kerosene, argon, water, ammonia, carbon dioxide, and breathing air. A comparison of the fluid characteristics, sampling, and test methods required by the ISO standards to the current military and NASA specifications, which are in use at NASA facilities and elsewhere, is presented. Many ISO standards composition limits and other content agree with those found in the applicable parts of NASA SE-S-0073, NASA SSP 30573, military performance standards and details, and Compressed Gas Association (CGA) commodity specifications. The status of a current project managed at NASA Johnson Space Center White Sands Test Facility (WSTF) to rewrite these documents is discussed.

Author

*Specifications; Aerospace Systems; Military Technology; Liquid Rocket Propellants; Fluid Flow*

**20080026096** NASA Glenn Research Center, Cleveland, OH, USA

**Heat Transfer in a Superelliptic Transition Duct**

Poinsatte, Philip; Thurman, Douglas; Hippensteele, Steven; May 2008; 25 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.02.02

Report No.(s): NASA/TP-2008-214943; ARL-TR-4200; E-16175; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026096>

Local heat transfer measurements were experimentally mapped using a transient liquid-crystal heat transfer technique on the surface of a circular-to-rectangular transition duct. The transition duct had a length-to-diameter ratio of 1.5 and an exit-plane aspect ratio of 3. The cross-sectional geometry was defined by the equation of a superellipse. The cross-sectional area was the same at the inlet and exit but varied up to 15 percent higher through the transition. The duct was preheated to a uniform temperature (nominally 64 C) before allowing room temperature air to be suddenly drawn through it. As the surface cooled, the resulting isothermal contours on the duct surface were revealed using a surface coating of thermochromic liquid crystals that display distinctive colors at particular temperatures. A video record was made of the surface temperature and time data for all points on the duct surfaces during each test. Using this surface temperature-time data together with the temperature of the air flowing through the model and the initial temperature of the model wall, the heat transfer coefficient was calculated by employing the classic one-dimensional, semi-infinite wall heat transfer conduction model. Test results are reported for inlet diameter-based Reynolds numbers ranging from  $0.4 \times 10^6$  to  $2.4 \times 10^6$  and two grid-generated freestream turbulence intensities

of about 1 percent, which is typical of wind tunnels, and up to 16 percent, which may be more typical of real engine conditions.

Author

*Heat Transfer; Liquid Crystals; Ducted Flow; Heat Transfer Coefficients; Aspect Ratio; Surface Temperature*

**20080026159** NASA Johnson Space Center, Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA

**Evaluation of Coatings and Materials for Future Radiators**

Tuan, George C.; Westheimer, David T.; Birur, Gajanana C.; Beach, Duane E.; Jaworske, Donald A.; Peters, Wanda C.; Triolo, Jack J.; July 17, 2006; 12 pp.; In English; International Conference on Environmental Systems, 17-20 Jul. 2006, Norfolk, VA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): 612-50-04-13

Report No.(s): 06ICES-318; Copyright; Avail.: Other Sources

Radiators are used to reject energy from space vehicles through radiant heat transfer. They are typically the largest component in a vehicle's thermal control system and can have a large impact on the vehicle design and operation. NASA's current vision for exploration dictates that radiators for a Crew Exploration Vehicle (CEV), a Lunar Surface Access Module (LSAM), and a lunar base will need to be developed. These applications present new challenges when compared to previous radiators on the Space Shuttle and International Space Station (ISS). In addition, many technological advances have been made that could positively impact future radiator design. This paper outlines new requirements for future radiators and documents a trade study performed to select the some promising technologies for further evaluation. The technologies include K1100 based carbon composites for the radiator surface as well as Optical Solar Reflectors (OSRs), a lithium based white paint, and electrochromic thin films for optical coatings. Coupons were made using these materials and tests were performed to characterize their performance. Testing included evaluating structural and thermal properties of the carbon composites, thermal cycling, launch pad weather simulation, and exposure to solar wind, and Ultraviolet (UV) radiation.

Author

*Spacecraft Radiators; Technology Assessment; Composite Materials; Coatings; Performance Tests; Thermodynamic Properties; Thermal Cycling Tests*

**20080026229** Marshall, Gerstein and Borun, LLP, Chicago, IL, USA; Michigan Univ., Ann Arbor, MI, USA

**Electromagnetic Flow Sensor Device**

Gianchandani, Y. B., Inventor; Takahata, K., Inventor; 6 Jun 05; 19 pp.; In English

Contract(s)/Grant(s): NSF-ECS-0233174

Patent Info.: Filed Filed 6 Jun 05; US-Patent-Appl-SN-11-146-193

Report No.(s): PB2007-110661; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed herein is an electromagnetic flow sensor device for monitoring flow of fluid in a channel. The sensor device includes a first electrode to be disposed along the channel and in communication with the fluid, a second electrode to be disposed along the channel and in communication with the fluid, and a radially expandable frame to structurally support the first electrode and the second electrode while conforming to the channel to position the first electrode and the second electrode along the channel. The device may also include an antenna coupled to the first and second electrodes to wirelessly provide an indication of a voltage induced between the first and second electrodes. In some embodiments, the radially expandable frame includes an insulating link such that the first and second electrodes are not electrically connected via the radially expandable frame. The sensor device may also include a structure having an inductance coupled to the first and second electrodes to wirelessly provide an indication of the induced voltage.

NTIS

*Fluid Flow; Sensors; Electromagnetism*

## 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*.

**20080023779** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**On-Orbit Noise Characterization for MODIS Reflective Solar Bands**

Xiong, X.; Xie, X.; Angal, A.; [2008]; 2 pp.; In English; Copyright; Avail.: CASI: [A01](#), Hardcopy

Since launch, the Moderate Resolution Imaging Spectroradiometer (MODIS) has operated successfully on-board the

NASA Earth Observing System (EOS) Terra and EOS Aqua spacecraft. MODIS is a passive cross-track scanning radiometer that makes observations in 36 spectral bands with spectral wavelengths from visible (VIS) to long-wave infrared. MODIS bands 1-19 and 26 are the reflective solar bands (RSB) with wavelengths from 0.41 to 2.2 micrometers. They are calibrated on-orbit using an on-board solar diffuser (SD) and a SD stability monitor (SDSM) system. For MODIS RSB, the level 1B calibration algorithm produces top of the atmosphere reflectance factors and radiances for every pixel of the Earth view. The sensor radiometric calibration accuracy, specified at each spectral band's typical scene radiance, is 2% for the RSB reflectance factors and 5% for the RSB radiances. Also specified at the typical scene radiance is the detector signal-to-noise ratio (SNR), a key sensor performance parameter that directly impacts its radiometric calibration accuracy and stability, as well as the image quality. This paper describes an on-orbit SNR characterization approach developed to evaluate and track MODIS RSB detector performance. In order to perform on-orbit SNR characterization, MODIS RSB detector responses to the solar illumination reflected from the SD panel must be corrected for factors due to variations of the solar angles and the SD bi-directional reflectance factor. This approach enables RSB SNR characterization to be performed at different response levels for each detector. On-orbit results show that both Terra and Aqua MODIS RSB detectors have performed well since launch. Except for a few noisy or inoperable detectors which were identified pre-launch, most RSB detectors continue to meet the SNR design requirements and are able to maintain satisfactory short-term stability. A comparison of on-orbit noise characterization results with results derived from pre-launch calibration and characterization are also provided.

Derived from text

*MODIS (Radiometry); Signal to Noise Ratios; Spectral Bands; Spectral Reflectance; Calibrating; Characterization; Reflectance; Onboard Equipment*

**20080023946** Northwestern Univ., Evanston, IL USA

**Ultrafast Target Recognition via Super-Parallel Holograph Based Correlator, RAM and Associative Memory**

Shahriar, Selim; Mar 11, 2008; 95 pp.; In English

Contract(s)/Grant(s): FA49620-03-1-0408

Report No.(s): AD-A478611; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall objective of this project was to develop an ultrafast target recognition system using holographic techniques, as well as spin-off technologies with other applications. We report here a set of significant accomplishments towards this goal. These include: (1) demonstrations of shared hardware operation of a super-parallel holographic correlator and RAM, (2) demonstrations of an ultra-fast holographic stokesmeter for polarization imaging; (3) demonstrations of off-axis transmission and reflection holographic lenses for use in the super-parallel architecture; (4) demonstrations of a translation-invariant correlation of images stored via holographic angle-multiplexing in a thick photopolymer material; (5) development of a large-area, thick, optical quality holographic recording disc capable of storing up to 2 terabyte of data; (6) demonstration of real-time, pico-second speed, translation-invariant correlation using a novel photorefractive material, and (7) demonstration of automatic target recognition of targets in a view from arbitrary altitudes and orientations during the flight of a remote-controlled aerial vehicle.

DTIC

*Associative Memory; Correlators; Holography; Target Recognition*

**20080024027** Army Aeromedical Research Lab., Fort Rucker, AL USA

**Apache Aviator Evaluation of Dual-Technology Night Vision Systems in Operation Iraqi Freedom (OIF) Urban Combat (Master's Thesis)**

Heinecke, J K; Rash, Clarence E; Ranaudo, Richard; Hiatt, Keith L; Jan 2008; 91 pp.; In English

Report No.(s): AD-A478732; USAARL-2008-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U. S. Army currently fields two variants of night vision devices (NVDs), the Aviator Night Vision Imaging System (ANVIS) and the Pilot Night Vision System/Target Acquisition and Designation System (PNVS/TADS). The effectiveness of these sensors in the AH-64D during urban missions in Iraq from November 2005 thru October 2006 was assessed with a questionnaire administered to 38 Apache AH-64D aviators. The survey compared sensors with regard to reconnaissance, situational awareness, and human factors issues. Results showed that the 12 ANVIS was preferable to the FLIR for reconnaissance missions. ANVIS was also preferred for wire and aircraft avoidance. The primary benefit of the PNVS/TADS system, as reported by aviators, was the flight symbology cues provided through the helmet-mounted display (HMD).

DTIC

*Aircraft Pilots; Combat; Night Vision; Thermal Mapping*

**20080024082** National Meteorological Administration, Bucharest, Romania

**Multi-Resolution Analysis of MODIS and ASTER Satellite Data for Water Classification**

Alecu, Corina; Oancea, Simona; Bryant, Emily; Sep 2006; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478835; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Classifications; Floods; Imaging Spectrometers; MODIS (Radiometry); Satellite Imagery; Water*

**20080024213** Indian Inst. of Tech., Kharagpur, India

**Development of Micromachined Silicon Accelerometers with Improved Off-Axis Sensitivity**

Sankar, A. Ravi; Das, S.; Kal, S.; International Journal of COMADEM, Volume 11, No. 1; January 2008, pp. 18-24; In English; See also [20080024209](#); Copyright; Avail.: Other Sources

Development of micromachined silicon piezoresistive accelerometers with improved off-axis sensitivity has been presented in this paper. Two accelerometer structures have been designed for low off-axis sensitivity. Complete comparative analysis based on simulation results has been given in this paper. Both the structures have been fabricated and testing results of structure-1 have been presented. The fabrication accelerometers involved three wafer levels and seven masking processes. Five masks were used for realizing piezoresistive sensing element and two masks were used for pyrex wafer processing which contains top and bottom cover lids for both the structures to provide squeeze film damping mechanism. In the fabrication process, dual-doped tetra-methyl ammonium-hydroxide (TMAH) solution is used for wet anisotropic etching. The novelty of this etching process is that the bulk micromachining can be performed after aluminum metallization. The fabrication process is CMOS compatible.

Author

*Micromachining; Accelerometers; Silicon; Electrical Resistivity*

**20080024264** Department of Defense, Arlington, VA USA

**Defense Hotline Allegations Concerning the Biometric Identification System for Access Omnibus Contract**

Mar 18, 2008; 20 pp.; In English

Report No.(s): AD-A478474; IG/DOD-D-2008-064; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478474>

Contracting personnel involved with the Biometric Identification System for Access (BISA) should read this report because it provides an assessment of whether fair opportunity was given to the contractors who competed for a task order on the BISA omnibus contract. Background. According to the Strategic Services Sourcing (S3) performance work statement the purpose of the BISA is to provide a biometric base access control system that can operate in a hostile environment. The DoD Biometrics Program Manager within the Program Executive Office-Enterprise Information Systems is responsible for the BISA. We conducted this audit in response to multiple allegations made by three complainants to the Defense Hotline regarding the award of the BISA omnibus contract under the Army's S3 contract vehicle. We also reviewed whether source selection procedures complied with Federal and DoD policy. The complainants' allegations follow. Complainant 1 stated that Ideal Innovations Incorporated (I3) had access to information not available to all vendors; 13 employees helped develop the requirements; and the contracting officer failed to comply with Federal Acquisition Regulation Part 15.506, 'Postaward Debriefing of Offerors,' which requires a debrief to an offeror. The task order was awarded to Sensor Technologies, Inc. (STI), with a bid of \$563 million while the Computer Sciences Corporation (CSC) bid was \$250 million, and data were provided on the U.S. Army Communications Electronics Life Cycle Management Command Web site that indicated the contract would cost between \$270 million and \$340 million.

DTIC

*Biometrics; Defense Program*

**20080025079** Army Construction Engineering Research Lab., Champaign, IL USA

**Threatened and Endangered Species Surveillance in Inaccessible Areas: A Feasibility Study**

Balbach, Harol; Pitts, Donald; Meyer, William; Tweddale, Scott; Nov 2007; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478347; ERDC/CERL-TR-07-47; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478347>

Monitoring threatened and endangered species on Army installations is not always feasible with respect to the areas that are either inaccessible or have limited times for entry. When biologists are unable to enter an area freely for periodic surveys,

it prevents normal application of standard methods, which results in the data being unavailable for reporting either management successes or problems. If these species are present in the inaccessible area, they cannot be credited toward management goals. The total population of the installation is assumed to be smaller, which can result in unnecessary expense and greater regulatory interference. This research examines each of the four broad categories of platforms (1) remote sensing, (2) airfoil aircraft, (3) lighter-than-air craft, and (4) ground surveillance instrumentation for remote or non-intrusive acquisition of data relevant to these species. The data might be of any nature, including spatial relevance, sound, presence or absence, or other categories. Some technologies, such as satellite and aerial imagery, continue to fill important niches, which are generally well understood. The overall conclusion of this survey was that there are no fully satisfactory, affordable platforms that can provide the full set of data acquisition needs for inaccessible areas.

DTIC

*Detection; Ecology; Endangered Species; Feasibility; Remote Sensing; Surveillance*

**20080025211** Gemini Observatory, Hilo, HI, USA

#### **GNIRS Update**

Jensen, Joseph; Kleinman, Scot; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 39-41; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

This article reviews the progress in restoring the Gemini Near-Infrared Spectrometer (GNIRS), that was damaged in 2007.

CASI

*Infrared Spectrometers; Replacing; Astronomical Observatories*

**20080025212** Florida Univ., FL, USA

#### **FLAMINGOS-2 Update**

Eikenberry, Stephen S.; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 42-43; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

The status of the FLAMINGOS-2 instrument is reviewed. The instrument will provide near infrared wide-field imaging and multi object spectroscopy on Gemini South.

CASI

*Infrared Imagery; Optical Equipment; Infrared Spectrometers*

**20080025217** Gemini Observatory, Hilo, HI, USA

#### **MCAO System Status**

Boccas, Maxime; Rigaut, Francois; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 44-45; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

The Gemini Multi-Conjugate Adaptive Optics (MCAO) system which is in its final phase of completion at Gemini South will use five laser guide stars and three natural guide stars to correct for limited sky coverage, restricted field of view and the cone effect that affect the performances of 'classical' adaptive optics systems. Since the last update in fall 2007, progress has been made on several fronts for the MCAO project.

Derived from text

*Adaptive Optics; Laser Applications; Instruments*

**20080025221** Gemini Observatory, Hilo, HI, USA

#### **Aspen Instrument Update**

Jensen, Joseph; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 46-48; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

This article reviews the progress made in the Aspen instrumentation program. The major component of the program is the Gemini Planet Imager, and Wide-field Fiber Multi-Object Spectrometer (WF MOS). The possibility of building a Ground-Layer Adaptive Optics (GLAO) is still being explored, and the Precision Radial Velocity Spectrometer (PRVS) instrument was canceled

CASI

*Instruments; Astronomical Observatories; Progress*

**20080025332** Army Research Lab., Adelphi, MD USA

**Validation of Xpatch Computer Models for Human Body Radar Signature**

Dogaru, Traian; Le, Calvin; Mar 2008; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478991; ARL-TR-4403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478991>

This technical report compares the radar signatures of a human body as computed by the Finite Difference Time Domain (FDTD) and Xpatch modeling techniques. Our main purpose is to validate the Xpatch (approximate) models with an exact electromagnetic solver (FDTD). We achieve this by comparing the radar cross section (RCS), range profiles and synthetic aperture radar (SAR) images of the human body, as computed by the two methods. This work is important in validating Xpatch as an accurate tool for modeling general STTW radar scenarios, where a major goal consists in detecting and identifying humans enclosed in building structures.

DTIC

*Computerized Simulation; Human Body; Radar Signatures*

**20080025335** Army Research Lab., Adelphi, MD USA

**Signal Processing Technique to Remove Signature Distortion in ARL Synchronous Impulse Reconstruction (SIRE) Ultra-Wideband (UWB) Radar**

Nguyen, Lam; Mar 2008; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479008; ARL-TR-4404; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479008>

ARL has designed and developed the SIRE UWB SAR radar in support of the U.S. Army vision for increased mobility, survivability, and lethality. The radar is based on time-domain wideband impulses. For this radar, ARL designed and implemented a data acquisition technique called Synchronous Impulse Reconstruction (SIRE) that allowed us to employ relatively slow ADC (40 MHz) to digitize wideband signals (>3000 MHz). However, the scheme assumed that the radar and targets are stationary during the data acquisition cycle and in reality the target signatures did suffer the distortions in phase and shape due to the radar motion. The phase error would lead to significant loss in target radar cross section values in resulting SAR imagery. The shape errors would destroy the frequency contents of the targets and thus the ability to discriminate targets from other confuser classes. This report describes a signal processing technique that removes the phase and shape distortions in the radar signal due to the motion of the platform. This technique results in SAR imagery with significant improvement in focus quality and signal-to-noise level. This has been tested and verified with simulated and measured radar data. This technique could be applied for any time-based impulse radar system that experiences the relative motion between the radar and the targets during the data acquisition cycle.

DTIC

*Broadband; Distortion; Impulses; Radar Signatures; Signal Processing; Signatures; Synthetic Aperture Radar*

**20080025363** Naval Surface Warfare Center, Crane, IN USA

**Evaluation of the AN/SAY-1 Thermal Imaging Sensor System**

Smith, John G; Middlebrook, Christopher T; Apr 2002; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479160; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479160>

The AN/SAY-1 Thermal Imaging Sensor System 'TISS' was developed to provide surface ships with a day/night imaging capability to detect low radar reflective, small cross-sectional area targets such as floating mines. Through field testing and laboratory measurements, the performance of the imaging sensors of TISS has been evaluated. The objective of this paper is to present program history, performance evaluation of TISS, and future considerations of the TISS program.

DTIC

*Detection; Infrared Imagery; Target Acquisition; Thermal Mapping*

**20080025470** NanoOpto Corp., Somerset, NJ USA

**Novel Pixilated Polarimeter and Associated Nanoimprinting Techniques, to Address Advanced Imaging Applications**

Wang, Jian J; Guo, Jay L; Jun 15, 2007; 40 pp.; In English

Contract(s)/Grant(s): FA9550-07-C-0012

Report No.(s): AD-A479246; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The final objective of this contract is to improve nano-optical sub-components and then further to demonstrate a

monolithically integrated nano-optical pixilated-array polarimeter. In parallel, part of the goal of this project is also to develop a low-cost web-to-web nanoimprint system/method/process for more efficiently making low-cost nano-structured optical devices directly onto plastic sheets. In the final report, we will report and summarize all the results and progresses which we have made during the whole phase-I program. We have made tremendous progress during this program. The results outperform our original expectation.

DTIC

*Imagery; Imaging Techniques; Lithography; Polarimeters*

**20080025476** Washington Univ., Seattle, WA USA

**Modeling the SAR Signature of Nonlinear Internal Waves**

Lettvin, Ellen E; Apr 2008; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0368

Report No.(s): AD-A479256; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Nonlinear Internal Waves are pervasive globally, particularly in coastal waters. The currents and displacements associated with internal waves influence acoustic propagation and underwater navigation, as well as ocean transport and mixing. Synthetic Aperture Radar (SAR) imagery can reveal the surface manifestations of internal waves (IW) in satellite imagery and so is routinely used to locate and characterize these features. Though some of the mechanisms that link the SAR signatures, surface processes, and the underlying internal structures have been understood for decades, a complete characterization has yet to emerge, making SAR imagery useful only as a qualitative tool. The objective of this research is to develop and validate a forward model to predict the SAR signature of NLIWs that explicitly includes relevant mechanisms that impact the sea surface roughness and corresponding backscattering cross section, such as wind speed and direction, compound modulation (i.e. modulation of intermediate-scale waves by IWs, which in turn modulate smaller waves), microscale breaking and breaking waves.

DTIC

*Internal Waves; Nonlinearity; Radar Signatures; Signatures; Synthetic Aperture Radar*

**20080025650** NASA, Washington, DC USA

**Video sensor with range measurement capability**

Briscoe, Jeri M., Inventor; Corder, Eric L., Inventor; Howard, Richard T., Inventor; Broderick, David J., Inventor; May 20, 2008; 6 pp.; In English

Patent Info.: Filed April 13, 2005; US-Patent-7,375,801; US-Patent-Appl-SN-11/108,140; No Copyright; Avail.: CASI:

A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025650>

A video sensor device is provided which incorporates a rangefinder function. The device includes a single video camera and a fixed laser spaced a predetermined distance from the camera for, when activated, producing a laser beam. A diffractive optic element divides the beam so that multiple light spots are produced on a target object. A processor calculates the range to the object based on the known spacing and angles determined from the light spots on the video images produced by the camera.

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

*Laser Beams; Range Finders; Cameras; Lasers; Rangefinding*

**20080025655** California Inst. of Tech., Pasadena, CA USA

**Single substrate camera device with CMOS image sensor**

Fossum, Eric R., Inventor; Nixon, Robert, Inventor; May 6, 2008; 19 pp.; In English

Patent Info.: Filed April 15, 2003; US-Patent-7,369,166; US-Patent-Appl-SN-10/414,871; No Copyright; Avail.: CASI:

A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025655>

Single substrate device is formed to have an image acquisition device and a controller. The controller on the substrate controls the system operation.

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

*Control Systems Design; Substrates; Cameras; Controllers*

**20080025656** Massachusetts Inst. of Tech., Cambridge, MA USA

**Elastomeric actuator devices for magnetic resonance imaging**

Dubowsky, Steven, Inventor; Hafez, Moustapha, Inventor; Jolesz, Ferenc A., Inventor; Kacher, Daniel F., Inventor; Lichter, Matthew, Inventor; Weiss, Peter, Inventor; Wingert, Andreas, Inventor; April 22, 2008; 57 pp.; In English  
Patent Info.: Filed November 8, 2002; US-Patent-7,362,889; US-Patent-Appl-SN-10/291,866; No Copyright; Avail.: CASI: A04, Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080025656>

The present invention is directed to devices and systems used in magnetic imaging environments that include an actuator device having an elastomeric dielectric film with at least two electrodes, and a frame attached to the actuator device. The frame can have a plurality of configurations including, such as, for example, at least two members that can be, but not limited to, curved beams, rods, plates, or parallel beams. These rigid members can be coupled to flexible members such as, for example, links wherein the frame provides an elastic restoring force. The frame preferably provides a linear actuation force characteristic over a displacement range. The linear actuation force characteristic is defined as  $\pm 20\%$  and preferably  $10\%$  over a displacement range. The actuator further includes a passive element disposed between the flexible members to tune a stiffness characteristic of the actuator. The passive element can be a bi-stable element. The preferred embodiment actuator includes one or more layers of the elastomeric film integrated into the frame. The elastomeric film can be made of many elastomeric materials such as, for example, but not limited to, acrylic, silicone and latex.

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

*Magnetic Resonance; Imaging Techniques; Dielectrics; Silicones; Curved Beams; Displacement*

**20080025699** Defence Research and Development Canada, Ottawa, Ontario Canada

**Performance Comparison of RADARSAT-2 Advanced Moving Object Detection Experiment Modes**

Chiu, S; Dec 2007; 42 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A479298; DRDC-ONTARIO-TM-2007-320; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It has been recognized that a two-aperture approach to ground moving target indication is sub-optimum and that target parameter estimation is often compromised by clutter interference or poor signal-to-clutter ratios. This paper investigates the Ground Moving Target Indication (GMTI) performance of several virtual channel concepts proposed for the RADARSAT-2 Moving Object Detection EXperiment (MODEX). These are capable of increasing the spatial diversity of RADARSAT-2 by exploiting its very flexible antenna programming capabilities and allowing the two-channel SAR system to operate like a three or four channel radar. A high fidelity Space-Based Radar Moving Target Indication Simulator (SBRMTISIM) is used to generate virtual channel raw GMTI data for analysis. Moving targets are detected using a combination of the Factored Space-Time Adaptive Processing (Factored STAP) and the Cell-Averaging Constant False Alarm Rate (CA-CFAR) detector. The detection performances of virtual multichannel MODEX modes are analyzed and compared with each other and with those of true or fictitious multichannel space-based radar systems.

DTIC

*Detection; Moving Target Indicators; RADARSAT*

**20080025812** Ladas and Parry, Los Angeles, CA, USA

**GaN-Based Sensor Nodes for In Situ Detection of Gases**

Moon, J. S., Inventor; Prokopuk, N., Inventor; Son, K. A., Inventor; 11 May 05; 13 pp.; In English  
Contract(s)/Grant(s): ARO-BAA05SST0028

Patent Info.: Filed 11 May 05; US-Patent-Appl-SN-11-128-110

Report No.(s): PB2007-110608; No Copyright; Avail.: CASI: A03, Hardcopy

A system for detecting chemical/biological substances and a detection method. The system comprises a plurality of sensing units or nodes and a radiofrequency link. Each unit has several sensors with different sensing curves. Each sensor is able to transmit information related to the sensed substance on a specific frequency. The sensors preferably comprise AlGaIn/GaN high electron mobility transistors.

NTIS

*Detection; Gallium Nitrides; Optical Measuring Instruments; High Electron Mobility Transistors; Gas Detectors*



**20080025853** Defence Research and Development Canada, Ottawa, Ontario Canada

**Validation of Ship Signatures in Envisat ASAR AP Mode Data using AISLive: Data Acquisition, Processing, and Analysis Results**

Vachon, Paris W; Wolfe, John; Mar 2008; 72 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479306; DRDC-TM-2008-005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ships appear in synthetic aperture radar (SAR) ocean imagery as bright targets against the ocean clutter background. Envisat Advanced SAR (ASAR) Alternating Polarization (AP) mode data acquisitions over the Strait of Dover and the Strait of Gibraltar, two high-density shipping regions with Automatic Identification System (AIS) coverage via AISLive, have provided a large database of validated ship signatures. For each validated ship signature, several metrics were computed including the clutter statistics, the total radar cross section of each ship, and the ship signature length. These metrics were evaluated in terms of the polarization, the local incidence angle, the validated ship length, the target to clutter ratio, and the ship aspect angle. This is a very rich data set that has yielded new observations and insights to ship detectability by SAR. These results could have bearing on the design of future SAR modes or SAR missions, and could be used to improve the performance of ship detection software.

DTIC

*Data Acquisition; Scientific Satellites; Ships; Signatures; Synthetic Aperture Radar*

**20080025868** Defence Research and Development Canada, Ottawa, Ontario Canada

**A Basic Fourier Transform Pair for Slant Range-Doppler Modeling of Moving Scatterers for SAR Applications: Theory**

Sabry, R; Nov 2007; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479330; DRDC-ONTARIO-TM-2007-289; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Considering the exploitation needs associated with the Synthetic Aperture Radar (SAR) applications involving moving and non-stationary targets, a fundamental spectral domain model for moving point and distribution of scatterers is presented. The approach is accurate as the spherical phase front is rigorously treated throughout the Doppler analysis. Due to the analytic nature of the model in range-Doppler plain, large squint-angle operations (e.g., SpotSAR) can be characterized. Furthermore, motion characteristics can be extracted in the sub-aperture level to better reflect the general motion (e.g., non-uniform). As a result, enhanced adaptivity can be achieved to improve the imagery and other target-signature measured products. The range-Doppler model can serve as a tool for polarimetric and multi-channel analysis.

DTIC

*Fourier Transformation; Scattering; Slopes; Synthetic Aperture Radar*

**20080025873** Defence Research and Development Canada, Ottawa, Ontario Canada

**Nonstationary Interference Excision for Noise Radar Systems using Time-Frequency based Methods**

Thayaparan, T; Dakovic, M; Stankovic, L; Dec 2007; 38 pp.; In English

Report No.(s): AD-A479301; DRDC-ONTARIO-TM-2007-334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The problem addressed in this memorandum is nonstationary interference suppression in noise radar systems. Towards this aim, linear time-frequency (TF) transforms, short time Fourier transform (STFT) and local polynomial Fourier transform (LPFT) are used as a means of signal representation. The noise radar return signal is a wideband random signal occupying the whole TF plane, while the interference signal is well concentrated in the TF plane. This implies that the filtering of the received signal can be performed by using a binary mask to excise only a portion of the TF plane corrupted by the interference. Simulations carried out on the radar return signal corrupted by an extremely strong nonstationary interferences, covering the same time and frequency ranges. Results confirm the effectiveness of the proposed method.

DTIC

*Fourier Transformation; Frequencies*

**20080025925** Defence Research and Development Canada, Ottawa, Ontario Canada

**Analysis of High Resolution Polarimetry Data of Static Targets in Automatic Target Recognition Context**

Sandrasegaram, Nicholas; Liu, Chen; Dec 2007; 66 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479331; DRDC-TM-2007-330; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reduction of false alarm with acceptable accuracy of classification rate is a challenge in Automatic Target Recognition (ATR) using Synthetic Aperture Radar (SAR) images. This report addresses the evaluation of polarimetric techniques features,

benefits of applying Two-Dimensional Fourier Transform on the polarimetric features, and the technique of training data selection to improve the classification accuracy and to reduce the false alarm in small stationary targets of high-resolution full polarimetric SAR images. The Pauli and Cameron decompositions, Self Organizing Maps, and Span techniques are applied on the polarimetric data and then Two-Dimensional Fourier Transform is applied to improve the performance. Two types of training data (one with samples of target only and the other with samples of target and Not-a-target) are used to train the Holographic Neural Technology (a neural network) classifier. The results show the Self Organizing Map feature extraction technique with Fourier Transform algorithm has a better classification rate and low false alarm. The ATR system trained with samples of target and not-a-target, produced low false alarm compared to the one trained with samples of target alone.

DTIC

*High Resolution; Polarimetry; Radar Imagery; Synthetic Aperture Radar; Target Recognition; Targets*

**20080026036** NASA Johnson Space Center, Houston, TX, USA

**Effect of DC Offset on the T-Wave Residuuum Parameter**

Scott, N.; Greco, E. C.; Schlegel, Todd T.; April 22, 2006; 1 pp.; In English; International Society for Computerized Electrocardiology, 22-27 Apr. 2006, Niagara-on-the-Lake, Canada; Copyright; Avail.: Other Sources; Abstract Only

The T-wave residuum (TWR) is a relatively new 12-lead ECG parameter that may reflect cardiac repolarization heterogeneity. TWR shows clinical promise and may become an important diagnostic tool if accurate, consistent, and convenient methods for its calculation can be developed. However, there are discrepancies between the methods that various investigators have used to calculate TWR, as well as some questions about basic methodology and assumptions that require resolution. The presence of a DC offset or very low frequency AC component to the ECG is often observed. Many researchers have attempted to compensate for these by high pass filters and by median beat techniques. These techniques may help minimize the contribution of a low frequency AC component to the TWR, but they will not eliminate a DC offset inherent within the instrumentation. The present study examined the presence of DC offsets in the ECG record, and their effect on TWR. Specifically, in healthy individuals, a DC offset was added to all 8 channels collectively or to each channel selectively. Even with offsets that were relatively small compared to T-wave amplitude, the addition of either collectively or individually applied offsets was observed to produce very significant changes in the TWR, affecting its value by as much as an order of magnitude. These DC offsets may arise from at least two possible sources: a transient artifact from EMG or electrode movement resulting in a transient baseline offset in one or more channels. Since highpass filters have a settling time of several seconds, these artifacts will contribute to a transitory baseline offset lasting 1020 cycles. The machine hardware may also introduce an offset. Regardless of the cause or source of a DC offset, this study demonstrates that offsets have a very significant impact on TWR, and that future studies must not ignore their presence, but rather more appropriately compensate for them.

Author

*Electrocardiography; Direct Current; Electromyography; Cardiac Output*

## 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*.

**20080023790** NASA Langley Research Center, Hampton, VA, USA

**Single-mode, All-Solid-State Nd:YAG Laser Pumped UV Converter**

Prasad, Narasimha S.; Armstrong, Darrell, J.; Edwards, William C.; Singh, Upendra N.; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, Co, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.15

Report No.(s): L-7084; Copyright; Avail.: CASI: [A01](#), Hardcopy

In this paper, the status of a high-energy, all solid-state Nd:YAG laser pumped nonlinear optics based UV converter development is discussed. The high-energy UV transmitter technology is being developed for ozone sensing applications from space based platforms using differential lidar technique. The goal is to generate greater than 200 mJ/pulse with 10-50 Hz PRF at wavelengths of 308 nm and 320 nm. A diode-pumped, all-solid-state and single longitudinal mode Nd:YAG laser designed to provide conductively cooled operation at 1064 nm has been built and tested. Currently, this pump laser provides an output pulse energy of >1 J/pulse at 50 Hz PRF and a pulsewidth of 22 ns with an electrical-to-optical system efficiency of greater

than 7% and a  $M(\text{sup } 2)$  value of  $<2$ . The single frequency UV converter arrangement basically consists of an IR Optical Parametric Oscillator (OPO) and a Sum Frequency Generator (SFG) setups that are pumped by 532 nm wavelength obtained via Second Harmonic Generation (SHG). In this paper, the operation of an inter cavity SFG with CW laser seeding scheme generating 320 nm wavelength is presented. Efforts are underway to improve conversion efficiency of this mJ class UV converter by modifying the spatial beam profile of the pump laser.

Author

*Neodymium Lasers; YAG Lasers; Continuous Wave Lasers; Solid State Lasers; Optical Radar; Energy Conversion Efficiency; Frequency Converters; Harmonic Generations; Transmitters*

**20080025290** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Laser Diagnostic System Validation and Ultra-Compact Combustor Characterization**

Hankins, Terry B; Mar 2008; 172 pp.; In English

Report No.(s): AD-A478891; AFIT/GAE/ENY/08-M14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478891>

The AFIT combustion optimization and analysis laser (COAL) lab is now completely operational and is state-of-the-art in combustion diagnostics. The objective of this research is to perform a validation of a laser diagnostic system and to begin the characterization of a small-scale model of an ultra-compact combustor (UCC). Validation of the laser system was accomplished by using planar laser induced fluorescence (PLIF) on a laminar premixed hydrogen-air flame produced by a Hencken burner. OH species concentrations are measured. Flame temperatures are determined with a two line fluorescence technique using different transitions in the (1,0) band of the OH (A-X) electronic transition system. Comparisons are made to existing research to prove accuracy. Characterization of the UCC began by developing an operational procedure. A proper starting condition and operating regime has been established. Pressures, temperature, and emissions data have been recorded for a range of equivalence ratios. Comparisons are made to previous computational fluid dynamic (CFD) research. Combustion efficiencies of over 99% have been recorded when operating the small-scale UCC. Future work will involve using PLIF to take non-intrusive measurements inside the combustor through optically clear quartz windows to study cavity-vane interactions.

DTIC

*Characterization; Combustion; Combustion Chambers; Diagnosis; Laser Induced Fluorescence; Lasers*

**20080025489** State Univ. of New York, NY USA

**3-5 Micrometers Room Temperature Operated CW Laser Diodes Based on Novel InGaAsNSb Material System**

Balenky, Gregory; Mar 14, 2008; 21 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0372

Report No.(s): AD-A479292; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Novel mid-IR photonic device technology has been developed. High power room temperature operated diode lasers for spectral region above 3 micrometer have been designed and fabricated. 120mW CW output power level was obtained at 3 micrometer and 80 mw CW at 3.1 micrometer at room temperature. More than 200mW CW output was obtained near 3 micrometer at temperatures accessible with thermo-electric cooling. We demonstrate a double-quantum-well GaSb-based diode laser operating at 2.3-2.4 micrometer with a room- temperature CW output power above 1W and a maximum power-conversion efficiency of 17.5%. Insufficient hole confinement in GaSb-based photonic nanostructures reported prior to this project work was identified by set of specially designed experimental studies and by theoretical modeling. We have developed novel design approach based on combination of strain engineered active region and quaternary barrier material to fabricate watt class efficient diode lasers for spectral region from 3 to 3.5 micrometer. These new devices will substitute bulky optically pumped solid-state light emitters with poor power conversion efficiency or cryogenically cooled semiconductor lasers in several important home security application.

DTIC

*Continuous Wave Lasers; Room Temperature; Semiconductor Lasers*

**20080025648** NASA, Washington, DC USA

**High speed three-dimensional laser scanner with real time processing**

Lavelle, Joseph P., Inventor; Schuet, Stefan R., Inventor; May 20, 2008; 17 pp.; In English

Patent Info.: Filed September 23, 2004; US-Patent-7,375,826; US-Patent-Appl-SN-10/956,517; No Copyright; Avail.:

CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025648>

A laser scanner computes a range from a laser line to an imaging sensor. The laser line illuminates a detail within an area covered by the imaging sensor, the area having a first dimension and a second dimension. The detail has a dimension perpendicular to the area. A traverse moves a laser emitter coupled to the imaging sensor, at a height above the area. The laser emitter is positioned at an offset along the scan direction with respect to the imaging sensor, and is oriented at a depression angle with respect to the area. The laser emitter projects the laser line along the second dimension of the area at a position where an image frame is acquired. The imaging sensor is sensitive to laser reflections from the detail produced by the laser line. The imaging sensor images the laser reflections from the detail to generate the image frame. A computer having a pipeline structure is connected to the imaging sensor for reception of the image frame, and for computing the range to the detail using height, depression angle and/or offset. The computer displays the range to the area and detail thereon covered by the image frame.

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

*Laser Applications; Optical Scanners; Lasers; Display Devices; Real Time Operation*

**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*.

**20080023855** USA Environmental, Inc., Oldsmar, FL USA

**Remote Excavation of Heavily Contaminated UXO Sites. The Range Master**

Crandall, Alan L; Sep 5, 2007; 94 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA72-03-C-0011; Proj-MM-0327

Report No.(s): AD-A478544; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478544>

USA Environmental, Inc., and Timberline Environmental Services, Inc., developed the Range Master, a remote controlled scraper with an integrated power screen, to excavate and sift the top 12 inches of heavily contaminated UXO sites. The Phase 1 effort demonstrated the manually operated Range Master at a controlled test site. The Phase 2 effort added system armor and the remote control systems. The Phase 2 Range Master was demonstrated at a live site at the Former Lowry Bombing and Gunnery Range (FLBGR), Bomb Target #2 (BT#2) in Colorado. This report documents the Phase 2 development and demonstration activities and results.

DTIC

*Ammunition; Contamination; Excavation; Hazardous Wastes; Ordnance; Remote Control; Scrapers*

**20080024039** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**The Concept Design of a Split Flow Liquid Hydrogen Turbopump**

Arguello, Michael A; Mar 2008; 125 pp.; In English

Report No.(s): AD-A478749; AFIT/GAE/ENY/08-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The static and dynamic pitch and roll stability derivatives of a finned, axisymmetric missile known as the Basic Finner were examined using a Computational Fluid Dynamics (CFD) approach. Stability derivatives are used to characterize vehicle motion, and knowledge of them is critical to the design of stable uncontrolled vehicles and control systems for controlled vehicles. Using CFD to characterize the motion of new munition designs has the potential to improve overall performance and reduce research and testing costs. The present analysis simulated forced oscillation and free oscillation of the Basic Finner model using the Air Force SEEK EAGLE Office's Beggar code. The pitch stability derivatives were determined at 0 degrees angle of attack for six Mach numbers from 1.58 to 2.50 and at Mach number equal to 1.96 for angles of attack from 0 to 20 degrees. The parameters defining the motion of the forced oscillation tests were the reduced pitch rate, amplitude, Newton

iterations, iterations per oscillation, and total oscillations. Convergence studies on each of these parameters were performed to ensure both convergence and solution independence. Roll stability derivatives were determined through forced, constant rate rolling motion for six Mach numbers from 1.58 to 2.50 at an angle of attack of 0 degrees. The parameters defining the roll motion were reduced roll rate and iterations per revolution, which were chosen in the same manner as the pitch parameters. Good agreement was found between the different methods tested, previous CFD analysis, and experimental data.

DTIC

*Liquid Hydrogen; Turbine Pumps*

**20080024161** Army Tank-Automotive Research and Development Command, Warren, MI USA

**System and Method for Hitch With Backup Anti-Jack Knife and Anti-Drive**

Kendall, Donald H, Inventor; Sep 5, 2006; 13 pp.; In English

Report No.(s): AD-D020325; PATENT-7 100 489 B1; No Copyright; Avail.: US Patent and Trademark Office

For use in landmine clearing, a hitch system providing backup with anti-jack knife and anti-dive, the system includes a hitch assembly and a roller assembly. The hitch assembly has a hinge axis housing containing a hinge shaft and a connector shaft housing containing a stop block having a first side that engages a flat region on the hinge shaft and a second side that engages a biasing spring that is held in the connector shaft housing using an end cap. The roller assembly includes a roller frame that is rigidly mechanically coupled to the hinge shaft. The biasing spring is selected to provide a compressive bias to the stop block such that the roller assembly selective rotates about the hinge axis housing when the roller assembly is subjected to a landmine detonation, and such that rotation of the hinge shaft is prevented during normal forward, reverse, and turning maneuvers.

DTIC

*Hinges; Patents*

**20080024166** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Noback Bolt**

Korpi, John G, Inventor; Aug 30, 2005; 6 pp.; In English

Report No.(s): AD-D020333; PATENT-6 935 214 B2; No Copyright; Avail.: US Patent and Trademark Office

There is described and claimed herein a noback bolt design which comprises an elongated shaft having two opposing ends. The first end has an enlarged conical bolt head that extends from this shaft. On the opposite shaft end is a terminus or tip. Between the tip and the conical head, the shaft bears an externally threaded segment on at least a portion of the shaft. The precise length of this segment is determined upon intended applications of my bolt, and the type or exact number of structural components to be assembled. These components include panels, brackets, planar surfaces, chassises, and like structures.

DTIC

*Bolts; Patents*

**20080025056** Indian Inst. of Tech., Bombay, India

**Diagnosis of Localized Defects in Tapered Roller Bearings. Part II: Frequency Domain Analysis**

Andhare, Atul; Manik, Dhanesh; International Journal of COMADEM, Volume 10, No. 3; July 2007, pp. 42-49; In English; See also [20080025055](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper presents results of vibration monitoring performed in the frequency domain, for diagnosing localised defects in tapered roller bearings. Initially, a few defect-free tapered roller bearings were tested for their vibration characteristics, for different operating speeds and loads. Later, a few bearings with single point defect, either on outer race or roller, were tested to obtain the vibration features. The vibrations of defect-free and defective bearings were compared to get information for defect diagnostics. based on the above investigations, it is found that axial and radial vibration frequency characteristics are different in tapered roller bearings. Enveloped spectra were found to be very useful for defect detection, followed by peak ratios. Using the experimental data, it was possible to clearly identify various types of defects.

Author

*Defects; Roller Bearings; Frequency Domain Analysis; Structural Vibration; Fault Detection; Solid Mechanics*

**20080025057** Tufts Univ., Medford, MA, USA

**Rotor Dynamics without Equations**

Nelson, F. C.; International Journal of COMADEM, Volume 10, No. 3; July 2007, pp. 2-10; In English; See also [20080025055](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The analysis of the lateral and torsional motion of spinning rotors is replete with applications of Newton's and Euler's

equations. Sometimes the intricacies of these equations overshadow their simpler physical meaning. This paper attempts to compensate for this by explaining the dynamic behavior of spinning rotors without writing any equations.

Author

*Rotor Dynamics; Rotors; Rotation; Mechanical Engineering*

**20080025058** Caledonian Univ., Glasgow, UK

**An Experimental Investigation to Analyze the Effect of Unbalance in a Horizontal Rotor System Using Coast-Down Factor**

Browne, R. Edwin; Ramachandran, K. P.; DeSilva, A. K. M.; Harrison, D. K.; International Journal of COMADEM, Volume 10, No. 3; July 2007, pp. 11-18; In English; See also [20080025055](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

When the power supply is cut off to any rotor system, the total momentum gained during the sustained operation will dissipate and the system will come to stop. The time elapsed between the power supply cut-off and the system to stop is defined as Coast Down Time (CDT). The nature of graph drawn between the cut-off speed and CDT is denoted as Coast Down Time-Profile (CDT-P). The profile of graph obtained during the deceleration period is often characterised by frictional behavior and is defined as CDT-P. This paper presents an experimental investigation conducted on horizontal rotor system with full journal bearing at different cut-off speeds, tribological condition and induced unbalance effect to the rotor system. Investigation indicates that the CDT is a dependant parameter upon inertia forces on the system components, mechanical and environmental conditions and tribological behavior. An empirical equation for Coast Down Factor (CDF) has been developed for proper interpretation of the CDT P. Observation on CDF reveals the potential benefits of using it as a diagnostic parameter for condition monitoring programme in order to analyze the effect of unbalance on the rotor system.

Author

*Rotors; Momentum; Deceleration; Asymmetry; Critical Velocity; Lubricants; Rotor Dynamics*

**20080025059** Indian Inst. of Tech., Bombay, India

**Diagnosis of Localized Defects in Tapered Roller Bearings. Part I : Time Domain Analysis**

Andhare, Atul; Manik, Dhanesh; International Journal of COMADEM, Volume 10, No. 3; July 2007, pp. 29-41; In English; See also [20080025055](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper presents results of experiments performed towards diagnosis of defects in tapered roller bearings using vibration monitoring. For studying the vibration characteristics of tapered roller bearings, an experimental set up was constructed. Initially, a few defect-free tapered roller bearings were tested for the vibration characteristics, under various operating speeds and loads. Later, a few bearings with a single point defect, either on outer race or rollers, were tested to obtain their vibration characteristics. The time-domain data were used for analysing the vibration using various techniques like: peak to valley, rms level, Skewness, Kurtosis, etc. The vibration parameters of defect-free and defective bearings were compared to get information for defect diagnosis. A MATLAB based GUI was developed for vibration signal processing and diagnostics. This GUI made use of all the time domain parameters to diagnose defects in bearings. Based on these investigations, it was concluded that, time waveform, form factor, parameter K and cepstrum are good fault indicators for outer race defects on tapered roller bearings; whereas Kurtosis, form factor and Skewness are good for detection of roller defects. The diagnosis cannot be correct by using a single time domain parameter. Frequency domain analysis has to be used in conjunction with time-domain analysis for correct diagnosis.

Author

*Roller Bearings; Time Domain Analysis; Defects; Fault Detection; Rollers*

**20080025232** Georgia Inst. for Research, Atlanta, GA, USA

**Atlanta Commute Vehicle Soak and Start Distributions and Engine Starts per Day: Impact on Mobile Source Emission Rates**

Guensler, R.; Yoon, S.; Li, H.; Elango, V.; Apr. 2007; 64 pp.; In English

Report No.(s): PB2007-112660; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of research efforts reported herein is to develop gasoline vehicle soak and start time distributions and engine starts per day for EPA light-duty vehicle (LDV) and light-duty truck (LDT combining LDT1, LDT2, LDT3, and LDT4) classes using vehicle trip data collected in the 13-county Atlanta metropolitan area during the calendar year 2004. Given the equipment and methods used in the Commute Atlanta vehicle activity data can be linked back to general household demographic parameters (household income, household size, and vehicle ownership) and vehicle characteristics (vehicle type

and model year). Approximately 80-85% of the vehicles in the study are not shared, meaning that most vehicle activity can also be linked back to individual driver characteristics (age and gender).

NTIS

*Gasoline; Cities; Income*

**20080025452** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Universal Single Element Filter Test Fixture**

Korpi, John, Inventor; Manceor, Michael, Inventor; Jun 13, 2006; 9 pp.; In English

Report No.(s): AD-D020337; PATENT-7 060 178 B2; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020337>

A filter-testing fixture holds a single fuel filter and is adjustable to accommodate a range of filter sizes and shapes. The fixture has a base section that defines a water collection reservoir, and the base opens upward toward a housing. Water separated from fuel in the housing thus drains into the reservoir. A fuel inlet conduit passes through the reservoir, one end of the conduit being disposed above the base section. The first, or filter-supporting, adapter is removably attached to this end of the conduit, and both the first adapter and this end are disposed within, the housing. The housing removably and sealingly mates to the base, and a cap assembly likewise removably and sealingly mates to the housing. A second, repositionable, filter-housing adapter is connected to the inner surface of the cap.

DTIC

*Fixtures; Fluid Filters; Patents*

**20080025455** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Reduced Shank External Flow Passage Bolt With Integral Pilot**

McGough, Matthew G, Inventor; Jan 7, 2003; 5 pp.; In English

Report No.(s): AD-D020347; PATENT-6 503 038 B2; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020347>

A specially designed bolt fastens together two parts of an engine and in particular can fasten together two components of a rocker arm assembly. The bolt is in a bore passing through the two components. The bolt has a full-diameter pilot that closely fits with the bore at a location where the components mate, and thereby locates the components relative to each other. On opposing axial sides of the pilot are reduced-diameter shank portions of the bolt, which form cylindrical gaps with the bore. The pilot has groove communicating the cylindrical gaps, whereby the gaps and grooves form an oil flow path along the bolt. A duct in each component communicates with a respective one of the cylindrical gaps, so that oil flows through one components, along the bolt and then into the other component.

DTIC

*Bolts; Joints (Junctions); Patents*

**20080025457** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Independent Steering Device for an Axle**

Warner, Joseph G, Inventor; Jul 12, 2005; 6 pp.; In English

Report No.(s): AD-D020349; PATENT-6 916 029 B2; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020349>

A trailer axle has steerable wheels that rotate on hub assemblies pivotally mounted to the axle. Connected to the axle is a mechanism for controlling the pivoting of the hub assemblies and thereby limiting the extent to which the steerable wheels turn. The mechanism has a rod disposed along the axle and pivotally connected to the hub assemblies. A bracket on the axle has an aperture through which the rod passes, the aperture permitting the rod's motion both parallel to the axle and transverse to the axle. Flanges on the rod span an opening of the aperture and slidingly engage the bracket. The flanges are translatable on the bracket transversely to the axle but are immobile in a direction parallel to the axle. The mechanism has collars at the ends of the rod and two elongate coil springs encircling the rod. One end of each spring is affixed to the collar and the other end of each spring is affixed to the flange. The springs bias the rod and hub assemblies toward a position where the hub assemblies and wheels are oriented at a desired steering angle. The position of the collars on the rod can be adjusted to vary the bias of the spring. Adjusting the collars' positions also controls the distance between the springs' coils and thereby ultimately controls the degree of steering of the wheels.

DTIC

*Brackets; Hubs; Mounting; Patents; Shafts (Machine Elements); Steering; Trailers*

**20080025461** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Rapid 4-Stokes Parameter Determination Via Stokes Filter Wheel**

Gerhart, Grant R, Inventor; Matchko, Roy M, Inventor; Nov 13, 2007; 13 pp.; In English

Report No.(s): AD-D020354; PATENT-7 295 312 B1; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020354>

A system for determining polarization profiles of points in a scene from video frames using Stokes parameters includes a scene having a region that emits scene light rays that correspond to the points in the scene, an optical chopper controller, a rotating Stokes filter wheel that includes five trigger holes, three rotating linear polarizers, a circular polarizer, and a reference screen, a color filter, a video camera having a video frame, and a computer system having a frame grabber apparatus. The scene light rays are transmitted through the Stokes filter and the color filter to the video camera. Images corresponding to the scene light rays are projected onto respective pixels in the video frame and recorded as two-dimensional (2-D) arrays, and the images corresponding to the scene light rays from four unique images, obtained from light transmitted consecutively through three linear polarizers and a circular polarizer of the rotating Stokes filter wheel, are used by programming in the computer system to calculate respective Stokes parameters of the points in the scene.

DTIC

*Navier-Stokes Equation; Patents; Wheels*

**20080025749** NASA Glenn Research Center, Cleveland, OH, USA

**Rolling Bearing Life Prediction, Theory, and Application**

Zaretsky, Erwin V.; [2008]; 94 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.07.03; No Copyright; Avail.: Other Sources

A tutorial is presented outlining the evolution, theory, and application of rolling-element bearing life prediction from that of A. Palmgren, 1924, W. Weibull, 1939, G. Lundberg and A. Palmgren, 1947 and 1952, E. Ioannides and T. Harris, 1985, and E. Zaretsky, 1987. Comparisons are made between these life models. The Ioannides-Harris model without a fatigue limit is identical to the Lundberg-Palmgren model. The Weibull model is similar to that of Zaretsky if the exponents are chosen to be identical. Both the load-life and Hertz stress-life relations of Weibull, Lundberg and Palmgren, and Ioannides and Harris reflect a strong dependence on the Weibull slope. The Zaretsky model decouples the dependence of the critical shear stress-life relation from the Weibull slope. This results in a nominal variation of the Hertz stress-life exponent. For 9th- and 8th-power Hertz stress-life exponents for ball and roller bearings, respectively, the Lundberg-Palmgren model best predicts life. However, for 12th- and 10th-power relations reflected by modern bearing steels, the Zaretsky model based on the Weibull equation is superior. Under the range of stresses examined, the use of a fatigue limit would suggest that (for most operating conditions under which a rolling-element bearing will operate) the bearing will not fail from classical rolling-element fatigue. Realistically, this is not the case. The use of a fatigue limit will significantly overpredict life over a range of normal operating Hertz stresses. (The use of ISO 281:2007 with a fatigue limit in these calculations would result in a bearing life approaching infinity.) Since the predicted lives of rolling-element bearings are high, the problem can become one of undersizing a bearing for a particular application.

Author

*Ball Bearings; Weibull Density Functions; Prediction Analysis Techniques; Critical Loading; Life (Durability); Loads (Forces); Roller Bearings*

**20080025986** NASA Glenn Research Center, Cleveland, OH, USA

**Preliminary Test Results of a Non-Contacting Finger Seal on a Herringbone-Grooved Rotor**

Proctor, Margaret P.; Delgado, Irebert R.; [2008]; 14 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.02

Report No.(s): E-16560; No Copyright; Avail.: Other Sources

Low leakage, non-contacting finger seals have potential to reduce gas turbine engine specific fuel consumption by 2 to 3% and to reduce direct operating costs by increasing the time between engine overhauls. A non-contacting finger seal with concentric lift-pads operating adjacent to a test rotor with herringbone grooves was statically tested at 300, 533, and 700 K inlet air temperatures at pressure differentials up to 576 kPa. Leakage flow factors were approximately 70% less than state-of-the-art labyrinth seals. Leakage rates are compared to first order predictions. Initial spin tests at 5000 rpm, 300 K inlet air temperature and pressure differentials to 241 kPa produced no measurable wear.

Author

*Labyrinth Seals; Rotors; Leakage; Mechanical Engineering; Grooves*



**20080025987** NASA Glenn Research Center, Cleveland, OH, USA

**Stirling System Modeling for Space Nuclear Power Systems**

Lewandowski, Edward J.; Johnson, Paul K.; June 2008; 14 pp.; In English; Space Nuclear Conference 2007 (SNC '07), 24-28 Jun. 2007, Boston, MA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-00145; WBS 138494.04.01.01

Report No.(s): NASA/CR-2008-215146; SNC-Paper- 2056; E-16310; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025987>

A dynamic model of a high-power Stirling convertor has been developed for space nuclear power systems modeling. The model is based on the Component Test Power Convertor (CTPC), a 12.5-kWe free-piston Stirling convertor. The model includes the fluid heat source, the Stirling convertor, output power, and heat rejection. The Stirling convertor model includes the Stirling cycle thermodynamics, heat flow, mechanical mass-spring damper systems, and the linear alternator. The model was validated against test data. Both nonlinear and linear versions of the model were developed. The linear version algebraically couples two separate linear dynamic models; one model of the Stirling cycle and one model of the thermal system, through the pressure factors. Future possible uses of the Stirling system dynamic model are discussed. A pair of commercially available 1-kWe Stirling convertors is being purchased by NASA Glenn Research Center. The specifications of those convertors may eventually be incorporated into the dynamic model and analysis compared to the convertor test data. Subsequent potential testing could include integrating the convertors into a pumped liquid metal hot-end interface. This test would provide more data for comparison to the dynamic model analysis.

Author

*Stirling Cycle; Spacecraft Power Supplies; Nuclear Electric Power Generation; Dynamic Models; Nuclear Models; Systems Engineering; Free-Piston Engines; Mechanical Engineering; Electric Generators*

**20080025996** General Electric Aircraft Engines, Cincinnati, OH, USA

**Intelligent Engine Systems: Bearing System**

Singh, Arnant P.; June 2008; 23 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-1135; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215239; E-16498; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025996>

The overall requirements necessary for sensing bearing distress and the related criteria to select a particular rotating sensor were established during the phase I. The current phase II efforts performed studies to evaluate the Robustness and Durability Enhancement of the rotating sensors, and to design, and develop the Built-in Telemetry System concepts for an aircraft engine differential sump. A generic test vehicle that can test the proposed bearing diagnostic system was designed, developed, and built. The Timken Company, who also assisted with testing the GE concept of using rotating sensors for the differential bearing diagnostics during previous phase, was selected as a subcontractor to assist General Electric (GE) for the design, and procurement of the test vehicle. A purchase order was prepared to define the different sub-tasks, and deliverables for this task. The University of Akron was selected to provide the necessary support for installing, and integrating the test vehicle with their newly designed test facility capable of simulating the operating environment for the planned testing. The planned testing with good and damaged bearings will be on hold pending further continuation of this effort during next phase.

Author

*Turbine Engines; Bearings; Fault Detection; Sensors; Systems Health Monitoring; Telemetry; Systems Engineering; Aircraft Engines; Smart Structures; Mechanical Engineering*

## 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*.

**20080024214** Structural Engineering Research Centre, Chennai, India

**Remote Structural Health Monitoring of Civil Infrastructures - Recent Trends**

Sridhar, S.; Sankar, K. Ravi; Sreeshylam, P.; Parivallal, S.; Kesavan, K.; Murthy, S. G. N.; International Journal of COMADEM, Volume 11, No. 1; January 2008, pp. 25-35; In English; See also [20080024209](#); Copyright; Avail.: Other Sources

Construction and maintenance of large civil infrastructures are very much essential for development of any country. The

modern constructed facilities involve a huge capital cost and complex design procedures to ensure longer service life and better performance in adverse environmental conditions. There is a growing demand to monitor the health of these structures to increase its safety and serviceability. Remote health monitoring (RHM) is a recent methodology, whereby the instrumented structure is continuously monitored from a distant place, using the latest communication and IT tools. Here, multiple structures, located at different places can be monitored from a single station and the response from the structure can be acquired even in adverse situations like flood, cyclone, etc. In remote health monitoring, in addition to the provision of continuous monitoring and warning during abnormal behavior, efficient damage detection and performance evaluation algorithms can be integrated with the system. This paper briefly discusses the various aspects of RMH techniques, the latest developments in software and hardware associated with RHM, and a short note on the development of a RHM system at Structural Engineering Research Centre, Chennai.

Author

*Structural Engineering; Buildings; Structural Stability; Wireless Communication; Data Acquisition*

**20080024671** National Chiao Tung Univ., Hsinchu, Taiwan, Province of China

**Experimental Study on Seismic Performance of Steel Beam to SRC Column Connections**

Weng, Cheng-Chiang; Yin, Yen-Liang; Wang, Huei-Shun; Yang, Chong-Han; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 239-252; In English; See also [20080024669](#); Copyright; Avail.: Other Sources

The seismic performance of steel beam to steel reinforced concrete (SRC) column connections was investigated experimentally through cyclic loading tests of two full-scale specimens. In this study, the SRC column was made of a steel box section encased in reinforced concrete. The reason for using an SRC column is to take advantage of its fire resistance, structural stiffness and strength. The experimental results showed that both of the test specimens demonstrated excellent seismic resistance capability. The steel beams of the connections were able to develop plastic rotations in excess of 5.3% radians. Satisfactory interstory drift angle up to 6.2% radians was observed from the tests. The experiments also indicated that the reinforced concrete in the beam-to-column connection zone provided an 'effective constraint' to the embedded portion of the steel beam in the joint. It was observed that this constraint successfully assisted the steel beam to develop a plastic hinge outside of the SRC column face. Consequently, the groove-welded joint of the steel beam to the steel box section in the SRC column was protected by the reinforced concrete and avoided possible premature failure.

Author

*Composite Materials; Cyclic Loads; Seismology; Box Beams; Steels; Welded Joints; Concretes*

**20080025083** Florida Univ., Gainesville, FL USA

**Finite Element Analysis of Fluid-Structure Interaction in a Blast-Resistant Window System**

Chung, Jae H; Consolazio, Gary R; Dinan, Robert J; Rinehart, Stephen A; Mar 2008; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4819-07-D-0001; Proj-4915

Report No.(s): AD-A478373; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478373>

This paper describes the development of a finite element model capable of representing a blast-resistant flexible window (flex-window) system developed by the Air Force Research Laboratory, Airbase Technologies Division (AFRL/RXQ). Computational fluid-structure interaction finite element simulations are used to develop an improved understanding of the manner in which fluid phenomena, such as air compression and flow, affect the behavior of the flex-window system under blast loading. Compressible air flow interacting with a flexible thin-shell structure of the flex-window (transient air-window panel interaction phenomena) is found to significantly influence system performance. The influences of shock wave propagation and fluid venting inside the damping chamber of the flex-window system are quantified and the influences of such phenomena on panel deflections, deformations, and internal forces are presented.

DTIC

*Finite Element Method; Shelters*

**20080025131** Army Construction Engineering Research Lab., Champaign, IL USA

**Energy and Process Optimization Assessment at U.S. Army Installation in Germany: Keiserslautern Army Depot, Piermasens Army Depot, Katterbach Kaserne, Storck Barracks in Illesheim, and U.S. Army Garrison Wiesbaden Schools**

Zhivov, Alexander M; Underwood, David M; Vavrin, John L; Woody, Alfred; Bjork, Curt; Newman, James; Reinkinen, Erja; Husu, Timo; Schmidt, Michael; Klassek, Manfred; Sep 2007; 240 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A478527; ERDC/CERL TR-07-37; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478527>

An energy and process optimization assessment (EPOA) study was conducted at selected U.S. Army installations in Germany and at two U.S. Army Garrison Wiesbaden schools to identify potential for energy conservation at those locations. The study identified energy conservation, process optimization, and environmental improvement opportunities that could significantly reduce operating costs and improve the installations mission readiness and competitive position. Eighty five energy conservation measures (ECMS) were identified, most of which were quantified economically; if implemented, these ECMS would reduce annual electrical energy consumption by approximately 2412 MWH, thermal heating consumption by 17277 MWH, and total operating costs by approximately \$1.4 million/yr. Implementation of all these ECMS would cost approximately \$9.7 million and would yield an average simple payback of 7.2 yrs. The study recommends that these potential cost savings be aggressively pursued with an program of energy and process optimization. A separate level I EPOA study of the industrial complex at the Germersheim DDDE and a Level II EPOA study at the flight simulator building in Illesheim were also recommended, since these locations both show potential for significant reductions in energy use and operating cost, and for improvement in worker productivity.

DTIC

*Cost Effectiveness; Costs; Energy Conservation; Energy Policy; Installing; Schools*

**20080025150** Army Construction Engineering Research Lab., Champaign, IL USA

**Fort Campbell Childers House: Historic Maintenance and Repair Manual**

Smith, Adam; Feucht, Jennifer; Tooker, Megan W; Stone, Sunny; Sep 2006; 226 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-131097

Report No.(s): AD-A478354; ERDC/CERL-SR-06-43; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478354>

The Childers House is located at Fort Campbell, Kentucky (the house is located in Montgomery County, Tennessee). The Childers family built the house during the years of 1938 and 1939. The cultural resources firm of Dennison and O'Malley found the building ineligible for National Register of Historic Places (NRHP) nomination in 1977, determining that the house did not meet the NRHP Criteria. A more detailed report in the 1990s concurred with the 1977 evaluation; however, in 1997, the Tennessee State Historic Preservation Officer (SHPO) made a determination that the Childers House appeared to be eligible for listing on the NRHP under Criterion C: architecture due to a resemblance to Gunston Hall, Virginia. The Fort Campbell Integrated Cultural Resources Management Plan (ICRMP) recommended a complete documentation and re-evaluation of the building. This report satisfies Section 110 of the National Historic Preservation Act (NHPA) of 1966 as amended and will help the Fort Campbell Cultural Resources Office and Directorate of Public Work in managing this historic building.

DTIC

*Buildings; Cultural Resources; Maintenance*

**20080025318** Library of Congress, Washington, DC USA

**U.S. Embassy in Iraq**

Epstein, Susan B; Oct 10, 2007; 6 pp.; In English

Report No.(s): AD-A478961; CRS-RS21867; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478961>

Concerns about the U.S. Embassy in Iraq have surfaced regarding the potential rising cost, delay in opening, quality of construction, and reported assertions of trafficking-like labor practices by First Kuwaiti General Trade and Contracting Company, the primary builder of the U.S. Embassy in Baghdad. On October 4, 2007, the Chairman of the House Foreign Affairs Committee, Representative Tom Lantos, sent questions to Deputy Secretary of State, John Negroponte, regarding concerns about the embassy construction defects, possible increasing costs, and delays. Construction costs for the U.S. Embassy in Iraq have been met through supplemental appropriations. Embassy operations also have been met primarily

through supplemental appropriations, with some embassy operation funding provided by the regular appropriation process. This year, the Bush Administration's FY2008 budget request includes \$65 million for base funding for operations in Iraq. In addition, the Administration requested \$823.9 million for mission operations in an FY2007 supplemental request and another \$1.9 million for mission operations in an FY2008 emergency request. On May 24, 2007, Congress passed a compromise supplemental appropriation (H.R. 2206), which the President signed into law (P.L. 110-28) on May 25. The enacted law included \$750 million for State Department operations in Iraq. As recently as September 2007, the Department of State claimed that the \$592 million from a previous emergency supplemental appropriation (H.R. 1268/P.L. 109-13), signed into law on May 11, 2005, was all that was needed for construction of the U.S. Embassy in Baghdad. In addition, administration officials claimed that completion of the embassy was still expected soon. This report will be updated as information becomes available.

DTIC

*Construction; Costs; Iraq*

**20080025729** NASA Marshall Space Flight Center, Huntsville, AL, USA

**An Alternative Method Of Specifying Shock Test Criteria**

Ferebee, R. C.; Clayton, J.; Alldredge, D.; Irvine, T.; April 2008; 48 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS8-02045

Report No.(s): NASA/TM-2008-215253; M-1226; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025729>

Shock testing of aerospace vehicle hardware has presented many challenges over the years due to the high magnitude and short duration of the specifications. Recently, component structural failures have occurred during testing that have not manifested themselves on over 200 Space Shuttle solid rocket booster (SRB) flights (two boosters per flight). It is suspected that the method of specifying shock test criteria may be leaving important information out of the test process. The traditional test criteria specification, the shock response spectrum, can be duplicated by any number of waveforms that may not resemble the actual flight test recorded time history. One method of overcoming this limitation is described herein, which may prove useful for qualifying hardware for the upcoming Constellation Program.

Author

*Shock Tests; Waveforms; Structural Failure; Aerospace Vehicles; Flight Tests*

**20080026188** NASA Langley Research Center, Hampton, VA, USA

**Efficient Modal Basis Selection Criteria for Reduced-Order Nonlinear Simulation**

Przekop, Adam; Rizzi, Stephen A.; July 07, 2008; 14 pp.; In English; EUROODYN 2008 - 7th European Conference on Structural Dynamics, 7-9 Jul. 2008, Southampton, UK; Original contains color illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.02.66

Report No.(s): Paper 69; Copyright; Avail.: CASI: A03, Hardcopy

A modal basis selection technique for a reduced-order nonlinear numerical simulation with application to two-dimensional structures is presented as a two-step procedure. A system identification analysis is first performed using proper orthogonal decomposition. Using these results, a set of load-invariant bases consisting of the normal modes is next selected. Two criteria for making the basis selection are offered; one using the modal assurance criterion and the other using the modal expansion theorem. The quality of the subsequent reduced-order analyses are examined through comparison with computationally intensive finite element nonlinear simulations in physical degrees-of-freedom. A clamped flat isotropic plate under a random acoustic loading is considered to demonstrate the procedure. It is found that the subject procedure enables formation of an accurate and computationally efficient reduced-order system applicable to a broad range of loading conditions.

Author

*Nonlinearity; Simulation; Modal Response; Mathematical Models; Dynamic Structural Analysis; Structural Design Criteria*

**20080026224** Jenkins, Wilson, Taylor and Hunt, P.A., Durham, NC, USA; Tennessee Univ., Knoxville, TN, USA

**Vehicle Fatigue Life and Durability Monitoring System and Methodology**

Ridnour, J. A., Inventor; Freeman, J. S., Inventor; 14 Jan 05; 94 pp.; In English

Contract(s)/Grant(s): DMD-05-01-P-0999

Patent Info.: Filed 14 Jan 05; US-Patent-Appl-SN-11-036-830

Report No.(s): PB2007-110664; No Copyright; Avail.: CASI: [A05](#), Hardcopy

Apparatuses and methods for determining the useful life status of a structure, such as a vehicular trailer, by predicting failure at a specific location on the structure are disclosed. The system includes one or more sensors placed at one or more selected locations on the structure, the selected locations being apart from the specific location, for generating data signals related to one or more variables measured at the selected locations. A network is included for gathering and combining the data signals generated by the one or more sensors. A processor is included for comparing the data signals with a predetermined expected failure value in order to predict failure at the specific location on the structure, thereby determining the useful life status of the structure.

NTIS

*Durability; Failure Analysis; Fatigue Life; Life (Durability); Predictions*

## 42

### GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

**20080024683** Chaoyang Univ. of Technology, Taichung, Taiwan, Province of China

#### **Copper Distribution for Contaminated Soils and Acid Wash Efficiency**

Cheng, Shu-Fen; Chang, Jih-Hsing; Huang, Chin-Yuan; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 231-237; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 94-2211-E-324-04; Copyright; Avail.: Other Sources

Current application of acid washing is to practice fractionation of soil based on particle size prior to washing. However, there is little published information concerning the relationship between the cost-effectiveness of this practice and soil characteristics; this shortage contributes to less than adequate application of washing in most remediation jobs in Taiwan. This research collected soil samples from a copper-contaminated agricultural field in central Taiwan to study the cleansing efficiency of using acid washing combined with particle sieving for remediating the contaminated soil. The soil texture is a sandy loam. The sandy portion constitutes more than 50% of the total soil mass; and its copper content is below the regulated limitation. Therefore, after separation by sieving, this saves more than 50% of the cost of acid washing. For the sandy portion, the hydrochloric acid solution is more effective but for the silt and clay portions, a mixture of hydrochloric acid and citric acid is most effective to remove copper. This study contributes information valuable to advance the application of acid washing to remediate contaminated soil.

Author

*Copper; Soil Sampling; Sediments; Soils; Contamination*

**20080026081** NASA Johnson Space Center, Houston, TX, USA

#### **In-Situ and Experimental Evidence for Acidic Weathering of Rocks and Soils on Mars**

Hurowitz, J. A.; McLennan, S. M.; Tosca, N. J.; Arvidson, R. E.; Michalski, J. R.; Ming, D.; Schroeder, C.; Squyres, S. W.; [2006]; 53 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-12916; 361426.04.05; Copyright; Avail.: CASI: [A04](#), Hardcopy

Experimental data for alteration of synthetic Martian basalts at pH=0-1 indicate that chemical fractionations at low pH are vastly different from those observed during terrestrial weathering. Rock analyses from Gusev crater are well described by the relationships apparent from low pH experimental alteration data. A model for rock surface alteration is developed which indicates that a leached alteration zone is present on rock surfaces at Gusev. This zone is not chemically fractionated to a large degree from the underlying rock interior, indicating that the rock surface alteration process has occurred at low fluid-to-rock ratio. The geochemistry of natural rock surfaces analyzed by APXS is consistent with a mixture between adhering soil/dust and the leached alteration zone. The chemistry of rock surfaces analyzed after brushing with the RAT is largely representative of the leached alteration zone. The chemistry of rock surfaces analyzed after grinding with the RAT is largely representative of the interior of the rock, relatively unaffected by the alteration process occurring at the rock surface. Elemental measurements from the Spirit, Opportunity, Pathfinder and Viking 1 landing sites indicate that soil chemistry from widely separated locations is consistent with the low-pH, low fluid to rock ratio alteration relationships developed for Gusev rocks.

Soils are affected principally by mobility of FeO and MgO, consistent with alteration of olivine-bearing basalt and subsequent precipitation of FeO and MgO bearing secondary minerals as the primary control on soil geochemistry.

Author

*Basalt; Fractionation; Geochemistry; Rocks; Soils; Mars Craters; Iron Oxides; Mars Landing Sites; Acidity; Weathering*

## 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*.

**20080023781** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Remote Sensing Information Classification**

Rickman, Douglas L.; April 29, 2008; 12 pp.; In English; HELIX-Israel Kick-Off Workshop/Center for Disease Control, 28-29 Apr. 2008, Tel Aviv, Israel; Original contains black and white illustrations; No Copyright; Avail.: CASI: [C01](#), CD-ROM: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023781>

This viewgraph presentation reviews the classification of Remote Sensing data in relation to epidemiology. Classification is a way to reduce the dimensionality and precision to something a human can understand. Classification changes SCALAR data into NOMINAL data.

CASI

*Classifications; Epidemiology; Remote Sensing*

**20080023784** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Remote Sensing**

Rickman, Douglas; April 29, 2008; 12 pp.; In English; HELIX-Israel Kick-Off Workshop/Center for Disease Control, 29 Apr. 2008, Tel-Aviv, Israel; Original contains black and white illustrations; No Copyright; Avail.: CASI: [C01](#), CD-ROM: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023784>

Remote sensing is measuring something without touching it. Most methods measure a portion of the electro-magnetic spectrum using energy reflected from or emitted by a material. Moving the instrument away makes it easier to see more at one time. Airplanes are good but satellites are much better. Many things can not be easily measured on the scale of an individual person. Example - measuring all the vegetation growing at one time in even the smallest country. A satellite can see things over large areas repeatedly and in a consistent way. Data from the detector is reported as digital values for a grid that covers some portion of the Earth. Because it is digital and consistent a computer can extract information or enhance the data for a specific purpose.

Author

*Remote Sensing; Digital Computers; Emittance; Extraction*

**20080023834** Oregon State Univ., Corvallis, OR USA

#### **Optical Imaging of the Nearshore**

Holman, Robert A; Mar 20, 2008; 6 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0154

Report No.(s): AD-A478443; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478443>

This grant supported a variety of studies in the area of littoral processes typically as revealed by the optical remote sensing data of the Argus Program. One principle theme was the development of algorithms for estimating relevant geophysical variables such as longshore currents and wave directional spectra from ground-based optical cameras. The second theme was the study of observed nearshore physics. Much of the latter work focused on the morpho-dynamics of nearshore sand bars or foreshore morphological features. Like many nearshore phenomena, the dynamics of nearshore sand bars is dominated by

strong feedbacks, with bars both causing and being caused by wave breaking. Weaknesses in our ability to characterize and understand such feedback systems are the single largest limitation in our current predictive capabilities.

DTIC

*Geophysics; Images; Imaging Techniques; Remote Sensors*

**20080023836** Naval Research Lab., Washington, DC USA

**Geochemical Characterization of Concentrated Gas Hydrate Deposits on the Hikurangi Margin, New Zealand: Preliminary Geochemical Cruise Report**

Coffin, Richard B; Hamdan, LeiLa; Pohlman, John; Wood, Warren; Pecher, Ingo; Henrys, Stuart; Greinert, Jens; Faure, Kevin; Gorman, Andrew; Orpin, Alan; Feb 29, 2008; 44 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478461; NRL/MR/6110-07-9085; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478461>

This report provides a preliminary summary of geochemical contribution to methane hydrate research and exploration on the Hikurangi Margin, off the northeastern coast of New Zealand from June 20 to July 3, 2006. Geochemical porewater profiles taken from shallow piston cores and vertical fluid migration measured with heatflow probing were compared with seismic summaries of potential deep sediment hydrates deposits. Research goals for this expedition include: (1) Refine geophysical, geochemical, and microbiological technologies for prospecting hydrate distribution and content; (2) Contribute to establishing high-priority geographical regions of prospective interest, in terms of methane volume estimates; (3) Prediction of environmental effects and geologic risks at the continental margin associated to the natural resource occurrence and resource exploitation; and (4) Expand understanding of the biogeochemical parameters and associated microbial community diversity in shallow sediments that influences the porewater sulfate gradient observed through anaerobic methane oxidation profiles. Scientists from New Zealand, USA, Belgium, Canada and Germany, representing 11 university and government research institutions contributed to this expedition. Expertise of the science team resulted in the contribution of geochemical, geophysical, geological, molecular ecology, and biological data to address ocean water column, sediment, and porewater research questions.

DTIC

*Deposits; Exploration; Geochemistry; Geophysics; Hydrates; Methane*

**20080024025** Engineer Research and Development Center, Alexandria, VA USA

**Handbook for Transformation of Datums, Projections, Grids, and Common Coordinate Systems**

Ackeret, James; Esch, Fred; Gard, Chris; Gloeckler, Frederick; Oimen, Daniel; Perez, Juan; Simpson, Justin; Specht, Daniel; Rossander, Harry; Stoner, David; May 2004; 150 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478730; ERDC/TEC-SR-00-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document provides U.S. Army organizations and agencies with general guidance on selecting the appropriate methods for shifting between local geodetic datums and the World Geodetic System (WGS), and for converting Cartesian and map projection coordinates to and from geodetic coordinates. This guidance is provided to aid the Army community in selecting datum shift algorithms; developing, selecting, and maintaining software using these algorithms; and implementing this software to support operational limits. Equations are furnished for map projections and datums commonly used within the Army. References are provided for other, less commonly encountered, map projections and datums.

DTIC

*Coordinates; Geodesy; Handbooks*

**20080024204** NASA Langley Research Center, Hampton, VA, USA

**EAQUATE: An International Experiment for Hyper-Spectral Atmospheric Sounding Validation**

Taylor, J. P.; Smith, W.; Cuomo, V.; Larar, A.; Zhou, D.; Serio, C.; Maestri, T.; Rizzi, R.; Newman, S.; Antonelli, P.; Mango, S.; DiGirolamo, P.; Esposito, F.; Grieco, G.; Summa, D.; Restieri, R.; Masiello, G.; Romano, F.; Pappalardo, G.; Pavese, G.; Mona, L.; Amodeo, A.; Pisani, G.; February 2008; 41 pp.; In English; Original contains color and black and white illustrations  
Contract(s)/Grant(s): WBS 23-291-01-01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The international experiment called EAQUATE (European AQUA Thermodynamic Experiment) was held in September 2004 in Italy and the UK to demonstrate certain ground-based and airborne systems useful for validating hyperspectral satellite sounding observations. A range of flights over land and marine surfaces were conducted to coincide with overpasses of the AIRS instrument on the EOS Aqua platform. Direct radiance evaluation of AIRS using NAST-I and SHIS has shown excellent

agreement. Comparisons of level 2 retrievals of temperature and water vapor from AIRS and NAST-I validated against high quality lidar and drop sonde data show that the 1K/1km and 10%/1km requirements for temperature and water vapor (respectively) are generally being met. The EAQUATE campaign has proven the need for synergistic measurements from a range of observing systems for satellite cal/val and has paved the way for future cal/val activities in support of IASI on the European Metop platform and CrIS on the US NPP/NPOESS platform.

Author

*Atmospheric Sounding; Thermodynamics; Satellite Sounding; Earth Observing System (EOS); Aqua Spacecraft*

**20080024223** NASA Langley Research Center, Hampton, VA, USA

**CALIPSO Observations of Stratospheric Aerosols: A Preliminary Assessment**

Thomason, Larry W.; Pitts, Michael C.; Winker, David M.; [2007]; 17 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 895632.04.07.06; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080024223>

We have examined the 532-nm aerosol backscatter coefficient measurements by the Cloud- Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) for their use in the observation of stratospheric aerosol. CALIPSO makes observations that span from 82 S to 82 N each day and, for each profile, backscatter coefficient values reported up to approx. 40 km. The possibility of using CALIPSO for stratospheric aerosol observations is demonstrated by the clear observation of the 20 May 2006 eruption of Montserrat in the earliest CALIPSO data in early June as well as by observations showing the 7 October 2006 eruption of Tavurvur (Rabaul). However, the very low aerosol loading within the stratosphere makes routine observations of the stratospheric aerosol far more difficult than relatively dense volcanic plumes. Nonetheless, we found that averaging a complete days worth of nighttime only data into 5-deg latitude by 1-km vertical bins reveals a stratospheric aerosol data centered near an altitude of 20 km, the clean wintertime polar vortices, and a small maximum in the lower tropical stratosphere. However, the derived values are clearly too small and often negative in much of the stratosphere. The data can be significantly improved by increasing the measured backscatter (molecular and aerosol) by approximately 5% suggesting that the current method of calibrating to a pure molecular atmosphere at 30 km is most likely the source of the low values.

Author

*Aerosols; CALIPSO (Pathfinder Satellite); Stratosphere; Technology Assessment; Scattering Coefficients*

**20080025047** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Forest Attributes from Radar Interferometric Structure and its Fusion with Optical Remote Sensing**

Treuhaft, Robert N.; Law, Beverly E.; Asner, Gregory P.; BioScience; June 2004; Volume 54, No. 6, pp. 561-571; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG5-8315; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40842>

The possibility of global, three-dimensional remote sensing of forest structure with interferometric synthetic aperture radar (InSAR) bears on important forest ecological processes, particularly the carbon cycle. InSAR supplements two-dimensional remote sensing with information in the vertical dimension. Its strengths in potential for global coverage complement those of lidar (light detecting and ranging), which has the potential for high-accuracy vertical profiles over small areas. InSAR derives its sensitivity to forest vertical structure from the differences in signals received by two, spatially separate radar receivers. Estimation of parameters describing vertical structure requires multiple-polarization, multiple-frequency, or multiple-baseline InSAR. Combining InSAR with complementary remote sensing techniques, such as hyperspectral optical imaging and lidar, can enhance vertical-structure estimates and consequent biophysical quantities of importance to ecologists, such as biomass. Future InSAR experiments will supplement recent airborne and spaceborne demonstrations, and together with inputs from ecologists regarding structure, they will suggest designs for future spaceborne strategies for measuring global vegetation structure.

Author

*Remote Sensing; Optical Radar; Interferometry; Synthetic Aperture Radar; Forests; Ecology; Carbon Cycle*



**20080025293** Ohio State Univ., Columbus, OH USA

**Optimal Mapping When Datasets are Massive**

Cressie, Noel A; Mar 25, 2008; 9 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0133

Report No.(s): AD-A478900; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478900>

Maps are an extremely important part of any military operation and producing timely and accurate maps is an essential planning tool. Ocean-floor or terrain data are static and spatial, while meteorological or visibility data are dynamic and spatio-temporal. Data upon which maps are based can be simultaneously massive and sparse, and they are noisy. In the presence of uncertainty due to missing data and measurement-error noise, spatial and spatio-temporal statistical analysis of massive data sets is challenging. The massiveness causes problems in computing optimal spatial predictors, such as kriging, since one has to solve (and store) systems of equations equal to the size of the data. In addition, a large spatial domain is often associated with nonstationary behavior over that domain. The objectives of this study are as follows: (1) construct a flexible family of nonstationary covariance functions using a truncated set of basis functions, fixed in number; (2) develop the necessary methodology and algorithms for covariance-parameter estimation; (3) derive optimal spatial or spatio-temporal maps that account for uncertainties statistically; and (4) incorporate spatial and spatio-temporal dependencies into the analysis of sensor-network data.

DTIC

*Data Processing; Mapping; Optimization; Prediction Analysis Techniques; Spatial Distribution; Statistical Analysis*

**20080025354** Army Engineer Research and Development Center, Vicksburg, MS USA

**Comparison of Acoustic and Aerial Photographic Methods for Quantifying the Distribution of Submersed Aquatic Vegetation in Sagamore Creek, NH**

Sabol, Bruce; Lord, Elizabeth; Reine, Kevin; Shafer, Deborah; Mar 2008; 30 pp.; In English

Report No.(s): AD-A479128; ERDC-TN-DOER-E23; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479128>

Maintenance dredging in the Black Channel portion of the Portsmouth Harbor and Piscatiqua River Federal Navigation Project in Portsmouth (commonly referred to as Sagamore Creek) occurs in close proximity to submersed aquatic vegetation (SAV). Species, density, and spatial distribution are of concern to resource agencies given the potential impacts associated with dredging activities including the physical removal of vegetation as well as increases in turbidity and/or siltation. A variety of techniques are available for determining these attributes, including manual sampling, aerial photographic surveys, and acoustic-based surveys. Aerial photography is a standard technique for characterizing SAV distribution and, under some conditions, distinguishing species. It may underestimate SAV coverage if water clarity is low or there is poor contrast between SAV and adjoining bottom material. Acoustic surveys employ the acoustic reflectivity of the SAV for detection and for determining canopy geometric characteristics. Although acoustic techniques are not limited by water clarity, they are typically unable to distinguish species. Both photographic and acoustic techniques require some physical ground-truth sampling to verify interpretation and output. In preparation for scheduled maintenance dredging in Sagamore Creek, near Little Harbor, NH, SAV surveys were scheduled. During coordination meetings to plan these surveys, the validity of the height-based rule for distinguishing eelgrass from marine macroalgae was questioned. Accordingly, a study was planned to compare an acoustic-based estimate of eelgrass distribution with that from aerial photography. In particular, the effect of the acoustic-based plant height discriminant for estimating eelgrass coverage was to be evaluated in this study.

DTIC

*Aerial Photography; Aquatic Plants; Sound Detecting and Ranging; Surveys; Vegetation*

**20080025356** Army Engineer Research and Development Center, Vicksburg, MS USA

**Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region**

Mar 2008; 146 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479138; ERDC/EL-TR-08-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479138>

This document is one of a series of Regional Supplements to the Corps of Engineers Wetland Delineation Manual, which provides technical guidance and procedures for identifying and delineating wetlands that may be subject to regulatory jurisdiction under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. The development of Regional Supplements is part of a nationwide effort to address regional wetland characteristics and improve the accuracy and efficiency of wetland-delineation procedures. This supplement is applicable to the Great Plains Region, which consists of all

or significant portions of 11 states: Colorado, Kansas, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming.

DTIC

*Delineation; Engineers; Wetlands*

**20080025357** Army Engineer Research and Development Center, Vicksburg, MS USA

**The Use of Sand Fences in Barrier Island Restoration: Experience on the Louisiana Coast**

Khalil, Syed M; Mar 2008; 23 pp.; In English

Report No.(s): AD-A479139; ERDC-TN-SWWRP-08-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479139>

This System-Wide Water Resources (SWWRP) technical note describes experiences with sand fences to reduce losses by wind-blown sand transport on restored barrier islands in Louisiana. Seven installations of sand fences with various plan view orientations and cross-sectional designs are reviewed. Recommendations are given for use of sand fences in conjunction with restoration of barrier island systems.

DTIC

*Coasts; Sands*

**20080025493** Library of Congress, Washington, DC USA

**U.S. Trade Deficit and the Impact of Rising Oil Prices**

Jackson, James K; Jan 15, 2008; 7 pp.; In English

Report No.(s): AD-A479305; CRS-RS22204; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Petroleum prices have risen sharply since early 2005. At the same time the average monthly volume of imports of energy-related petroleum products has fallen slightly. The combination of sharply rising prices and a slightly lower level of imports of energy-related petroleum products translates into an escalating cost for those imports. This rising cost added an estimated \$70 billion to the nation's trade deficit in 2005 and \$50 billion in 2006. Imported energy prices moderated in early 2007, before rising again through the summer and more sharply in the fall, following a pattern of rising energy import prices in the spring and summer. This report provides an estimate of the initial impact of the rising oil prices on the nation's merchandise trade deficit. This report will be updated as warranted by events.

DTIC

*Costs; Crude Oil; Economic Impact; Oils; Petroleum Products; United States*

## 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*.

**20080023738** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Fabrication Procedures for LiMn(2)O(4)/Graphite-based Lithium-ion Rechargeable Pouch Cells**

Liu, G.; Zheng, H.; Battaglia, V. S.; Apr. 23, 2007; 7 pp.; In English

Report No.(s): DE2007-909518; No Copyright; Avail.: Department of Energy Information Bridge

The following procedures were developed at LBNL specifically for making electrodes and batteries of LiMn<sub>2</sub>O<sub>4</sub> (spinel) and MCMB (meso carbon micro beads) graphite for high-power applications (HEVs). Electrode performance can be very dependent on the materials used so it is pointed out that Toda M809 was used for the cathode active material and MCMB 10-28 from Osaka Gas was used for the anode active material. The conductive additives were Dankon black, an acetylene black, and SFG-6, a micron-size graphite. The binder used was PVdF (Kureha 1100). More details of these procedures can be found in the lab notebook of Gao Liu. These procedures are documented here but are continuously being refined, and should therefore be considered a work in progress.

NTIS

*Fabrication; Graphite; Lithium; Lithium Batteries; Metal Ions*

**20080023838** Army Construction Engineering Research Lab., Champaign, IL USA

**Detailed Fuel Cell Demonstration Site Summary Report: Edwards Air Force Base, CA**

Torrey, J M; Westerman, John F; Taylor, William R; Holcomb, Franklin H; Bush, Joseph; Aug 2006; 134 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478463; ERDC/CERL TR-06-19; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: <http://hdl.handle.net/100.2/ADA478463>

Fuel cells are an environmentally clean, quiet, and a highly efficient method for generating electricity and heat from natural gas and other fuels. In fiscal year 1993 (FY93), the Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) was assigned the mission of managing the DOD Fuel Cell Demonstration Program. Specific tasks included developing turnkey PAFC packages, devising site criteria, screening candidate DOD installation sites based on selection criteria, evaluating viable applications at each candidate site, coordinating fuel cell site designs, installation and acceptance of the PAFC power plants, and performance monitoring and reporting. CERL selected and evaluated 30 application sites, supervised the design and installation of fuel cells, actively monitored the operation and maintenance of fuel cells, and compiled 'lessons learned' for feedback to fuel cell manufacturers. At the conclusion of the demonstration period, each of the demonstration fuel cell sites was given the choice to either have the fuel cell removed or to keep the fuel cell power plant. This report presents a detailed review of a 200 kW fuel cell installed at Edwards Air Force Base (AFB) and operated between July 1997 and July 2002.

DTIC

*Field Tests; Fuel Cells*

**20080023845** Army Construction Engineering Research Lab., Champaign, IL USA

**Process and Energy Optimization Assessment Level II Analysis. Rock Island Arsenal, IL**

Lin, Mike C; Zhivov, Alexander M; Underwood, David M; Osborn, David I; Woody, Alfred; Smith, Walter P; Bjork, Curt; Chimack, Michael J; Miller, Robert A; Aug 2005; 234 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A478487; ERDC/CERL-TR-05-15; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: <http://hdl.handle.net/100.2/ADA478487>

In summer 2004, researchers from the Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) led a Level I Process and Energy Optimization Assessment at Rock Island Arsenal (RIA). The team identified 36 process and energy improvement ideas that could significantly improve the RIA manufacturing mission readiness and competitive position. Arsenal staffs selected 28 measures for a follow on Level II analysis. This report documents the Level II analysis results and provides recommendation of 15 'appropriation grade' process improvement projects for Army Energy Conservation Investment Program (ECIP) funding application. If implemented, these projects were estimated to yield annual savings of \$0.57M with a total investment of \$1.5 M for an average simple payback of 2.6 years. ECIP funding guidance is also included in this report.

DTIC

*Cost Analysis; Energy Levels; Rocks*

**20080023983** Army Construction Engineering Research Lab., Champaign, IL USA

**Molten Carbonate Fuel Cell Operation With Dual Fuel Flexibility**

Daly, Joseph; Steinfeld, George; Moyer, David K; Holcomb, Franklin H; Oct 2007; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478672; ERDC/CERL-TR-07-43; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ability to operate highly-efficient, pollution-free, distributed-generation power plants on either natural gas or HD-5 grade propane is of interest to the U.S. Army and the U.S. Department of Homeland Security as secure power for critical power operations. To address this interest, Concurrent Technologies Corporation (CTC) teamed with FuelCell Energy (FCE) to test an internally reforming 250 kW carbonate direct fuel cell using HD-5 propane. This fuel cell power plant, originally designed to operate on pipeline natural gas or digester gas, was modified for dual fuel operation (natural gas and propane). Fuel cell operation using HD-5 propane was demonstrated for over 3,900 hrs and achieved high electrical efficiency (45.7 to 47.1 percent lower heating value [LHV]) over a broad range of power outputs. In addition, instantaneous and on-load fuel switching from natural gas to propane and back was demonstrated without loss of power. This dual fuel power plant operated efficiently on either fuel and can provide the U.S. Army and other power users with a viable technology solution for critical power operations.

DTIC

*Fuel Cells; Molten Carbonate Fuel Cells; Natural Gas; Propane*

**20080025274** Spire Corp., Bedford, MA, USA

**Infrared Detection of Solar Cell Defects Under Forward Bias**

Nowlan, M. J., Inventor; Moore, S. B., Inventor; Miller, D. C., Inventor; Sutherland, S. F., Inventor; 12 May 04; 4 pp.; In English

Contract(s)/Grant(s): NREL-ZDO-3-306628-12

Patent Info.: Filed 12 May 04; US-Patent-Appl-SN-10-709-529

Report No.(s): PB2007-109085; No Copyright; Avail.: CASI: [A01](#), Hardcopy

Methods and apparatus are disclosed for detecting solar cell defects by applying a forward-biasing electric current through a silicon solar cell or a group of interconnected solar cells for a short duration and then analyzing the resulting thermal image of each cell with an infrared (IR) camera. The invention is particularly useful in assembling solar cell arrays or modules in which large numbers of cells are to be wired together. Automated module assemblers are disclosed in which the cells (or strings of cells) are tested for defects prior to final module assembly.

NTIS

*Bias; Infrared Detectors; Nondestructive Tests; Solar Cells*

**20080025892** Sandia National Labs., Albuquerque, NM USA

**Copper Corrosion and Its Relationship to Solar Collectors: A Compendium**

Menicucci, D. F.; Mahoney, A. R.; Jul. 2007; 138 pp.; In English

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

Report No.(s): DE2007-912648; SAND2007-4347; No Copyright; Avail.: National Technical Information Service (NTIS)

Copper has many fine qualities that make it a useful material. It is highly conductive of both heat and electricity, is ductile and workable, and reasonably resistant to corrosion. Because of these advantages, the solar water heating industry has been using it since the mid-1970s as the material of choice for collectors, the fundamental component of a solar water heating system. In most cases copper has performed flawlessly, but in some situations it has been known to fail. Pitting corrosion is the usual failure mode, but erosion can also occur. In 2000 Sandia National Laboratories and the Copper Development Association were asked to analyze the appearance of pin-hole leaks in solar collector units installed in a housing development in Arizona, and in 2002 Sandia analyzed a pitting corrosion event that destroyed a collector system at Camp Pendleton. This report includes copies of the reports and accounts of these corrosion failures, and provides a bibliography with references to many papers and articles that might be of benefit to the solar community. It consolidates in a single source information that has been accumulated at Sandia relative to copper corrosion, especially as it relates to solar water heaters.

NTIS

*Copper; Corrosion; Corrosion Resistance; Solar Collectors*

**20080025923** Army Research Lab., Adelphi, MD USA

**Chemistry and Structure of Sony's Nexelion Li-ion Electrode Materials**

Wolfenstine, J; Allen, J L; Read, J; Foster, D; Jun 2006; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-6NV5NY

Report No.(s): AD-A479387; ARL-TN-0257; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The composition and structure of Sony Corporation's new 14430 lithium-ion battery electrodes was investigated. It was observed that the anode is a composite consisting of an equal amount on a weight basis of graphite and an amorphous alloy phase. The alloy phase consists mainly of tin and cobalt, with a tin:cobalt ratio of about 1:1. The particle size of the alloy phase is less than 1 micron. For the cathode it was observed that it is a composite consisting of a majority LiCoO<sub>2</sub> phase and a second phase (15 to 20 volume %) whose formula is of the form Li(Co<sub>y</sub>Ni<sub>1.7x</sub>Mn<sub>x</sub>)O<sub>2</sub>. The particle size of both phases is in the micron range with many particles for the Li(Co<sub>y</sub>Ni<sub>1.7x</sub>Mn<sub>x</sub>)O<sub>2</sub> phase in the range between 10 and 20 microns.

DTIC

*Chemical Composition; Electric Batteries; Electrode Materials; Lithium Batteries; Microstructure*

**20080025949** Applied Research Associates, Inc., Tyndall AFB, FL USA

**Transportable Waste-to-Energy System (TWES) Energy Recovery From Bare Base Waste**

Sawyer, Mikel L; Feb 2008; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4819-07-D-0001; Proj-GOVT

Report No.(s): AD-A478934; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478934>

The Air Force Research Laboratory, Airbase Technologies Division (AFRL/RXQ) is developing a Transportable

Waste-to-Energy System (TWES) to produce electricity at domestic and deployed military bases. The project has two stages. Stage 1 is complete. AFRL built a Transportable Furnace System (TFS) that shreds and burns solid waste (wood, paper, plastic, etc.). No additional fuels are required to sustain combustion. It also burns waste oils and contaminated JP-8 or diesel. This full-scale prototype is mounted on a 48-foot flatbed semi-trailer. Burn tests with wood have been successful. No visible emissions are produced. In Stage 2, a heat recovery steam generator, turbine, electric generator, and scrubbing equipment will be added to complete the TWES. The steam alone could be used for a variety of purposes, including showers, laundry, cleaning equipment, heating facilities, and absorption cycle heat pump. The TWES will help the DoD implement Executive Order (EO) 13423 and increase the use of renewable energy. The presentation describes work completed in Stage 1 and work planned for Stage 2 of the TWES project.

DTIC

*Electric Generators; Electric Power Plants; Electricity; Furnaces; Solid Wastes*

**20080026230** Foley and Lardner, LLP, Madison, WI, USA; Chicago Univ., Chicago, IL USA

**Methods for Fabricating Lithium Rechargeable Batteries**

Oh, B., Inventor; Amine, K., Inventor; 23 May 05; 13 pp.; In English

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

Patent Info.: Filed Filed 23 May 05; US-Patent-Appl-SN-11-135-101

Report No.(s): PB2007-110670; No Copyright; Avail.: CASI: [A03](#), Hardcopy

There are provided novel methods of fabricating batteries, particularly rechargeable lithium ion batteries comprising a microporous polymeric gel layer on one or more electrodes of the batteries. The methods include laminating a gellable polymer film to at least one electrode and forming a microporous gellable polymer layer from the laminated film on the electrode. The microporous gellable polymer layer can be produced by extracting plasticizer from the polymer with a solvent. The polymeric gel on the electrode can be formed by exposing the microporous gellable polymer layer to an electrolyte solution which includes a lithium salt.

NTIS

*Electric Batteries; Fabrication; Lithium Batteries; Metal Ions*

## 45

### ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

**20080023950** Desert Research Inst., Reno, NV USA

**Characterizing and Quantifying Local and Regional Particulate Matter Emissions From Department of Defense Installations**

Gillies, J A; Arnott, P; Etyemezian, V; Kuhns, H; Moosmuller, H; DuBois, D; Nickolic, D; Ahonen, S; Schwemmer, Geary; Gillette, D A; Jan 7, 2005; 97 pp.; In English

Contract(s)/Grant(s): Proj-SERDP-CP-1191

Report No.(s): AD-A478617; No Copyright; Avail.: Defense Technical Information Center (DTIC)

CP-1191 had six primary objectives: (1) Determine contributions from dust and other sources at Ft. Bliss, TX, to assess the regional impacts of these emissions on ambient particulate matter levels, (2) Develop a dust emission factor database for military vehicles traveling on unpaved surfaces that reflects the influence of the surface over which the travel takes place and the speed of the vehicles, (3) Develop and test a dust emission transport model that can effectively determine the potential of these emissions for long-range transport, (4) Evaluate military vehicle disturbance effects on soil and surface properties and quantify the effects of disturbance on dust emission potential from impacted surfaces, (5) Assess the potential visibility degradation off-post by the emitted PM, and (6) Develop emission components that will be integrated with a GIS-based emission model to estimate dust emission contributions from testing and training activities. To meet the objectives listed above several field studies and one modeling exercise were carried out.

DTIC

*Air Quality; Defense Program; Deserts; Dust; Particulates*

**20080025068** Army Construction Engineering Research Lab., Champaign, IL USA

**Source Term Model for Fine Particle Resuspension from Indoor Surfaces**

Kim, Yoojeong; Gidwani, Ashok; Sippola, Mark; Sohn, Chang W; Feb 2008; 76 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478675; ERDC/CERL-TR-08-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Phase I effort developed a source term model for particle resuspension from indoor surfaces to be used as a source term boundary condition for CFD simulation of particle transport and dispersion in a building. Specifically, this work: (1) investigated responsible mechanisms for fine particle resuspension from indoor surfaces, (2) identified parameters relevant to resuspension, (3) performed a dimensional analysis and derivation of a resuspension model, and (4) evaluated the model against published experimental data on resuspension. Preliminary validation of the derived model was conducted based on a set of experimental data from the Lawrence Berkeley National Laboratory.

DTIC

*Air Quality; Computational Fluid Dynamics; Indoor Air Pollution*

**20080025157** NASA Langley Research Center, Hampton, VA, USA

**Origins of Chemical Pollution Derived From Mid-Atlantic Aircraft Profiles Using a Clustering Technique**

Hains, Jennifer C.; Taubman, Brett F.; Thompson, Anne M.; Stehr, Jeffrey W.; Doddridge, Bruce G.; Dickerson, Russell R.; March 2008; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 305311.01.07.53; Copyright; Avail.: Other Sources

Upwind sources of NO<sub>x</sub> and SO<sub>2</sub> play a crucial role in the amount of O<sub>3</sub> and aerosols in the lower troposphere in the Mid-Atlantic U.S. This paper describes a novel method of clustering trace gas and aerosol profiles allowing for the quantification of the relationship between point sources and pollution levels. This improves our understanding of pollution origins and potential for prediction of episodes of poor air quality. A hierarchical clustering method was used to classify distinct chemical and meteorological events from over 200 aircraft vertical profiles in the lower troposphere. Profile measurements included O<sub>3</sub>, SO<sub>2</sub>, CO and particle scattering from June through August 1997-2003, in the Mid-Atlantic US (mostly in Maryland, Pennsylvania and Virginia). The clustering technique could discriminate distinct profile shapes including measurements made during the 2002 Canadian forest fires. Forty-eight-hour back trajectories were run for each profile and the integrated NO<sub>x</sub> and SO<sub>2</sub> point source emissions encountered by each trajectory were calculated using data from the EPA Clean Air Market Division's emissions database. There was a strong correlation between integrated NO<sub>x</sub> emissions and O<sub>3</sub> profiles, indicating that O<sub>3</sub> profiles are strongly influenced by and can be predicted with point source emissions. There is a prevalent concentration of SO<sub>2</sub> over the eastern US with mixing ratios decreasing smoothly from about 3.5 ppb near the surface to 0.2 ppb at 2400 m.

Author

*Breguet 1150 Aircraft; Mathematical Models; Air Pollution; Cluster Analysis; Atmospheric Chemistry*

**20080025197** National Renewable Energy Lab., Golden, CO USA

**Improving Wind Turbine Gearbox Reliability**

Musial, W.; Butterfield, S.; McNiff, B.; May 2007; 13 pp.; In English

Contract(s)/Grant(s): DE-AC36-99-GO10337

Report No.(s): DE2007-909663; NREL/CP-500-41548; No Copyright; Avail.: Department of Energy Information Bridge

This paper describes a new research and development initiative to improve gearbox reliability in wind turbines begun at the National Renewable Energy Laboratory (NREL) in Golden, Colorado, USA.

NTIS

*Gears; Reliability; Transmissions (Machine Elements); Wind Turbines*

**20080025201** Oregon State Univ., Corvallis, OR, USA

**VOC and HAP Recovery Using Ionic Liquids. (Final Report, April 2004-March 2007)**

Milota, M. R.; Li, K.; May 29, 2007; 76 pp.; In English

Contract(s)/Grant(s): DE-FC07-03ID14432

Report No.(s): DE2007-909870; No Copyright; Avail.: National Technical Information Service (NTIS)

During the manufacture of wood composites, paper, and to a lesser extent, lumber, large amounts of volatile organic compounds (VOCs) such as terpenes, formaldehyde, and methanol are emitted to air. Some of these compounds are hazardous air pollutants (HAPs). The air pollutants produced in the forest products industry are difficult to manage because the

concentrations are very low. Presently, regenerative thermal oxidizers (RTOs and RCOs) are commonly used for the destruction of VOCs and HAPs. RTOs consume large amounts of natural gas to heat air and moisture. The combustion of natural gas generates increased CO<sub>2</sub> and NO<sub>x</sub>, which have negative implications for global warming and air quality. The aforementioned problems are addressed by an absorption system containing a room-temperature ionic liquid (RTIL) as an absorbent. RTILs are salts, but are in liquid states at room temperature. RTILs, an emerging technology, are receiving much attention as replacements for organic solvents in industrial processes with significant cost and environmental benefits. Some of these processes include organic synthesis, extraction, and metal deposition. RTILs would be excellent absorbents for exhausts from wood products facilities because of their unique properties: no measurable vapor pressure, high solubility of wide range of organic compounds, thermal stability to 200DGC (almost 400DGF), and immiscibility with water. Room temperature ionic liquids were tested as possible absorbents. Four were imidazolium-based and were eight phosphonium-based. The imidazolium-based ionic liquids proved to be unstable at the conditions tested and in the presence of water. The phosphonium-based ionic liquids were stable. Most were good absorbents; however, cleaning the contaminants from the ionic liquids was problematic.

NTIS

*Air Pollution; Liquids; Oxidizers; Pollution Control; Volatile Organic Compounds*

**20080025683** Western Research Inst., Laramie, WY, USA

#### **Mercury CEM Calibration**

Schabron, J. F.; Rovani, J. F.; Sorini, S. S.; Mar. 01, 2007; 166 pp.; In English

Contract(s)/Grant(s): DE-FC26-98FT40323

Report No.(s): DE2007-910141; WRI-07-R004R; No Copyright; Avail.: National Technical Information Service (NTIS)

The Clean Air Mercury Rule (CAMR) which was published in the Federal Register on May 18, 2005, requires that calibration of mercury continuous emissions monitors (CEMs) be performed with NIST-traceable standards. Western Research Institute (WRI) is working closely with the Electric Power Research Institute (EPRI), the National Institute of Standards and Technology (NIST), and the Environmental Protection Agency (EPA) to facilitate the development of the experimental criteria for a NIST traceability protocol for dynamic elemental mercury vapor generators. The traceability protocol will be written by EPA. Traceability will be based on the actual analysis of the output of each calibration unit at several concentration levels ranging from about 2-40 ug/m<sup>3</sup>, and this analysis will be directly traceable to analyses by NIST using isotope dilution inductively coupled plasma / mass spectrometry (ID ICP/MS) through a chain of analyses linking the calibration unit in the power plant to the NIST ID ICP/MS. Prior to this project, NIST did not provide a recommended mercury vapor pressure equation or list mercury vapor pressure in its vapor pressure database. The NIST Physical and Chemical Properties Division in Boulder, Colorado was subcontracted under this project to study the issue in detail and to recommend a mercury vapor pressure equation that the vendors of mercury vapor pressure calibration units can use to calculate the elemental mercury vapor concentration in an equilibrium chamber at a particular temperature. As part of this study, a preliminary evaluation of calibration units from five vendors was made. The work was performed by NIST in Gaithersburg, MD and Joe Rovani from WRI who traveled to NIST as a Visiting Scientist.

NTIS

*Air Pollution; Calibrating; Monitors*

**20080025688** Sandia National Labs., Albuquerque, NM USA

#### **Illustration of Sampling-Based Approaches to the Calculation of Expected Dose in Performance Assessments for the Proposed High Level Radioactive Waste Repository at Yucca Mountain, Nevada**

Helton, J. C.; Sallaberry, C. J.; Apr. 01, 2007; 103 pp.; In English

Contract(s)/Grant(s): DE-AC04-98AL85000

Report No.(s): DE2007-910196; SAND2007-1353; No Copyright; Avail.: National Technical Information Service (NTIS)

A deep geologic repository for high level radioactive waste is under development by the U.S. Department of Energy at Yucca Mountain (YM), Nevada. As mandated in the Energy Policy Act of 1992, the U.S. Environmental Protection Agency (EPA) has promulgated public health and safety standards (i.e., 40 CFR Part 197) for the YM repository, and the U.S. Nuclear Regulatory Commission has promulgated licensing standards (i.e., 10 CFR Parts 2, 19, 20, etc.) consistent with 40 CFR Part 197 that the DOE must establish are met in order for the YM repository to be licensed for operation. Important requirements in 40 CFR Part 197 and 10 CFR Parts 2, 19, 20, etc. relate to the determination of expected (i.e., mean) dose to a reasonably maximally exposed individual (RMEI) and the incorporation of uncertainty into this determination. This presentation describes and illustrates how general and typically nonquantitative statements in 40 CFR Part 197 and 10 CFR Parts 2, 19, 20, etc. can be given a formal mathematical structure that facilitates both the calculation of expected dose to the RMEI and the

appropriate separation in this calculation of aleatory uncertainty (i.e., randomness in the properties of future occurrences such as igneous and seismic events) and epistemic uncertainty (i.e., lack of knowledge about quantities that are poorly known but assumed to have constant values in the calculation of expected dose to the RMEI).

NTIS

*Dosage; Dosimeters; Mountains; Radiation Dosage; Radioactive Wastes; Radiology; Sampling; Waste Disposal*

**20080025772** Christian (Stephen R.), Idaho Falls, ID, USA

**Sensor System for Buried Waste Containment Sites**

Smith, A. M., Inventor; Gardner, B. M., Inventor; Kostelnik, K. M., Inventor; Partin, J. K., Inventor; Lancaster, G. D., Inventor; 3 Aug 05; 15 pp.; In English

Contract(s)/Grant(s): DE-AC07-99ID13727; DE-AC07-94ID13223

Patent Info.: Filed Filed 3 Aug 05; US-Patent-Appl-SN-11-197-185

Report No.(s): PB2007-110547; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A sensor system is disclosed for a buried waste containment site having a bottom wall barrier and/or sidewall barriers, for containing hazardous waste. The sensor system includes one or more sensor devices disposed in one or more of the barriers for detecting a physical parameter either of the barrier itself or of the physical condition of the surrounding soils and buried waste, and for producing a signal representing the physical parameter detected. Also included is a signal processor for receiving signals produced by the sensor device and for developing information identifying the physical parameter detected, either for sounding an alarm, displaying a graphic representation of a physical parameter detected on a viewing screen and/or a hard copy printout. The sensor devices may be deployed in or adjacent the barriers at the same time the barriers are deployed and may be adapted to detect strain or cracking in the barriers, leakage of radiation through the barriers, the presence and leaking through the barriers of volatile organic compounds, or similar physical conditions.

NTIS

*Containment; Radioactive Wastes; Detectors*

**20080025907** Michigan Univ., Ann Arbor, MI USA

**Impact of Attribute-Based Corporate Average Fuel Economy (CAFE) Standards: Preliminary Findings**

McManus, W.; Jul. 2007; 20 pp.; In English

Contract(s)/Grant(s): 385120

Report No.(s): PB2007-112693; UMTRI-2007-31; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report is the first rigorous analysis of the economic impacts of current legislative proposals to raise CAFE under the reformed attribute-based structure. Whereas historic CAFE standards set one standard for every automaker, the reformed system fundamentally alters the impact of the standards on individual companies. Under the reformed CAFE structure, which applies to light trucks starting next year and is the leading proposal under discussion in Congress, each vehicle is assigned a fuel economy target based on vehicle attributes. Light truck targets are a function of the trucks footprint that is, the area defined by the trucks wheels. Each automakers truck CAFE target will be a sales-weighted average of the targets for its truck models automakers that market larger vehicles will face a less stringent standard.

NTIS

*Organizations; Targets*

**20080025911** National Inst. for Occupational Safety and Health, Cincinnati, OH, USA

**Evaluation of Catalytic Emission Controls to Prevent Carbon Monoxide Poisonings from Houseboat Generator Exhaust (EPHB-171-05vv)**

Garcia, A.; McCleery, R.; Dowell, C.; Dunn, K. H.; Earnest, G. S.; Mar. 2007; 31 pp.; In English

Report No.(s): PB2007-112685; NIOSH-EPHB-171-05VV; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Working under an interagency agreement with the USA Coast Guard, researchers from the National Institute for Occupational Safety and Health (NIOSH) evaluated carbon monoxide (CO) emissions, exposures, and controls from gasoline-powered generators on houseboats. This evaluation was part of a series of studies conducted by NIOSH investigators during the past several years to identify and recommend effective engineering controls to reduce the CO hazard and prevent CO poisonings on houseboats and other recreational marine vessels. The performance of two (20 KW and 14 KW) Westerbeke Safe-CO(TM) generators were tested after being used on rental houseboats for two full boating seasons. The evaluated generators had 2,835 and 4,656 hours of use respectively and were equipped with catalytic converters and electronic fuel injection systems. A 12.5 KW Westerbeke generator was also tested that had been retrofitted with a Zenith electronic fuel



injection (EFI) retrofit kit. Each of the engineering control devices were designed to improve generator performance and reduce CO emissions.

NTIS

*Carbon Monoxide; Contaminants; Exhaust Gases; Gasoline; Health; Safety*

**20080025915** Naval Postgraduate School, Monterey, CA USA

**Afforestation for Reduction of NO<sub>x</sub> Concentration in Lanzhou China**

Chu, Peter C; Chen, Yuchun; Lu, Shihua; Jan 2008; 33 pp.; In English

Report No.(s): AD-A478899; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478899>

Lanzhou is one of the major industrial cities in northwest China, the capital of Gansu Province, and located at a northwest-to-southeast oriented valley basin with elevation about 1,500-1,600-m. Due to topographic and meteorological characteristics, Lanzhou is one of the most polluted cities in China Meteorological conditions (low winds, stable stratification especially inversion), pollutant sources and sinks affect the air quality Lanzhou government carried out afforestation and pollutant-source reduction (closing several heavy industrial factories) to improve the air-quality for the past two decades In this study, effect of afforestation on reducing the NO<sub>x</sub> concentration is investigated numerically using RAMS-HYPACT model.

DTIC

*China; Contaminants; Industries; Meteorology; Nitrogen Oxides; Topography*

**20080025937** Sandia National Labs., Albuquerque, NM USA

**CADS Cantera Aerosol Dynamics Simulator**

Moffat, H. K.; Jul. 2007; 191 pp.; In English

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

Report No.(s): DE2007-912650; SAND-2007-4216; No Copyright; Avail.: National Technical Information Service (NTIS)

This manual describes a library for aerosol kinetics and transport, called CADS (Cantera Aerosol Dynamics Simulator), which employs a section-based approach for describing the particle size distributions. CADS is based upon Cantera, a set of C++ libraries and applications that handles gas phase species transport and reactions. The method uses a discontinuous Galerkin formulation to represent the particle distributions within each section and to solve for changes to the aerosol particle distributions due to condensation, coagulation, and nucleation processes. CADS conserves particles, elements, and total enthalpy up to numerical round-off error, in all of its formulations. Both 0-D time dependent and 1-D steady state applications (an opposing-flow flame application) have been developed with CADS, with the initial emphasis on developing fundamental mechanisms for soot formation within fires. This report also describes the 0-D application, TDCads, which models a time-dependent perfectly stirred reactor.

NTIS

*Aerosols; Simulators; Air Pollution; Pollution Monitoring*

**20080025938** National Inst. for Occupational Safety and Health, Cincinnati, OH, USA

**Preliminary Testing of the Modified Mail Pass and Biohazard Detection System for the Ventilation and Filtration System of the Automated Facer Cancellor System at Siemens Postal Automation Facility, Arlington, TX**

Hammond, D. R.; Crouch, K. G.; Nov. 2006; 10 pp.; In English

Report No.(s): PB2007-112686; NIOSH-ECTB-279-23A; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Researchers from the National Institute for Occupational Safety and Health (NIOSH) conducted a preliminary evaluation of the local exhaust ventilation at the delivery bins and a qualitative evaluation of the contaminant capture capabilities of the Biohazard Detection System (BDS) and Ventilation/Filtration System (VFS) for the Advanced Facer Cancellor System (APCS). This evaluation was made on September 26, 2006 at Siemens in Arlington, Texas. The APCS was being modified for the USA Postal Service (USPS) by Siemens to meet USPS requirements and where possible reduce the potential for employee exposure to harmful substances that could be contained in mail processed by the equipment. The ventilation system for the APCS was designed to be used with a Biohazard Detection System (BDS) that samples and analyzes air from the APCS to determine if a biohazard is present. NIOSH has been evaluating Ventilation/Filtration Systems (VFS) for the USPS as a part of the USPS Emergency Preparedness Plan since January 2002. Evaluations were based on air velocity measurements and smoke release observations. Since the evaluation was only a preliminary test and Siemens was in the process of making additional modifications to the equipment, a full evaluation including sulfur hexafluoride (SF<sub>6</sub>) as a tracer gas was not yet

performed. The smoke release experiments showed that generally there is good capture by the VFS. Recommendations are made to further improve the control of potential contaminants by the APCS ventilation and filtration system.

NTIS

*Detection; Exposure; Filtration; Health; Personnel; Safety; Ventilation*

**20080025941** AVL, Plymouth, MI, USA

**Fuel Chemistry Impacts in Gasoline HCCI (Revised)**

Shen, Y.; Sep. 2007; 108 pp.; In English

Contract(s)/Grant(s): AVFL-13

Report No.(s): PB2007-112635; CRC-AVFL-13-REV; No Copyright; Avail.: National Technical Information Service (NTIS)

In this revised study, 10 gasoline-like test fuels are tested in an AVL (of Plymouth, MI) single cylinder engine equipped with a hydraulic variable valve train (VVT) and gasoline direct injection (GDI) system. By using VVT and GDI, three different intake charge preparation modes are implemented: re-compression early injection (RCEI), re-compression split injection (RCSI), and re-breathing early injection (RBEI). For each intake charge preparation mode, three engine operating conditions are investigated: 1.5 bar IMEP at 1000 rpm, 3 bar IMEP at 2000 rpm, and 5.5 bar/deg of maximum rate of pressure rise at 3000 rpm (IMEPs very near 3 bar). For all engine operating conditions and intake charge preparation modes, the combustion phasing, represented by the 50 percent mass fraction burned location (CA50), were fixed at 5 degrees after top dead center (TDC). The fuel impacts on HCCI combustion are quantified by a multiple regression method, in which two out of nine independent fuel properties are correlated with combustion or emission related parameters. In the report, only emissions (HC, CO, NOx), fuel consumptions, and combustion stability results are presented. It is concluded that engine emissions, fuel consumptions, and combustion stability are influenced by both fuel chemistry and octane-related properties.

NTIS

*Diesel Engines; Gasoline; Ignition*

**20080025948** Pacific Northwest National Lab., Richland, WA, USA

**Final Technical Report: Development of the DUSTRAN GIS-Based Complex Terrain Model for Atmospheric Dust Dispersion**

Allwine, K. J.; Rutz, F. C.; Shaw, W. J.; Rishel, J. P.; Fritz, B. G.; May 2007; 76 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2007-912513; PNNL-16588; No Copyright; Avail.: National Technical Information Service (NTIS)

Activities at U.S. Department of Defense (DoD) training and testing ranges can be sources of dust in local and regional airsheds governed by air-quality regulations. The U.S. Department of Energy's Pacific Northwest National Laboratory just completed a multi-year project to develop a fully tested and documented atmospheric dispersion modeling system (DUST TRANsport or DUSTRAN) to assist the DoD in addressing particulate air-quality issues at military training and testing ranges.

NTIS

*Atmospheric Models; Dust; Terrain; Atmospheric Composition*

**20080025954** Washington State Dept. of Health, Spokane, WA, USA

**Health Consultation: LaFarge Corporation, (a/k/a Ideal Basic Industries-Cement Plant), Seattle, King County, Washington. EPA Facility ID: WAD041580176**

Jun. 23, 2004; 28 pp.; In English

Report No.(s): PB2007-114111; No Copyright; Avail.: National Technical Information Service (NTIS)

The Washington State Department of Health (DOH) was asked by the Community Coalition for Environmental Justice (CCEJ) to evaluate the potential health impacts posed by eight businesses (sites) of concern in the South Park community. The petitioner, CCEJ, worked with the community to prepare this site list. One of these sites was LaFarge Corporation's Seattle plant. This health consultation uses existing data to evaluate the potential human health impacts resulting from exposure to emissions at the LaFarge site.

NTIS

*Cements; Industries; Public Health; Emission; Pollution*

**20080025956** Battelle Columbus Labs., OH USA

**Demonstration of In Situ Dehalogenation of DNAPL through Injection of Emulsified Zero-Valent Iron at Launch Complex 34 in Cape Canaveral Air Force Station, Florida, Innovative Technology Evaluation Report**

Sep. 2004; 107 pp.; In English

Report No.(s): PB2007-114485; No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of this project was to evaluate the technical and cost performance of emulsified zero-valent iron (EZVI) technology when applied to DNAPL contaminants in the saturated zone. This demonstration was conducted at Launch Complex 34, Cape Canaveral Air Force Station, FL, where chlorinated volatile organic compounds (CVOCs), mainly trichloroethylene (TCE), are present in the subsurface as DNAPL. Smaller amounts of dichloroethylene (DCE) and vinyl chloride (VC) also are present as a result of the natural degradation of TCE.

NTIS

*Liquids; Solvents; Trichloroethylene; Soil Pollution; Water Pollution; Iron; Environmental Cleanup; Technology Assessment*

**20080025958** Washington State Dept. of Highways, Olympia, WA, USA

**Health Consultation: Tetrachloroethylene (PCE) Release, Caribou Realty Group Site, Vancouver, Clark County, Washington**

Apr. 26, 2006; 16 pp.; In English

Report No.(s): PB2007-114097; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Washington State Department of Health (DOH) conducted a health consultation for the Caribou Realty Group site after being contacted by the Washington State Department of Ecology (Ecology) about elevated levels of tetrachloroethylene (PCE) discovered in shallow groundwater below the property. DOH conducts health consultations in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). The PCE contaminated groundwater discovered at the Caribou site poses a potential threat to drinking water because groundwater in the area is used as a drinking water source. The contaminated groundwater also poses an indoor air health risk because PCE can volatilize from the groundwater, move through the overlying soil, and enter indoor air in nearby buildings. DOH discussed these two potential exposure pathways with Ecology and Clark County Health Department (CCHD) shortly after being made aware of the groundwater contamination in November 2005 and recommended that the agencies identify whether any drinking water wells are at risk or indoor air at the Caribou or nearby properties is affected by the PCE contaminated groundwater.

NTIS

*Health; Washington; Toxic Diseases*

**20080025961** Washington State Dept. of Health, Spokane, WA, USA

**Health Consultation: TMC Cleaners (a/k/a Howard's Cleaners and Olympia Cleaners) Evaluation Follow-Up Indoor Air Sampling Results at the Washington Traffic Safety Commission Offices, City of Olympia, Thurston County, Washington. EPA Facility ID: WAH000017277**

Mar. 11, 2005; 26 pp.; In English

Report No.(s): PB2007-114109; No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of this health consultation is to evaluate health risks from exposure to Volatile Organic Compounds (VOCs), primarily tetrachloroethylene (PCE) and trichloroethylene (TCE), associated with the operation and/or contamination at TMC Cleaners. The Washington State Department of Health prepared this health consultation in response to indoor air quality concerns raised by the some staff at the Washington Traffic Safety Commission (WTSC) and the Thurston County Public Health and Social Services Department (TCHD) regarding potential exposure to PCE and TCE in indoor air. This health consultation is a follow-up to a previous indoor air-sampling event that revealed slightly elevated levels of PCE in indoor air. DOH prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

NTIS

*Cleaners; Exposure; Health; Risk; Safety; Traffic; Trichloroethylene; Washington*

**20080025964**; Washington State Dept. of Health, Spokane, WA, USA

**Health Consultation: Pacific Cleaners Site, Evaluation of Follow-Up Indoor Air Sample Taken at Randy's Nutrition Center, Adjacent to Pacific Cleaners Site, City of Olympia, Thurston County, Washington. EPA Facility ID: WAD988479838**

Mar. 14, 2005; 25 pp.; In English

Report No.(s): PB2007-114108; No Copyright; Avail.: National Technical Information Service (NTIS)

This health consultation evaluates health risks from exposure to tetrachloroethylene (PCE or perc) and trichloroethylene

(TCE) associated with the operation and/or contamination at Pacific Cleaners. The owners of an adjacent health food store, Randys Nutrition Center, and the Thurston County Public Health and Social Services Department (TCHD) had raised concerns regarding potential exposure to PCE and TCE in indoor air. The Washington State Department of Health (DOH) prepared this health consultation in response to those concerns. DOH prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). This health consultation is a follow-up to a previous indoor air-sampling event that revealed elevated levels of PCE and TCE in indoor air at this location.

NTIS

*Cleaners; Exposure; Health; Nutrition; Risk; Trichloroethylene; Washington*

**20080025965** Washington State Dept. of Highways, Olympia, WA, USA

**Health Consultation: Master Park Site Near Intersection of South 160 Street and International Boulevard, Seatac, King County, Washington**

Jan. 06, 2006; 17 pp.; In English

Report No.(s): PB2007-114104; No Copyright; Avail.: National Technical Information Service (NTIS)

The Washington State Department of Health (DOH) conducted this health consultation in response to information obtained from the Washington State Department of Ecology (Ecology) regarding groundwater contamination discovered in the regional aquifer at the Master Park site in SeaTac, Washington. The regional aquifer, which underlies a commercial and residential area, may serve as a water supply for the City of Seattle. The purpose of the health consultation is to evaluate whether contaminants found in the groundwater below the Master Park site poses a health threat to nearby drinking water wells or indoor air. DOH prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

NTIS

*Aquifers; Contamination; Ground Water; Health; Streets; Washington*

**20080025966** Washington State Dept. of Highways, Olympia, WA, USA

**Health Consultation: Hamilton/Labree Roads Groundwater Contamination Site. Evaluation of United Rentals Indoor Air Sampling Results (July 2002), Chehalis, Lewis County, Washington. EPA Facility ID: WASFN1002174**

Sep. 07, 2005; 30 pp.; In English

Report No.(s): PB2007-114100; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Washington State Department of Health (DOH) conducted an exposure investigation to evaluate whether employees at a business situated above an area of contaminated groundwater (known as the Hamilton/Labree Roads groundwater contamination site, or site) were being exposed to harmful levels of chemicals that have the potential to migrate into indoor air. The site is located about three miles south of Chehalis, Washington, near the intersection of Hamilton and Labree Roads in Lewis County. The purpose of this health consultation is to evaluate the results of indoor air samples collected by DOH inside United Rentals, the subject business. The United Rentals property is located south of Hamilton Road, adjacent to a portion (or sub-area) of the site, known as the Hamilton Road Impacted Area (HRIA). DOH is in the process of finalizing a public health assessment for the Hamilton/Labree site that describes this, and other exposure pathways in greater detail.

NTIS

*Air Sampling; Contamination; Ground Water; Health; Roads; Washington*

## 46

### GEOFYSICS

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*.

**20080023984** Army Research Lab., Adelphi, MD USA

**An Inversion Method to Backtrack Source Parameters and Associated Concentration Field for an Inert Gas Release in Urban Environments**

Wang, Yansen; Mar 2008; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478673; ARL-TN-304; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document describes a prototype of an inversion method to reconstruct the unknown atmospheric release parameters, including hiding the release location and strength, and associated concentration field. The inversion method is based on the analysis of the data collected from wind, chemical/biological sensors. A combined process of backward trajectory and

Bayesian inference is used for the inversion. The retrieved atmospheric release location and strength by this method are the optimal estimations of the physical parameters. A simple test case is used to demonstrate the accuracy and application of the inversion method.

DTIC

*Cities; Gases; Inversions; Rare Gases*

**20080024051** Institut Franco-Allemand de Recherches, Saint-Louis, France

**On-Going ISL Research in Modeling Acoustic Propagation in the Atmosphere**

Cheinet, Sylvain; Naz, Pierre; Oct 1, 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478770; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Acoustic Propagation; Atmospheric Circulation; Mathematical Models; Signal Transmission; Sound Waves; Wave Propagation*

**20080024206** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Critical Phenomena in Microgravity: Past, Present, and Future**

Barmatz, M.; Hahn, Inseob; Lipa, J. A.; Duncan, R. V.; Reviews of Modern Physics; January 2, 2007; ISSN 0034-6861; Volume 79; 52 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): JPL-957448; NAG3-2873; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1103/RevModPhys.79.1>; <http://hdl.handle.net/2014/40826>

This review provides an overview of the progress in using the low-gravity environment of space to explore critical phenomena and test modern theoretical predictions. Gravity-induced variations in the hydrostatic pressure and the resulting density gradients adversely affect ground-based measurements near fluid critical points. Performing measurements in a low-gravity environment can significantly reduce these difficulties. A number of significant experiments have been performed in low-Earth orbit. Experiments near the lambda transition in liquid helium explored the regime of large correlation lengths and tested the theoretical predictions to a level of precision that could not be obtained on Earth. Other studies have validated theoretical predictions for the divergence in the viscosity as well as the unexpected critical speeding up of the thermal equilibrium process in pure fluids near the liquid-gas critical point. We describe the scientific content of previously flown low-gravity investigations of critical phenomena as well as those in the development stage, and associated ground-based work.

Author

*Gravitation; Microgravity; Thermodynamic Equilibrium; Critical Point; Hydrostatic Pressure*

**20080024232** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Learning and Prediction of Slip from Visual Information**

Angelova, Anelia; Matthies, Larry; Helmick, Daniel; Perona, Pietro; March 2007; 27 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40846>

This paper presents an approach for slip prediction from a distance for wheeled ground robots using visual information as input. Large amounts of slippage which can occur on certain surfaces, such as sandy slopes, will negatively affect rover mobility. Therefore, obtaining information about slip before entering such terrain can be very useful for better planning and avoiding these areas. To address this problem, terrain appearance and geometry information about map cells are correlated to the slip measured by the rover while traversing each cell. This relationship is learned from previous experience, so slip can be predicted remotely from visual information only. The proposed method consists of terrain type recognition and nonlinear regression modeling. The method has been implemented and tested offline on several off-road terrains including: soil, sand, gravel, and woodchips. The final slip prediction error is about 20%. The system is intended for improved navigation on steep slopes and rough terrain for Mars rovers.

Author

*Robots; Terrain; Soils; Mobility; Planetary Geology; Roving Vehicles; Slopes*

**20080024658** Hokkaido Univ., Sapporo, Japan

**Geophysical Bulletin of Hokkaido University, No. 71**

Koyama, Junji, Editor; Heki, Kosuke, Editor; Ikeda, Ryuji, Editor; Kasahara, Minoru, Editor; Kuramoto, Kiyoshi, Editor; Minobe, Shoshiro, Editor; Mogi, Toru, Editor; Watanabe, Shigeto, Editor; Yomogida, Kiyoshi, Editor; March 2008; ISSN 0439-3503; 137 pp.; In Japanese; See also 20080024659 - 20080024666; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The contents include: 1) Reconsideration of Volcanic Block Kinematics (3): Model Calculations Considering the Effects of the Wind and the Initial Velocity of Volcanic Block; 2) Reconsideration of Volcanic Block Kinematics (4): Data Analysis of Ejected Volcanic Blocks with Special Attention to the 1938 Asama and the 1977 Usu Eruptions; 3) Seismic Waves Generated by North Korean Nuclear Test on October 9, 2006; 4) Numerical Modeling of Hydrothermal Systems Due to a Magma Intrusion; 5) Radial Diffusion Coefficient for the Inner Part of the Earth's Electron Radiation Belt; 6) Gravity Survey in the Northern Hokkaido Region, Northern Japan; 7) Subsurface Structure Analysis of Gravity and Magnetic Anomalies in Northern Hokkaido using Poisson's Equation; and 8) On Continuous Crustal Deformation Data Recorded at 5 Stations Located along the Pacific Coast in Hokkaido before and after the 2003 Tokachi-Oki Earthquake, Mw=8.0.

Author

*Geophysics; Earthquakes; Mathematical Models; Lunar Geology*

**20080024659** Hokkaido Univ., Sapporo, Japan

**Radial Diffusion Coefficient for the Inner Part of the Earth's Electron Radiation Belt**

Komatsu, Kengo; Watanabe, Shigeto; Geophysical Bulletin of Hokkaido University, No. 71; March 2008, pp. 61-70; In English; See also [20080024658](#); Copyright; Avail.: Other Sources

The radiation belts are the region that energetic charged particles are trapped by Earth's magnetic field. The radiation belts have been observed by a lot of satellites and researched by theoretical approach since the discovery of it. The electron radiation belt is separated into two regions called the outer belt and the inner belt by the slot region in which the flux is very small. It is well known that the outer belt flux vary by several orders of magnitude associated with geomagnetic disturbances and the exact mechanism of such variations has been a puzzle so that the outer belt flux variations have been well researched to explain this in two-decade. On the other hand, the inner belt is more stable and the flux variation in the inner belt is smaller than that of the outer belt so that the inner belt has not been attracted much attention. A radial diffusion model can reproduce an equilibrium structure of the electron radiation belts. Radiation belt electrons are supplied from the outer boundary of the radiation belt, and the flux is arranged by the balance of intensity of the diffusion and the loss due to pitch-angle scattering by whistler mode waves in the magnetosphere. The electron flux variations of the radiation belt can be investigated by using a radial diffusion model with time-dependent radial diffusion coefficients and a time-dependent outer boundary condition. Brautigam and Albert investigated the outer belt electron flux variation by using the time-dependent radial diffusion model. The time-dependent radial diffusion coefficients formulated by Brautigam and Albert are customarily used in the time-dependent radial diffusion model. They parameterized the amplitude of the electrostatic field variation as a linear function of Kp index, and applied them to the electrostatic coefficient derived by Cornwall. They were also formulated the electromagnetic coefficient as a function of Kp index. Because these coefficients are based on the observation of the outer belt, it is not appropriate to apply them to the slot and the inner belt regions. In fact, extrapolating these diffusion coefficients to the slot and the inner belt and doing numerical simulation, the slot is not formed and the electron flux near the Earth region is extremely large. In this study, in order to find a radial diffusion coefficient that can apply the inner part of the electron radiation belt as well as the outer belt, we performed some simulations by using the time-dependent radial diffusion model assuming that several types of the amplitude and the profile of the electrostatic field variation. The results show that the amplitude of the electrostatic field variation depends on L and is smaller toward the Earth.

Author

*Diffusion Coefficient; Electron Radiation; Inner Radiation Belt; Radiation Belts; Radial Distribution; Time Dependence*

**20080024660** Hokkaido Univ., Sapporo, Japan

**On Continuous Crustal Deformation Data Recorded at 5 Stations Located along the Pacific Coast in Hokkaido before and after the 2003 Tokachi-Oki Earthquake, Mw=8.0**

Kasahara, Minoru; Yamaguchi, Teruhiro; Takada, Masamitsu; Ichiyonagi, Masayoshi; Okayama, Muneo; Geophysical Bulletin of Hokkaido University, No. 71; March 2008, pp. 103-129; In English; See also [20080024658](#); Copyright; Avail.: Other Sources

Secular and short term strain variations before and after the 2003 Tokachi-Oki earthquake, Mw8.0, recorded at five continuous crustal movement stations located along the Pacific coast are reported. There is no obvious forerunner movement

at all stations. However, clear co-seismic and post-seismic strain changes are recorded at all stations. Strain data are digitized by 18 bits with 1 Hz sampling rate so that the complete strain seismogram of Mw8.0 event were recorded at MYR station nearest the source of the event. Strain seismograms recorded at all stations in Hokkaido are also reported.

Author

*Crustal Fractures; Earthquakes; Seismology*

**20080024661** Hokkaido Univ., Sapporo, Japan

### **Numerical Modeling of Hydrothermal Systems Due to a Magma Intrusion**

Mogi, Tohru; Nishida, Yasunori; Hashimoto, Takeshi; Tamura, Makoto; Geophysical Bulletin of Hokkaido University, No. 71; March 2008, pp. 49-59; In English; See also [20080024658](#); Copyright; Avail.: Other Sources

Cooling of intruded magma, development and decay of hydrothermal systems are investigated by model calculations for various combination of parameters such as hydraulic permeability of the intruded magma and its surroundings. Dependence of the pressure gradient on the hydrothermal systems is also investigated to inspect the effect of the potential flow of the groundwater along the topography. In the case that the horizontal pressure gradient is smaller than buoyancy, the hydrothermal system develops just above the intruded magma, while the greater pressure gradient as well as high permeability of surroundings carries the hydrothermal system to downstream. We applied these examinations to the newly formed Nishiyama geothermal field at the time of the 2000 Usu eruption. Numerical calculations considering the real topography in and around the Nishiyama geothermal field well reproduce the observed temporal variations of geothermal field appeared on the ground surface, assuming the in-situ hydraulic permeability of the intruded magma and the surroundings as  $10(\exp -12)$  approximates  $10(\exp -13)$  m( $\exp 2$ ) and  $10(\exp -10)$  approximates  $10(\exp -11)$  m( $\exp 2$ ), respectively.

Author

*Hydrothermal Systems; Magma; Mathematical Models*

**20080024662** Hokkaido Univ., Sapporo, Japan

### **Seismic Waves Generated by North Korean Nuclear Test on October 9, 2006**

Yoshizawa, Kazunori; Geophysical Bulletin of Hokkaido University, No. 71; March 2008, pp. 39-48; In English; See also [20080024658](#); Copyright; Avail.: Other Sources

Seismic waves generated by a nuclear test carried out by North Korea on October 9, 2006 were observed throughout the Japanese islands. Clear arrivals of Pn waves, which traveled below the Moho discontinuity underneath the Japan Sea, were recorded by the Japanese broad-band seismic network, F-net, deployed by National Research Institute for Earth Science and Disaster Prevention (NIED). We analyzed the waveforms of the nuclear event observed at F-net stations as well as some global seismic stations in East Asia. Apparent path-average velocity of Pn waves and their maximum amplitudes are estimated from vertical component seismograms of the F-net stations. We found conspicuous regional variations of apparent path-average velocity and maximum amplitude. For example, fast apparent velocity and larger amplitude are observed in the paths across the Japan basin in the northern Japan Sea, whereas slow velocity as well as relatively smaller amplitudes are found in the path to stations in Kyushu. Such regional variability of Pn waves is likely to make it difficult to estimate source parameters for this small-scale explosive event in the Korean Peninsula, only using the Japanese seismic network. These results suggest the necessity of a precise three-dimensional seismic model of the Japan Sea to utilize Japanese seismic network data for analysis of regional seismic waves that propagate along a variety of paths in the Japan Sea.

Author

*Seismic Waves; Nuclear Explosions; Nuclear Explosion Effect; North Korea*

**20080024663** Hokkaido Univ., Sapporo, Japan

### **Subsurface Structure Analysis of Gravity and Magnetic Anomalies in Northern Hokkaido using Poisson's Equation**

Kajiwara, Takanori; Mogi, Toru; Geophysical Bulletin of Hokkaido University, No. 71; March 2008, pp. 91-101; In English; See also [20080024658](#); Copyright; Avail.: Other Sources

The Poisson's equation expresses a linear relationship between the gravity and magnetic potentials arising from a body with uniform density and magnetization contrast. The equation was extended to multi body case by repeatedly applying it within a small uniform body called the moving window. The moving-window Poisson's (MWP) analysis technique was proposed by Chandler et al to apply to general complex structures. The correlation coefficient between the total magnetic intensity anomaly reduced to the pole and vertical derivative of the gravity anomaly, and the magnetization-to-density ratio were obtained by the MWP analysis. We investigated the profiles of these parameters for synthetic multi density and magnetic intensity structures and clarified how structure boundaries are delineated. The MWP was applied to the dataset of gravity

anomalies and magnetic intensity anomalies collected in Northern Hokkaido. As the result, the MWP analysis put some constraints on density and magnetization structures modeled by a conventional analytical method such as the Talwani method.

Author

*Gravity Anomalies; Magnetic Anomalies; Poisson Equation*

**20080024664** Hokkaido Univ., Sapporo, Japan

**Gravity Survey in the Northern Hokkaido Region, Northern Japan**

Honda, Ryo; Mogi, Toru; Geophysical Bulletin of Hokkaido University, No. 71; March 2008, pp. 71-90; In English; See also [20080024658](#); Copyright; Avail.: Other Sources

The northern part of Hokkaido (Dohoku region) is recognized as the boundary region between the Okhotsk and Amurian plates. In this region, strain concentration is reported based on triangulation and GPS observations. However, there had not been observed any inland earthquakes larger than  $M(\text{sub JMA})$  6 in Dohoku region, until the 2004 Rumoi-Nambu earthquake ( $M(\text{sub JMA})$  6.1) occurred. There may be a possibility of occurrence of intraplate large earthquake in the future. The mechanism of the earthquakes observed in the region is strikeslip and thrust type, owing to the east-west compression. In case the thrust type earthquake had been rupturing recurrently, it should be resulted as positive Bouguer gravity anomalies. There exists plenty amounts of gravity observation data in this region, for the purpose of oil and mineral exploration. However, it exists as a hand written paper document. Additionally, these data are basically unreleased. So we performed gravity measurement in the Dohoku region to draw more detailed Bouguer anomaly map. The observed gravity data is listed in this document.

Author

*Earthquakes; Gravitation; Gravity Anomalies; Seismology*

**20080024665** Polytechnic Univ., Kanagawa, Japan

**Reconsideration of Volcanic Block Kinematics (4): Data Analysis of Ejected Volcanic Blocks with Special Attention to the 1938 Asama and the 1977 Usu Eruptions**

Suzuki, Takeo; Niida, Kiyooki; Nishida, Yasunori; Oshima, Hiromitsu; Murofushi, Makoto; Geophysical Bulletin of Hokkaido University, No. 71; March 2008, pp. 19-38; In English; See also [20080024658](#); Copyright; Avail.: Other Sources

Spatial distribution of volcanic blocks, as well as landing distance from a crater, landing angle and diameter of the blocks has been well investigated on and around the crater in cases of the 1938 Asama and the 1977 Usu eruptions by some researchers. Then, this paper reproduces detailed kinematic aspects of the eruptions so as to interpret the above-mentioned field data, on the basis of a generalized ballistic equation of ejected volcanic blocks proposed by the present authors. Calculations are made for combination of various parameters, such as air resistance to the blocks, direction of the wind, orientation dependence of the initial velocity and so on. The observed wind velocities are referred in the calculation. Comparison between the calculated and the observed results leads to the following conclusion: (1) In the 1938 Asama eruption, the distribution of volcanic blocks shows that the direction of the explosion principal axis is due east (N90 deg. E) and its inclination angle is 30°. The angle dependence of the initial velocity ( $M = 1.5$ ) is almost the same as that in the Sakurajima volcano. (2) In the 1977 Usu eruption, direction of the explosion principal axis is N170 deg E and its inclination angle is 20 deg, and the angle dependence of the initial velocity is large as much as  $M = 5.0$ . (3) The air resistance to the blocks is estimated as about  $K(\text{sub d}) = 0.5$  in both the eruptions. This value is valid in other volcanic eruptions because the air resistance seems to be same everywhere.

Author

*Kinematics; Spatial Distribution; Volcanoes; Volcanic Eruptions; Volcanology; Effluents*

**20080024666** Polytechnic Univ., Kanagawa, Japan

**Reconsideration of Volcanic Block Kinematics (3): Model Calculations Considering the Effects of the Wind and the Initial Velocity of Volcanic Block**

Suzuki, Takeo; Niida, Kiyooki; Nishida, Yasunori; Oshima, Hiromitsu; Murofushi, Makoto; Geophysical Bulletin of Hokkaido University, No. 71; March 2008, pp. 1-18; In English; See also [20080024658](#); Copyright; Avail.: Other Sources

From the volcano-energetics point of view, it is very important to evaluate the velocity, direction and distribution of ejected volcanic blocks. However, in most cases, it is hard to measure directly such quantities during the eruption. Therefore, the volcanic blocks landed on and around the crater have been investigated to reproduce dynamic aspects of eruption after the eruption. In the present paper, ballistic curves of the volcanic blocks are numerically analyzed for various combination of parameters, such as direction of the explosion principal axis of ejection, velocity and direction of the wind, air resistance to



the block and dependence of direction of the initial velocity of ejection. The calculations are made on the basis of a generalized ballistic equation of ejected blocks, in which the wind velocity and the air resistance to the block are treated as vector quantities. Calculated results lead to the following characteristic conclusions: (1) The winds above 20 m/s along the direction of ejection plays the major role in the ballistic curves, while the lower wind velocity is less effective. (2) Spatial distribution of the landed blocks is mainly affected by the direction of the explosion principal axis. The distribution of the volcanic blocks which was spread to the specific direction is described by inclination of the explosion principal axis. (3) The spatial distribution of the small size blocks depends remarkably on the air resistance.

Author

*Kinematics; Spatial Distribution; Volcanoes; Wind Effects; Volcanic Eruptions; Volcanology; Effluents*

**20080025046** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

### **Global Dayside Ionospheric Uplift and Enhancement Associated with Interplanetary Electric Fields**

Tsurutani, Bruce; Mannucci, Anthony; Iijima, Byron; Abdu, Mangalathayil Ali; Sobral, Jose Humberto A.; Gonzalez, Walter; Guarnieri, Fernando; Tsuda, Toshitaka; Saito, Akinori; Yumoto, Kiyohumi; Fejer, Bela; Fuller-Rowell, Timothy J.; Kozyra, Janet; Foster, John C.; Coster, Anthea; Vasyliunas, Vytenis M.; *Journal Of Geophysical Research*; August 7, 2004; ISSN 0148-0227; Volume 109; 16 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.:

Other Sources

ONLINE: <http://dx.doi.org/10.1029/2003JA010342>; <http://hdl.handle.net/2014/40828>

The interplanetary shock/electric field event of 5-6 November 2001 is analyzed using ACE interplanetary data. The consequential ionospheric effects are studied using GPS receiver data from the CHAMP and SAC-C satellites and altimeter data from the TOPEX/ Poseidon satellite. Data from ~100 ground-based GPS receivers as well as Brazilian Digisonde and Pacific sector magnetometer data are also used. The dawn-to-dusk interplanetary electric field was initially ~33 mV/m just after the forward shock (IMF BZ = -48 nT) and later reached a peak value of ~54 mV/m 1 hour and 40 min later (BZ = -78 nT). The electric field was ~45 mV/m (BZ = -65 nT) 2 hours after the shock. This electric field generated a magnetic storm of intensity DST = -275 nT. The dayside satellite GPS receiver data plus ground-based GPS data indicate that the entire equatorial and midlatitude (up to +/-50(deg) magnetic latitude (MLAT)) dayside ionosphere was uplifted, significantly increasing the electron content (and densities) at altitudes greater than 430 km (CHAMP orbital altitude). This uplift peaked ~2 1/2 hours after the shock passage. The effect of the uplift on the ionospheric total electron content (TEC) lasted for 4 to 5 hours. Our hypothesis is that the interplanetary electric field "promptly penetrated" to the ionosphere, and the dayside plasma was convected (by  $E \times B$ ) to higher altitudes. Plasma upward transport/convergence led to a ~55-60% increase in equatorial ionospheric TEC to values above ~430 km (at 1930 LT). This transport/convergence plus photoionization of atmospheric neutrals at lower altitudes caused a 21% TEC increase in equatorial ionospheric TEC at ~1400 LT (from ground-based measurements). During the intense electric field interval, there was a sharp plasma "shoulder" detected at midlatitudes by the GPS receiver and altimeter satellites. This shoulder moves equatorward from -54(deg) to -37(deg) MLAT during the development of the main phase of the magnetic storm. We presume this to be an ionospheric signature of the plasmopause and its motion. The total TEC increase of this shoulder is ~80%. Part of this increase may be due to a 'superfountain effect.' The dayside ionospheric TEC above ~430 km decreased to values ~45% lower than quiet day values 7 to 9 hours after the beginning of the electric field event. The total equatorial ionospheric TEC decrease was ~16%. This decrease occurred both at midlatitudes and at the equator. We presume that thermospheric winds and neutral composition changes produced by the storm-time Joule heating, disturbance dynamo electric fields, and electric fields at auroral and subauroral latitudes are responsible for these decreases.

Author

*Electric Fields; Interplanetary Shock Waves; Ionospheric Electron Density; Winds Aloft; Geophysics*

**20080025050** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

### **Scientific Objectives, Measurement Needs, and Challenges Motivating the PARAGON Aerosol Initiative**

Seinfeld, John H.; Kahn, Ralph A.; Anderson, Theodore L.; Charlson, Robert J.; Davies, Roger; Ogren, John A.; Diner, David J.; Schwartz, Stephen E.; Wielicki, Bruce A.; *Bulletin of the American Meteorological Society*; October 2004; Volume 85, Issue 10, pp. 1503-1509; In English; Original contains color illustrations

Contract(s)/Grant(s): NSF ATM-0138250; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1175/BAMS-85-10-1503>; <http://hdl.handle.net/2014/40830>

Aerosols are involved in a complex set of processes that operate across many spatial and temporal scales. Understanding these processes, and ensuring their accurate representation in models of transport, radiation transfer, and climate, requires knowledge of aerosol physical, chemical, and optical properties and the distributions of these properties in space and time. To

derive aerosol climate forcing, aerosol optical and microphysical properties and their spatial and temporal distributions, and aerosol interactions with clouds, need to be understood. Such data are also required in conjunction with size-resolved chemical composition in order to evaluate chemical transport models and to distinguish natural and anthropogenic forcing. Other basic parameters needed for modeling the radiative influences of aerosols are surface reflectivity and three-dimensional cloud fields. This large suite of parameters mandates an integrated observing and modeling system of commensurate scope. The Progressive Aerosol Retrieval and Assimilation Global Observing Network (PARAGON) concept, designed to meet this requirement, is motivated by the need to understand climate system sensitivity to changes in atmospheric constituents, to reduce climate model uncertainties, and to analyze diverse collections of data pertaining to aerosols. This paper highlights several challenges resulting from the complexity of the problem. Approaches for dealing with them are offered in the set of companion papers.

Author

*Aerosols; Climate Change; Climate Models; Atmospheric Composition; Atmospheric Physics; Atmospheric Models*

**20080025128** Air Force Research Lab., Tyndall AFB, FL USA

**Atmospheric Transformation of Volatile Organic Compounds**

Henley, Michael V; Grziano, Gina M; Wells, J R; Bradley, William R; Wyatt, Sheryl E; Mar 2008; 9 pp.; In English

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

Report No.(s): AD-A478494; AFRL-RX-TY-TR-2000-4529; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478494>

To be able to understand and predict the concentration of a target compound in the atmosphere one must understand the atmospheric chemistry involved. The transformation of volatile organic compounds (VOCs) in the troposphere is predominantly driven by the interaction with the hydroxyl and nitrate radicals. The hydroxyl radical exists in daylight conditions and its reaction rate constant with an organic compound is typically very fast. The nitrate radical drives the nighttime chemistry. These radicals can scavenge hydrogen from an organic molecule generating secondary products that are often overlooked in detection schemes. Secondary products can be more stable and serve as a better target compound in detection schemes. The gas-phase reaction of the hydroxyl radical (OH) with cyclohexanol (COL) has been studied. The rate coefficient was determined to be  $(19.0 \pm 4.8) \times 10^{-12} \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$  (at  $297 \pm 3 \text{ oK}$  and 1 atmosphere total pressure) using the relative rate technique with pentanal, decane, and tridecane as the reference compounds. Assuming an average OH concentration of  $1 \times 10^6 \text{ molecules cm}^{-3}$ , an atmospheric lifetime of 15 h is calculated for cyclohexanol. Products of the OH + COL reaction were determined to more clearly define cyclohexanol's atmospheric degradation mechanism. The observed products were: cyclohexanone, hexanedial, 3-hydroxycyclohexanone, and 4-hydroxycyclohexanone. Consideration of the potential reaction pathways suggests that each of these products is formed via hydrogen abstraction at a different site on the cyclohexanol ring.

DTIC

*Atmospheric Chemistry; Hydroxyl Radicals; Organic Compounds; Volatile Organic Compounds*

**20080025158** NASA Langley Research Center, Hampton, VA, USA

**Using Observations of Deep Convective Systems to Constrain Atmospheric Column Absorption of Solar Radiation in the Optically Thick Limit**

Dong, Xiquan; Wielicki, Bruce A.; Xi, Baike; Hu, Yongxiang; Mace, Gerald G.; Benson, Sally; Rose, Fred; Kato, Seiji; Charlock, Thomas; Minnis, Patrick; Journal of Geophysical Research; May 2008; Volume 113, pp. 1-18; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 921266.04.07.07; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2007JD009769>

Atmospheric column absorption of solar radiation  $A(\text{sub col})$  is a fundamental part of the Earth's energy cycle but is an extremely difficult quantity to measure directly. To investigate  $A(\text{sub col})$ , we have collocated satellite-surface observations for the optically thick Deep Convective Systems (DCS) at the Department of Energy Atmosphere Radiation Measurement (ARM) Tropical Western Pacific (TWP) and Southern Great Plains (SGP) sites during the period of March 2000 December 2004. The surface data were averaged over a 2-h interval centered at the time of the satellite overpass, and the satellite data were averaged within a  $1 \text{ deg} \times 1 \text{ deg}$  area centered on the ARM sites. In the DCS, cloud particle size is important for top-of-atmosphere (TOA) albedo and  $A(\text{sub col})$  although the surface absorption is independent of cloud particle size. In this study, we find that the  $A(\text{sub col})$  in the tropics is approximately 0.011 more than that in the middle latitudes. This difference, however, disappears, i.e., the  $A(\text{sub col})$  values at both regions converge to the same value (approximately 0.27 of the total

incoming solar radiation) in the optically thick limit ( $\tau$  greater than 80). Comparing the observations with the NASA Langley modified Fu\_Liou 2-stream radiative transfer model for optically thick cases, the difference between observed and model-calculated surface absorption, on average, is less than 0.01, but the model-calculated TOA albedo and  $A(\text{sub col})$  differ by 0.01 to 0.04, depending primarily on the cloud particle size observation used. The model versus observation discrepancies found are smaller than many previous studies and are just within the estimated error bounds. We did not find evidence for a large cloud absorption anomaly for the optically thick limit of extensive ice cloud layers. A more modest cloud absorption difference of 0.01 to 0.04 cannot yet be ruled out. The remaining uncertainty could be reduced with additional cases, and by reducing the current uncertainty in cloud particle size.

Author

*Radiation Absorption; Solar Radiation; Satellite Observation; Atmospheric Attenuation; Convection; Clouds; Particle Size Distribution; Earth Radiation Budget; Radiative Transfer*

**20080025161** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Comparison of Seasonal Terrestrial Water Storage Variations from GRACE with Groundwater-level Measurements from the High Plains Aquifer (USA)**

Strassberg, Gil; Scanlon, Bridget R.; Rodell, Matthew; Geophysical Research Letters; July 18, 2007; Volume 34; 5 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2007GL030139>

This study presents the first direct comparison of variations in seasonal GWS derived from GRACE TWS and simulated SM with GW-level measurements in a semiarid region. Results showed that variations in GWS and SM are the main sources controlling TWS changes over the High Plains, with negligible storage changes from surface water, snow, and biomass. Seasonal variations in GRACE TWS compare favorably with combined GWS from GW-level measurements (total 2,700 wells, average 1,050 GW-level measurements per season) and simulated SM from the Noah land surface model ( $R = 0.82$ ,  $\text{RMSD} = 33$  mm). Estimated uncertainty in seasonal GRACE-derived TWS is 8 mm, and estimated uncertainty in TWS changes is 11 mm. Estimated uncertainty in SM changes is 11 mm and combined uncertainty for TWS-SM changes is 15 mm. Seasonal TWS changes are detectable in 7 out of 9 monitored periods and maximum changes within a year (e.g. between winter and summer) are detectable in all 5 monitored periods. Grace-derived GWS calculated from TWS-SM generally agrees with estimates based on GW-level measurements ( $R = 0.58$ ,  $\text{RMSD} = 33$  mm). Seasonal TWS-SM changes are detectable in 5 out of the 9 monitored periods and maximum changes are detectable in all 5 monitored periods. Good correspondence between GRACE data and GW-level measurements from the intensively monitored High Plains aquifer validates the potential for using GRACE TWS and simulated SM to monitor GWS changes and aquifer depletion in semiarid regions subjected to intensive irrigation pumpage. This method can be used to monitor regions where large-scale aquifer depletion is ongoing, and in situ measurements are limited, such as the North China Plain or western India. This potential should be enhanced by future advances in GRACE processing, which will improve the spatial and temporal resolution of TWS changes, and will further increase applicability of GRACE data for monitoring GWS.

Author

*Surface Water; Ground Water; Irrigation; Aquifers; In Situ Measurement*

**20080025514** Army Research Lab., Aberdeen Proving Ground, MD USA

**Preliminary High Spectral-Resolution PFNDAT**

Wetmore, Alan; Ligon, David; Kvavilashvili, Ramaz; May 2004; 109 pp.; In English

Report No.(s): AD-A479364; ARL-TR-3194; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The High Resolution Phase Function Database (HRPFNDAT) is a component of the Weather and Atmospheric Visualization Effects for Simulation (WAVES) suite. It is also usable with models such as the Electro-Optical Systems Atmospheric Effects Library (EOSAEL) and MODTRAN. The interim version of HRPFNDAT consists of a series of phase functions and extinction and scattering coefficient data for the rural, urban, and maritime haze models, water fog models, and fog oil smoke model for the wavelength region 0.35-40.0 micrometer at 1  $\text{cm}^{-1}$  resolution. The resolution of HRPFNDAT is comparable to the -1  $\text{cm}^{-1}$  resolution available from MODTRAN.

DTIC

*Fog; Haze; High Resolution; Smoke; Spectral Resolution; Weather*

**20080025905** Naval Postgraduate School, Monterey, CA USA

**South China Sea Wave Characteristics During Typhoon Muifa Passage in Winter 2004**

Chu, Peter C; Cheng, Kuo-Feng; Jan 2008; 49 pp.; In English

Report No.(s): AD-A478909; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478909>

Ocean wave characteristics in the western Atlantic Ocean (Hurricane Region) to tropical cyclones have been investigated extensively, but not the regional seas in the western Pacific such as the South China Sea (Typhoon Region). This is due to the lack of observational and modeling studies in western Pacific regional seas. To fill this gap, Wavewatch-III (WW3) is used to study the response of the South China Sea (SCS) to Typhoon Muifa (2004). The WW3 model is integrated from the JONSWAP wave spectra (Hasselmann et al. 1973, 1980) using NASA Quikscatter winds and tropical cyclone wind profile model during Typhoon Muifa passage from 0000UTC 16 on November to 1200UTC on 25 November 2004. This study shows strong similarities in the responses between Hurricane and Typhoon Regions, including strong asymmetry in the significant wave height (Hs) along the typhoon translation track with the maximum Hs in the right-front quadrant of the typhoon center, and asymmetry in the directional wave spectra at different locations (frontward, backward, rightward, leftward) around the typhoon center. The unique features of the SCS wave characteristics to Muifa are also discussed.

DTIC

*China; Seas; Typhoons; Winter*

**20080025906** Boston Coll., Chestnut Hill, MA USA

**Ionospheric Modeling: Development, Verification and Validation**

Doherty, Patricia H; McNamara, Leo F; Burke, William J; McNeil, William J; Gentile, Louise C; Aug 15, 2007; 30 pp.; In English

Contract(s)/Grant(s): FA8718-04-C-0055; Proj-1010

Report No.(s): AD-A478975; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478975>

The objectives of this contract are to improve specification and forecast models currently in use and in development at AFRL. These efforts include performing independent research to augment AFRL's programs in the areas of direct simulation Monte Carlo modeling of chemical releases, Geospace plasma dynamics, validating the theoretical models and applications that are the basis of the Parameterized Real-Time Ionospheric Specification Model (PRISM) and the Ionospheric Forecast Model, and validating the first of the Global Assimilation Ionospheric Models (GAIM). In the past year, we have continued our efforts to calibrate and validate the data products of the SSUSI UV imager on the DMSP F17 satellite. We have also continued a thorough validation of the GAIM model and the WideBand Scintillation Model (WBMod). In addition, we have initiated studies of Magnetosphere-Ionosphere-Thermosphere coupled models.

DTIC

*Assimilation; Atmospheric Models; Earth Ionosphere; Scintillation*

**20080025929** Naval Postgraduate School, Monterey, CA USA

**Atmospheric Effects on Winter SO<sub>2</sub> Pollution in Lanzhou China**

Chu, Peter C; Chen, Yuchun; Lu, Shihua; Jan 2008; 30 pp.; In English

Report No.(s): AD-A478907; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478907>

Lanzhou is one of the most polluted cities in China SO<sub>2</sub> concentration has evident seasonal variability It is generally within the second-level criterion (< 0.15 mg m<sup>-3</sup>) in spring, summer, and fall, but is much higher than the second-level criterion and sometimes reaches mid level pollution (API > 200) in winter Meteorological conditions (low winds, stable stratification) are found to be important for the SO<sub>2</sub> pollution Observational and modeling studies conducted in this study show a close connection between the static stability and the SO<sub>2</sub> pollution of Lanzhou China in winter This study also shows the capability of coupled RAMS-HYPACT on air-quality prediction.

DTIC

*Air Pollution; Atmospheric Effects; Atmospherics; China; Sulfur Dioxides; Winter*

**20080026034** NASA Johnson Space Center, Houston, TX, USA

**Mapping the Rainforest of the Sea: Global Coral Reef Maps for Global Conservation**

Robinson, Julie A.; May 23, 2006; 1 pp.; In English; 2006 Spring Lecture Series at Brookfield Zoo, 23 May 2006, Brookfield, IL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Coral reefs are the center of marine biodiversity, yet are under threat with an estimated 60% of coral reef habitats

considered at risk by the World Resources Institute. The location and extent of coral reefs in the world are the basic information required for resource management and as a baseline for monitoring change. A NASA sponsored partnership between remote sensing scientists, international agencies and NGOs, has developed a new generation of global reef maps based on data collected by satellites. The effort, dubbed the Millennium Coral Reef Map aims to develop new methods for wide distribution of voluminous satellite data of use to the conservation and management communities. We discuss the tradeoffs between remote sensing data sources, mapping objectives, and the needs for conservation and resource management. SeaWiFS data were used to produce a composite global shallow bathymetry map at 1 km resolution. Landsat 7/ETM+ data acquisition plans were modified to collect global reefs and new operational methods were designed to generate the first ever global coral reef geomorphology map. We discuss the challenges encountered to build these databases and in implementing the geospatial data distribution strategies. Conservation applications include a new assessment of the distribution of the world's marine protected areas (UNEPWCMC), improved spatial resolution in the Reefs at Risk analysis for the Caribbean (WRI), and a global basemap for the Census of Marine Life's OBIS database. The Millennium Coral Reef map and digital image archive will pay significant dividends for local and regional conservation projects around the globe. Complete details of the project are available at <http://eol.jsc.nasa.gov/reefs>.

Author

*Biological Diversity; Conservation; Coral Reefs; Geomorphology; Rain Forests; Remote Sensing; Thematic Mapping; Seas*

**20080026040** NASA Johnson Space Center, Houston, TX, USA

**Spectral Variability among Rocks in Visible and Near Infrared Multispectral Pancam Data Collected at Gusev Crater: Examinations using Spectral Mixture Analysis and Related Techniques**

Farrand, W. H.; Bell, J. F., III; Johnson, J. R.; Squyres, S. W.; Soderblom, J.; Ming, D. W.; [2006]; 79 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 361426.04.05; Copyright; Avail.: CASI: [A05](#), Hardcopy

Visible and Near Infrared (VNIR) multispectral observations of rocks made by the Mars Exploration Rover Spirit's Panoramic camera (Pancam) have been analysed using a spectral mixture analysis (SMA) methodology. Scenes have been examined from the Gusev crater plains into the Columbia Hills. Most scenes on the plains and in the Columbia Hills could be modeled as three endmember mixtures of a bright material, rock, and shade. Scenes of rocks disturbed by the rover's Rock Abrasion Tool (RAT) required additional endmembers. In the Columbia Hills there were a number of scenes in which additional rock endmembers were required. The SMA methodology identified relatively dust-free areas on undisturbed rock surfaces, as well as spectrally unique areas on RAT abraded rocks. Spectral parameters from these areas were examined and six spectral classes were identified. These classes are named after a type rock or area and are: Adirondack, Lower West Spur, Clovis, Wishstone, Peace, and Watchtower. These classes are discriminable based, primarily, on near-infrared (NIR) spectral parameters. Clovis and Watchtower class rocks appear more oxidized than Wishstone class rocks and Adirondack basalts based on their having higher 535 nm band depths. Comparison of the spectral parameters of these Gusev crater rocks to parameters of glass-dominated basaltic tuffs indicates correspondence between measurements of Clovis and Watchtower classes, but divergence for the Wishstone class rocks which appear to have a higher fraction of crystalline ferrous iron bearing phases. Despite a high sulfur content, the rock Peace has NIR properties resembling plains basalts.

Author

*Near Infrared Radiation; Basalt; Infrared Astronomy; Spectral Mixture Analysis; Petrology; Mars Exploration; Igneous Rocks; Spectrum Analysis*

**20080026045** NASA Johnson Space Center, Houston, TX, USA

**Martian Meteorite Ages and Implications for Martian Cratering History**

Nyquist, Laurence E.; May 21, 2006; 2 pp.; In English; Workshop on Surface Ages and Histories, 21-23 May 2006, Houston, TX, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026045>

New radiometrically determined ages of Martian meteorites add to the growing number with crystallization ages  $< \sim 1.4$  Ga. The observation of mainly geologically young ages for the Martian meteorites, the only exception being the  $\sim 4.5$  Ga ALH84001 [1], is paradoxical when viewed in context of a Martian surface thought to be mostly much older as inferred from the surface density of meteorite craters [2]. There appears to be at least a twofold difference between the observed ages of Martian meteorites and their expected ages as inferred from the ages of Martian surfaces obtained from crater densities.

Author

*SNC Meteorites; Meteorite Craters; Mars Craters; Mars Surface; Cratering*

**20080026094** NASA Johnson Space Center, Houston, TX, USA

**Feldspathic Clasts in Yamato 86032: Remnants of the Lunar Crust with Implications for its Formation and Impact History**

Nyquist, L.; Bogard, D.; Yamaguchi, A.; Shih, C.-Y.; Ebihara, M.; Reese, Y.; Garrison, D.; Takeda, H.; [2006]; 63 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): MOE-12740300; 811073.02.02.01.04; RTOP 344-31; NIPR Research Proj. P-8; Copyright; Avail.:

CASI: [A04](#), Hardcopy

Yamato (Y)-86032 is a relatively large, feldspathic lunar highlands meteorite composed of a variety of highland lithologies. Low bulk contents of Th and Fe indicated that it came from a region of the moon far distant from the Procellarum KREEP Terrain (PKT) and the Apollo landing sites, perhaps from the farside. A large (5.2 x 3.6 cm) slab was cut from Y-86032. We report results from coordinated textural, mineralogical-petrological, chemical, and isotopic studies of lithologies identified in the slab, emphasizing the results of Ar-39/Ar-40, Rb-Sr, and Sm-Nd chronological studies as well as Sm-isotopic studies. These studies characterize the history of Y-86032 and its precursors in the farside mega-regolith, leading to inferences about the formation and evolution of the lunar crust. Textural studies establish that the Y-86032 breccia is composed of a variety of highland components including feldspathic breccias, and other components, such as possible VLT mare basalts. Impact melt veins smoothly abut the other lithologies. Thus, Y-86032 experienced at least two impact events. These impacts occurred on a predominantly feldspathic protolith, which formed 4.43±0.03 Ga ago as determined from a Sm-Nd isochron for mineral clasts separated from the two dominant lithologies. Initial Nd-143/Nd-144 in the protolith at that time was -0.64±0.13 epsilon-units below Nd-143/Nd-144 in reservoirs having chondritic Sm/Nd ratios, consistent with prior fractionation of mafic cumulates from the LMO. Although the mineral chemistry of these clasts differs in detail from that of minerals in Apollo 16 Ferroan Anorthosites (FANs), the Rb-Sr studies establish that the initial Sr-87/Sr-86 in them was the same as in the FANs.

Author

*Lunar Crust; Petrology; Basalt; Fractionation; Lunar Maria; Regolith; Mineralogy; Lithology; Impact Melts*

**20080026124** NASA Johnson Space Center, Houston, TX, USA

**The Alpha Particle X-Ray Spectrometer (APXS): Results from Gusev Crater and Calibration Report**

Gellert, R.; Rieder, R.; Brueckner, J.; Clark, B.; Dreibus, G.; Klingelhofer, G.; Lugmair, G.; Ming, D.; Waenke, H.; Yen, A.; Zipfel, J.; Squyres, S.; [2006]; 103 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): INTAS 001-348; DLR 50QM0014; DLR 50QM0005; 361426.04.05; Copyright; Avail.:

CASI: [A06](#), Hardcopy

The chemical composition of rocks and soils on Mars analyzed during the Mars Exploration Rover Spirit Mission was determined by X-ray analyses with the Alpha Particle X-Ray Spectrometer (APXS). Details of the data analysis method and the instrument calibration are presented. Measurements performed on Mars to address geometry effects and background contributions are shown. Cross calibration measurements among several instrument sensors and sources are discussed. An unintentional swap of the two flight instruments is evaluated. New concentration data acquired during the first 470 sols of rover Spirit in Gusev Crater are presented. There are two geological regions, the Gusev plains and the Columbia Hills. The plains contain soils that are very similar to previous landing sites on Mars. A meteoritic component in the soil is identified. Rocks in the plains revealed thin weathering rinds. The underlying abraded rock was classified as primitive basalt. One of these rocks contained significant Br that is probably associated with vein-filling material of different composition. One of the trenches showed large subsurface enrichments of Mg, S, and Br. Disturbed soils and rocks in the Columbia Hills revealed different elemental compositions. These rocks are significantly weathered and enriched in mobile elements, such as P, S, Cl, or Br. Even abraded rock surfaces have high Br concentrations. Thus, in contrast to the rocks and soils in the Gusev Plains, the Columbia Hills material shows more significant evidence of ancient aqueous alteration.

Author

*Mars Craters; Mars Exploration; Chemical Composition; Alpha Particles; Basalt; Mars Landing Sites; Rocks; Crusts; Calibrating*

**20080026125** NASA Johnson Space Center, Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA

**Laboratory Simulated Acid-Sulfate Weathering of Basaltic Materials: Implications for Formation of Sulfates at Meridiani Planum and Gusev Crater, Mars**

Golden, D. C.; Ming, Douglas W.; Morris, Richard V.; Mertzman, A.; [2006]; 45 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.:

CASI: [A03](#), Hardcopy  
Acid-sulfate weathering of basaltic materials is a candidate formation process for the sulfate-rich outcrops and rocks at

the MER rover Opportunity and Spirit landing sites. To determine the style of acid-sulfate weathering on Mars, we weathered basaltic materials (olivine-rich glassy basaltic sand and plagioclase feldspar-rich basaltic tephra) in the laboratory under different oxidative, acid-sulfate conditions and characterized the alteration products. We investigated alteration by (1) sulfuric-acid vapor (acid fog), (2) three-step hydrothermal leaching treatment approximating an open system and (3) single-step hydrothermal batch treatment approximating a 'closed system.' In acid fog experiments, Al, Fe, and Ca sulfates and amorphous silica formed from plagioclase-rich tephra, and Mg and Ca sulfates and amorphous silica formed from the olivine-rich sands. In three-step leaching experiments, only amorphous Si formed from the plagioclase-rich basaltic tephra, and jarosite, Mg and Ca sulfates and amorphous silica formed from olivine-rich basaltic sand. Amorphous silica formed under single-step experiments for both starting materials. Based upon our experiments, jarosite formation in Meridiani outcrop is potential evidence for an open system acid-sulfate weathering regime. Waters rich in sulfuric acid percolated through basaltic sediment, dissolving basaltic phases (e.g., olivine) and forming jarosite, other sulfates, and iron oxides. Aqueous alteration of outcrops and rocks on the West Spur of the Columbia Hills may have occurred when vapors rich in SO<sub>2</sub> from volcanic sources reacted with basaltic materials. Soluble ions from the host rock (e.g., olivine) reacted with S to form Ca-, Mg-, and other sulfates along with iron oxides and oxyhydroxides.

Author

*Sulfuric Acid; Weathering; Basalt; Leaching; Iron Oxides; Sulfur Dioxides; Sulfates; Mars Craters; Amorphous Materials*

**20080026134** NASA Johnson Space Center, Houston, TX, USA

**Concordant Rb-Sr and Sm-Nd Ages for NWA 1460: A 340 Ma Old Basaltic Shergottite Related to Lherzolithic Shergottites**

Nyquist, L. E.; Shih, C-Y; Reese, Y. D.; Irving, A. J.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Preliminary Rb-Sr and Sm-Nd ages reported by [1] for the NWA 1460 basaltic shergottite are refined to 336 $\pm$ 14 Ma and 345 $\pm$ 21 Ma, respectively. These concordant ages are interpreted as dating a lava flow on the Martian surface. The initial Sr and Nd isotopic compositions of NWA 1460 suggest it is an earlier melting product of a Martian mantle source region similar to those of the lherzolithic shergottites and basaltic shergottite EETA79001, lithology B. We also examine the suggestion that generally 'young' ages for other Martian meteorites should be reinterpreted in light of Pb-207/Pb-206 - Pb-204/Pb-206 isotopic systematics [2]. Published U-Pb isotopic data for nakhlites are consistent with ages of approx.1.36 Ga. The UPb isotopic systematics of some Martian shergottites and lherzolites that have been suggested to be approx.4 Ga old [2] are complex. We nevertheless suggest the data are consistent with crystallization ages of approx.173 Ma when variations in the composition of in situ initial Pb as well as extraneous Pb components are considered.

Author

*Shergottites; Planetary Mantles; Basalt; Nakhlites; Crystallization; Fluid Flow; Chronology; Mars Surface*

**20080026135** NASA Johnson Space Center, Houston, TX, USA

**Additional Complexities in Nakhlite Pyroxenes: A Progress (?) Report**

McKay, G.; Mikouchi, T.; Schwandt, C.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Nakhlites are olivine-bearing clinopyroxene cumulates [e.g., 1]. Based on petrographic characteristics, they may be divided into groups that cooled at different rates and may have been formed at different depths in a single flow [e.g., 2, 3]. The order of cooling rate is Lafayette < Governador Valadares ~ Nakhla < Yamato000593 < NWA817 ~ MIL03346. Nakhlite cumulus pyroxene grains consist of large cores that are nearly homogeneous in major element composition surrounded by thin rims that are zoned to Fe-rich compositions. Detailed study of these pyroxenes is important because they retain a record of the crystallization history of the nakhlite magma. Moreover, because the composition of the nakhlite parent melt cannot be directly determined, inversion of the major and minor element composition of the cumulate pyroxene cores can be used to estimate the composition of that melt. Thus it is important to understand the major and minor element zoning in the cumulus pyroxenes. We recently reported complications in the minor element zoning of nakhlite pyroxenes, especially for Al and Cr [4]. This abstract reports additional complications noted since that report.

Derived from text

*Nakhlites; Olivine; Petrography; Pyroxenes; Crystallization; Magma; Inversions*

**20080026136** NASA Johnson Space Center, Houston, TX, USA

**Relative Burial Depths of Nakhrites: An Update**

Mikouchi, T.; Miyamoto, M.; Koizumi, E.; Makishima, J.; McKay, G.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Nakhrites are augite-rich cumulate rocks with variable amounts of olivine and groundmass plus minor Fe, Ti oxides [e.g., 1]. Our previous studies revealed that nakhrites showed correlated petrography and mineralogy that could be explained by different locations (burial depths) in a common cooling cumulate pile [e.g., 2]. We so far analyzed six of the seven currently known nakhrites, Nakhla (Nak), Governador Valadares (GV), Lafayette (Laf), NWA817, Y000593 (Y) and MIL03346 (MIL) [e.g., 2,3] and calculated cooling rates of four nakhrites (Nak, GV, Laf, and NWA817) by using chemical zoning of olivine [e.g., 4]. In this abstract, we complete our examination of petrographic and mineralogical variation of all currently known nakhrites by adding petrology and mineralogy of NWA998. We also report results of cooling calculations for Y, MIL and NWA998. Then, we update our model of the nakhrite igneous body in terms of relative burial depth of each sample.

Derived from text

*Nakhrites; Petrography; Rocks; Olivine; Metamorphism (Geology); Chemical Composition; Mineralogy*

**20080026137** NASA Johnson Space Center, Houston, TX, USA

**Calibration of the EU Oxybarometer for Nakhrites**

Makishima, J.; McKay, G.; Le, L.; Miyamoto; Mikouchi, T.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Martian meteorites have various characteristics, which are direct clues to understanding the petrogenesis of Mars rocks. The variation in oxidation state among the Martian meteorites must have important implications for redox conditions of the Martian crust/mantle and overall differentiation on Mars. Wadhwa [1] and Herd et al. [2] reported that Martian basalts were formed under a range of oxidation states, suggesting complex petrogenesis processes. The nakhrites, which have rather different characteristics from basaltic shergottites, may give us additional clues to Martian petrogenesis. The oxidation states of meteorites are usually described by the oxygen fugacity ( $fO_2$ ) under which the meteorites crystallized. One of the methods to estimate the oxygen fugacity is the depth of Eu anomaly.  $Eu(2+)/Eu(3+)$  is determined by the oxygen fugacity and partitioning is different for  $Eu(2+)$  and  $Eu(3+)$ . Therefore, the depth of Eu anomaly in a mineral is a function of the oxygen fugacity and the  $Eu(2+)/Eu(3+)$  in the melt from which the mineral crystallized. This method has some advantages over another major method, the two-oxide oxybarometer [3], which can more easily be affected by subsolidus processes. The Eu oxybarometer can analyze the cores of the earliest formed crystals in Martian meteorites, which means it can give us a better indication of the oxygen fugacity of the parent melt. The calibration of the Eu oxybarometer has been done with the basaltic shergottites before [4]. However, it has never been applied to nakhrites (Oe et al. [5] measured the depth of Eu anomaly in the synthetic pyroxene only at QFM). Partition coefficients are strongly affected by phase compositions, especially pyroxene Ca content and melt Al content [e.g., 5,6]. The composition of nakhrite pyroxene is rather different from basaltic shergottite pyroxene. Thus, there may be problems in applying the Eu oxybarometer calibration for the basaltic shergottites [7] to nakhrites. Thus, we report in this abstract preliminary results of our experimental calibration of the depth of Eu anomaly in pyroxene vs. oxygen fugacity for nakhrites.

Derived from text

*Calibrating; Planetary Crusts; Planetary Geology; Nakhrites; Mars Surface; Basalt; Crystallization; SNC Meteorites; Rocks; Pyroxenes*

**20080026156** Max-Planck-Inst. for Chemical Physics and Solids, Germany; Guelph Univ., Ontario, Canada; Centre d'Etude Spatiale des Rayonnements, Toulouse, France; Chicago Univ., Chicago, IL, USA

**Two Years of Chemical Sampling on Meridiani Planum by the Alpha Particle X-Ray Spectrometer Onboard the Mars Exploration Rover Opportunity**

Bruckner, J.; Gellert, R.; Clark, B.C.; Dreibus, G.; Rieder, R.; Wanke, H.; d'Uston, C.; Economou, T.; Klingelhofer, G.; Lugmair, G.; Ming, D.W.; Squyres, S.W.; Yen, A.; Zipfel, J.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, South Shore harbor, League City, Texas, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

For over two terrestrial years, the Mars Exploration Rover Opportunity has been exploring the martian surface at Meridiani Planum using the Athena instrument payload [1], including the Alpha Particle X-Ray Spectrometer (APXS). The APXS has a small sensor head that is mounted on the robotic arm of the rover. The chemistry, mineralogy and morphology



of selected samples were investigated by the APXS along with the Moessbauer Spectrometer (MB) and the Microscopic Imager (MI). The Rock Abrasion Tool (RAT) provided the possibility to dust and/or abrade rock surfaces down to several millimeters to expose fresh material for analysis. We report here on APXS data gathered along the nearly 6-kilometers long traverse in craters and plains of Meridiani.

Derived from text

*X Ray Spectrometers; Alpha Particles; Mars Exploration; Rocks; Mineralogy; Craters; Dust*

**20080026157** NASA Johnson Space Center, Houston, TX, USA

**Opaque Assemblages in CK and CV Carbonaceous Chondrites**

Neff, K. E.; Righter, K.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

CK carbonaceous chondrites are the only group of carbonaceous chondrites that exhibit thermal metamorphism. As a result, CKs display features of metamorphism such as silicate darkening, recrystallization and shock veins. Calcium Aluminum Inclusions and Fe-Ni metal are rare. CV carbonaceous chondrites are unequilibrated and have two subgroups; oxidized and reduced. The CV and CK carbonaceous chondrite groups have been compared to each other often because of petrographic similarities, such as overlapping oxygen isotopic ratios. Scientists have suggested the two groups of carbonaceous chondrites formed from the same parent body and CKs are equilibrated CV chondrites [1, 2]. The oxidized CV group has been most closely related to CKs. This study examines the petrology and mineralogy of CKs and CVs focusing on opaque minerals found in the meteorites. Using the oxide, metal and sulfide assemblages, constraints can be placed on the temperature and oxygen fugacity at which the meteorites equilibrated. The temperature and oxygen fugacity of the CK and CV chondrites can be compared in order to help define their formation history.

Derived from text

*Carbonaceous Chondrites; Metamorphism (Geology); Petrography; Impact Melts; Mineralogy; Inclusions; Recrystallization*

**20080026164** NASA Johnson Space Center, Houston, TX, USA

**Fe-Bearing Phases Identified by the Moessbauer Spectrometers on the Mars Exploration Rovers: An Overview**

Morris, R. V.; Klingelhofer, G.; Rodionov, D.; Yen, A.; Gellert, R.; March 13, 2006; 1 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

The twin Mars Exploration Rovers Spirit and Opportunity have explored the martian surface at Gusev Crater (GC) and Meridiani Planum (MP), respectively, for about two Earth years. The Moessbauer (MB) spectrometers on both rovers have analyzed an aggregate of ~200 surface targets and have returned to Earth information on the oxidation state of iron, the mineralogical composition of Fe-bearing phases, and the distribution of Fe among oxidation states and phases at the two landing sites [1-7]. To date, 15 component subspectra (10 doublets and 5 sextets) have been identified and most have been assigned to mineralogical compositions. Two subspectra are assigned to phases (jarosite and goethite) that are marker minerals for aqueous processes because they contain hydroxide anion in their structures. In this paper, we give an overview of the Fe-bearing phases identified and their distributions at Gusev crater and Meridiani Planum.

Derived from text

*Iron Oxides; Mars Surface; Roving Vehicles; Mineralogy; Hydroxides; Mars Craters; Spectrometers*

**20080026166** NASA Johnson Space Center, Houston, TX, USA

**Identification of Hydrated Sulfates Collected in the Northern Rio Tinto Valley by Reflectance and Raman Spectroscopy**

Chemtob, S. M.; Arvidson, R. E.; Fernandez-Remolar, D. C.; Amils, R.; Morris, R. V.; Ming, D. W.; Prieto-Ballesteros, O.; Mustard, J. F.; Hutchinson, L.; Stein, T. C.; Donovan, C. E.; Fairchild, G. M.; Friedlander, L. R.; Karas, N. M.; Klasen, N.; Mendenhall, M. P.; Robinson, E. M.; Steinhardt, S. E.; Weber, L. R.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

OMEGA recently identified spectral signatures of kieserite, gypsum, and other polyhydrated sulfates at multiple locations on the surface of Mars [1,2]. The presence of sulfates was confirmed through in situ spectroscopy by MER Opportunity [3]. An approach to validate these interpretations is to collect corresponding spectral data from sulfate-rich terrestrial analog sites. The northern Rio Tinto Valley near Nerva, Spain, is a good Martian analog locale because it features extensive seasonal sulfate mineralization driven by highly acidic waters [4]. We report on mineralogical compositions identified by field VNIR spectroscopy and laboratory Raman spectroscopy.

Derived from text

*Sulfates; Gypsum; Spectral Signatures; Mineralogy; Mars Surface; Raman Spectroscopy; Emission Spectra; Acidity*

**20080026167** NASA Johnson Space Center, Houston, TX, USA

**Magnetite in Martian Meteorite Mil 03346 and Gusev Adirondack Class Basalt: Moessbauer Evidence for Variability in the Oxidation State of Adirondack Lavas**

Morris, R. V.; McKay, G. A.; Ming, D. W.; Klingelhofer, G.; Schroeder, C.; Rodionov, D.; Yen, A.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Moessbauer spectrometers on the Mars Exploration Rovers Spirit (Gusev crater) and Opportunity (Meridiani Planum) have returned information on the oxidation state of iron, the mineralogical composition of Fe-bearing phases, and the distribution of Fe among oxidation states and phases [1,2,3]. To date, ~100 and ~85 surface targets have been analyzed by the Spirit and Opportunity spectrometers, respectively. Twelve component subspectra (8 doublets and 4 sextets) have been identified and most have been assigned to mineralogical compositions [4]. Two sextet subspectra result from the opaque and strongly magnetic mineral magnetite (Fe<sub>3</sub>O<sub>4</sub> for the stoichiometric composition), one each for the crystallographic sites occupied by tetrahedrally-coordinated Fe<sup>3+</sup> and by octahedrally-coordinated Fe<sup>3+</sup> and Fe<sup>2+</sup>. At Gusev crater, the percentage of total Fe associated with magnetite for rocks ranges from 0 to ~35% (Fig. 1) [3]. The range for soils (~5 to ~12% of total Fe from Mt, with one exception) is narrower. The ubiquitous presence of Mt in soil firmly establishes the phase as the strongly magnetic component in martian soil

Derived from text

*Spectrometers; Mars Exploration; Roving Vehicles; Mineralogy; Crystallography; Iron; Oxidation; Mars Surface; SNC Meteorites; Soils*

**20080026208** NASA Johnson Space Center, Houston, TX, USA

**Chemistry of Meridiani Outcrops**

Clark, B. C.; Squyres, S. W.; Ming, D. W.; Morris, R. V.; Yen, A.; Gellert, R.; Knoll, A.H.; Arvidson, R. E.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The chemistry and mineralogy of the sulfate-rich sandstone outcrops at Meridiani Planum, Mars, have been inferred from data obtained by the Opportunity rover of the MER mission and reported in recent publications [1-6]. Here, we provide an update on more recent samples and results derived from this extensive data set.

Derived from text

*Mars Surface; Outcrops; Mineralogy*

**20080026209** NASA Johnson Space Center, Houston, TX, USA

**Evidence for Halite at Meridiani Planum**

Yen, Albert S.; Grotzinger, J.; Gellert, R.; Clark, B. C.; McLennan, S. M.; Morris, R. V.; Schroeder, C.; Klingelhofer, G.; Johnson, J. R.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

The outcrop rocks investigated by the Mars Exploration Rover (MER) Opportunity at Meridiani Planum consist of altered basaltic fines emplaced through aeolian and aqueous processes. Diagenesis through episodes of groundwater influx is likely responsible for lithification of the sediments, formation and subsequent dissolution of embedded crystals, and development of hematitic spherules with occasional cemented overgrowths [1]. The action of liquid water in the development of these rocks prompts the search for pure evaporative salts such as chlorides. Extensive deposits of this nature have not yet been discovered and may be a result of erosion and removal from stratigraphic layers above those sampled by Opportunity, or burial beneath accessible depths [2]. Nonetheless, the presence of small amounts of halite (NaCl) associated with coatings and rinds is indicated by the available data.

Derived from text

*Outcrops; Basalt; Rocks; Halites; Spherules; Mars Exploration; Metamorphism (Geology); Chlorides*

**20080026211** NASA Johnson Space Center, Houston, TX, USA

**Depletion of Vanadium in Planetary Mantles: Controlled by Metal, Oxide, or Silicate?**

Righter, Kevin; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026211>

Vanadium concentrations in planetary mantles can provide information about the conditions during early accretion and

differentiation. Because V is a slightly siderophile element, it is usually assumed that any depletion would be due to core formation and metal-silicate equilibrium. However, V is typically more compatible in phases such as spinel, magnesiowuestite and garnet. Fractionation of all of these phases would cause depletions more marked than those from metal. In this paper consideration of depletions due to metal, oxide and silicate are critically evaluated.

Derived from text

*Vanadium; Depletion; Planetary Mantles; Silicates; Fractionation; Metal Oxides*

**20080026212** NASA Johnson Space Center, Houston, TX, USA

**The Role of CO<sub>2</sub> in Aqueous Alteration of Ultra-Mafic Rocks and the Formation of MF-,FE-Rich Aqueous Solutions on Early Mars**

Niles, Paul B.; Yu, M.; Zolotov, M. Yu.; Leshin, L. A.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

An adequate understanding of water on Mars that moves beyond the simplistic 'warmwet' vs. 'cold-dry' dichotomy must include strong constraints on the variables: water/rock ratio, time, temperature, and chemical composition. By constraining these variables first on local, then regional and global scales we will be capable of precisely targeting landed missions to definitively understand the history of water on Mars and the possible existence of life. Data from remote sensing of Mars, landed missions, and martian meteorites indicate that secondary minerals formed from aqueous fluids on Mars are predominately Fe- and Mg-rich. The unique Mg-, Fe-rich carbonates in the ALH 84001 meteorite provide an excellent opportunity to provide strong constraints on an Fe-, Mg-rich aqueous system on early Mars. This work seeks to use the unusual chemical compositions of the ALH 84001 carbonates as a constraint for the composition of their formation fluid. These constraints can be used to better understand aqueous processes at a critical time in martian history.

Derived from text

*Carbon Dioxide; Chemical Composition; Mineralogy; Mars Surface; Time Temperature Parameter; Water; SNC Meteorites; Rocks; Remote Sensing*

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### METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

**20080023775** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Aerosol/Cloud/Ecosystems Mission (ACE)**

Schoeberl, Mark; May 27, 2008; 19 pp.; In English; 2008 Joint Assembly: A Meeting of the Americas, 27-30 May 2008, Fort Lauderdale, FL, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023775>

The goals and measurement strategy of the Aerosol/Cloud/Ecosystems Mission (ACE) are described. ACE will help to answer fundamental science questions associated with aerosols, clouds, air quality and global ocean ecosystems. Specifically, the goals of ACE are: 1) to quantify aerosol-cloud interactions and to assess the impact of aerosols on the hydrological cycle and 2) determine Ocean Carbon Cycling and other ocean biological processes. It is expected that ACE will: narrow the uncertainty in aerosol-cloud-precipitation interaction and quantify the role of aerosols in climate change; measure the ocean ecosystem changes and precisely quantify ocean carbon uptake; and, improve air quality forecasting by determining the height and type of aerosols being transported long distances. Overviews are provided of the aerosol-cloud community measurement strategy, aerosol and cloud observations over South Asia, and ocean biology research goals. Instruments used in the measurement strategy of the ACE mission are also highlighted, including: multi-beam lidar, multiwavelength high spectra resolution lidar, the ocean color instrument (ORCA)--a spectroradiometer for ocean remote sensing, dual frequency cloud radar and high- and low-frequency micron-wave radiometer. Future steps for the ACE mission include refining measurement requirements and carrying out additional instrument and payload studies.

Derived from text

*Aerosols; Clouds (Meteorology); Ecosystems; Oceans; Hydrological Cycle; Biological Effects; Climatology*

**20080023791** NASA Langley Research Center, Hampton, VA, USA

**Airborne LIDAR Measurements of Water Vapor, Ozone, Clouds, and Aerosols in the Tropics Near Central America During the TC4 Experiment**

Kooi, Susan; Fenn, Marta; Ismail, Syed; Ferrare, Richard; Hair, John; Browell, Edward; Notari, Anthony; Butler, Carolyn; Burton, Sharon; Simpson, Steven; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, Co, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.05.04.07

Report No.(s): L-6638; Copyright; Avail.: CASI: [A01](#), Hardcopy

Large scale distributions of ozone, water vapor, aerosols, and clouds were measured throughout the troposphere by two NASA Langley lidar systems on board the NASA DC-8 aircraft as part of the Tropical Composition, Cloud, and Climate Coupling Experiment (TC4) over Central and South America and adjacent oceans in the summer of 2007. Special emphasis was placed on the sampling of convective outflow and transport, sub-visible cirrus clouds, boundary layer aerosols, Saharan dust, volcanic emissions, and urban and biomass burning plumes. This paper presents preliminary results from this campaign, and demonstrates the value of coordinated measurements by the two lidar systems.

Author

*Cirrus Clouds; Water Vapor; Optical Radar; Ozone; Aerosols; Air Pollution; Radar Measurement; Convection; Climate; Boundary Layers*

**20080023848** Desert Research Inst., Reno, NV USA

**Particulate Matter Emissions for Dust From Unique Military Activities**

Gillies, J A; Etyemezian, V; Kuhns, H; Moosmueller, H; Engelbrecht, J; King, J; Uppapalli, S; Nikolich, G; McAlpine, J D; Gillette, D A; Allwine, K J; Dec 31, 2007; 33 pp.; In English

Report No.(s): AD-A478503; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478503>

Particulate Matter (PM) emission is a critical problem for the Department of Defense (DoD). PM emitted during DoD testing and training activities threatens the safety and respiratory health of military personnel and can impact the health of urban populations encroaching on military installations. Moreover, new regulations protecting visibility at Class I national parks, forests, and wilderness areas mandate reductions in PM emissions and its chemical precursors over the next 60 years. Since many military installations are located near Class I areas, these regulations are likely to affect training activities in coming years. Military activities create unique dust emission sources not encountered in the civilian environment and which have not been accurately characterized and quantified. Without source specific emissions factors of known precision and accuracy, the uncertainties on these estimates are high. Understanding of the atmospheric and surficial influences on the amount of the dust available for longer distance transport as well as the modeling of this phenomenon remains poor. As a result emission factors applied without proper consideration of the factors that control the transportable fraction of PM will produce overestimates of these contributions.

DTIC

*Dust; Emission; Particulates*

**20080023856** Desert Research Inst., Reno, NV USA

**Effect of Vehicle Characteristics on Unpaved Road Dust Emissions**

Gillies, J A; Etyemezian, V; Kuhns, H; Nikolic, D; Gillette, D A; Jan 2005; 8 pp.; In English

Report No.(s): AD-A478550; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478550>

This paper presents PM10 fugitive dust emission factors for a range of vehicles types and examines the influence of vehicle and wake characteristics on the strength of emissions from an unpaved road. Vertical profile measurements of mass concentration of the passing plumes were carried out using a series of 3 instrumented towers. PM 10 emission fluxes at each tower were calculated from knowledge of the vertical mass concentration profile, the ambient wind speed and direction, and the time the plume took to pass the towers. The emission factors showed a strong linear dependence on speed and vehicle weight. Emission factors (EF = grams of PM10 emitted per vehicle kilometer traveled) ranged from approximately EF = 48 x (kmh(exp -1)) for a light (~1200 kg) passenger car to EF = 48 (kmh(exp-1))for large military vehicles (~18 000 kg). In comparison to emission estimates derived using US EPA AP-42 methods the measured emission factors indicate larger than estimated contributions for speeds generally > 10-20kmh(exp-1) and for vehicle weights >3000 kg. The size of a wake created by a vehicle was observed to be dependent on the size of the vehicle, increasing roughly linearly with vehicle height. Injection

height of the dust plume is least important to long-range transport of PM10 under unstable conditions and most important under stable atmospheric conditions.

DTIC

*Dust; Emission; Roads*

**20080023922** NASA Langley Research Center, Hampton, VA, USA

**On the Observed Changes in Upper Stratospheric and Mesospheric Temperatures From UARS HALOE**

Remsberg, E. E.; January 30, 2008; 50 pp.; In English; To be published in *Annales Geophysicae*, volume 26, no. 5, pp. 1287-1297, 2008; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 584635.04.02.01; No Copyright; Avail.: Other Sources

Temperature versus pressure or T(p) time series from the Halogen Occultation Experiment (HALOE) of the Upper Atmosphere Research Satellite (UARS) have been extended and re-analyzed for the period of 1991-2005 and for the upper stratosphere and mesosphere in 10-degree wide latitude zones from 60S to 60N. Even though sampling from a solar occultation experiment is somewhat limited, it is shown to be quite adequate for developing both the seasonal and longer-term variations in T(p). Multiple linear regression (MLR) techniques were used in the re-analyses for the seasonal and the significant interannual, solar cycle (SC-like or decadal-scale), and linear trend terms. Plots of the amplitudes and phases for the interannual (QBO and subbiennial) terms are provided. A simple SC-like term of 11-yr period was fitted to the time series residuals after accounting for the seasonal and interannual terms. Highly significant SC-like responses were found for both the upper mesosphere and the upper stratosphere. The phases of these SC-like terms were checked for their continuity with latitude and pressure-altitude; the larger amplitude responses are directly in-phase with that of standard proxies for the solar flux variations. The analyzed, max minus min, responses at low latitudes are of order 0.5 to 1 K, while at middle latitudes they are as large as 3 K in the upper mesosphere. Highly significant, linear cooling trends were found at middle latitudes of the middle to upper mesosphere (-1.5 to -2.0 K/decade), at tropical latitudes of the lower mesosphere (about -0.5 K/decade), and at 2 hPa (of order -1 K/decade). Both the diagnosed solar cycle responses and trends from HALOE for the mid to upper mesosphere at middle latitudes are larger than simulated with most models, perhaps an indication of decadal-scale dynamical forcings that are not being simulated so well.

Author

*Time Series Analysis; Halogen Occultation Experiment; Upper Atmosphere Research Satellite (UARS); Stratosphere; Periodic Variations; Atmospheric Temperature; Solar Cycles*

**20080023926** Army War Coll., Carlisle Barracks, PA USA

**Responding Logistically to Future Natural and Man-Made Disasters and Catastrophes**

McBride-Davis, Vivian L; Mar 15, 2008; 39 pp.; In English

Report No.(s): AD-A478576; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On 28 August 2005, Hurricane Katrina hit Louisiana and Mississippi and was among the most devastating, destructive and largest natural catastrophes in USA history. Hurricane Katrina impacted 93,000 square miles and killed 1,300 people. More than two years later, the U.S. has still not fully recovered. The federal government and FEMA received widespread criticism for the slow and ineffective response to Hurricane Katrina. Inadequate logistical planning and ineffective execution of support activities played a large part in the poor response efforts. Federal resource managers had great difficulty in determining logistics requirements. Even when Federal resource managers had a clear understanding of what was needed, they often could not determine accurately whether the Federal government had the requisite supplies and equipment nor could track the provision of those supplies to those in need. This paper focuses primarily on the key logistics aspects of our government's ability to respond to natural disasters or catastrophes. It examines the responsible organizations, processes and governing documents; highlights current initiatives for improving logistical response and sustainment activities; assesses our current state of logistics response readiness; and recommends several areas for continued improvement.

DTIC

*Disasters; Hurricanes; Logistics; Security*

**20080023947** Utah State Univ., Logan, UT USA

**Development of an Ionosphere-Plasmasphere-Polar Wind Model and Studies of Storms and Substorms**

Gardner, Larry C; Carlson, Herbert C; Mar 10, 2008; 10 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0217

Report No.(s): AD-A478612; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The focus of this project was on the development of an ionosphere- plasmasphere-polar wind model to study storms and

substorms. Four papers were published in the scientific literature, with the titles and abstracts listed below. The topics studied include polar patch formation and dynamics, including their role in neutral stream particle production. The final paper covers a simulation of the May 4 1998 magnetic storm using realistic inputs to drive the model. By using realistic inputs during storms, there is a more realistic, changing character to the model inputs, thereby showing more of the dynamic, changing nature that should be associated with storm, and substorm simulations. The results of the current studies show that in order to model the near earth environment, realistic inputs are necessary, and with the realistic drivers the model produces a more spatially and temporally varying output. This then shows that to model the magnetosphere-ionosphere interactions, the dynamical nature of the ionospheric flows must be taken into account to accurately portray magnetosphere- ionosphere coupling. More detail on this study is included in the appendix in the form of a powerpoint poster which will be displayed at the Fall AOU meeting.

DTIC

*Ionospheres; Plasmasphere; Polar Regions; Storms*

**20080023955** Washington Univ., Seattle, WA USA

**ensembleBMA: An R Package for Probabilistic Forecasting using Ensembles and Bayesian Model Averaging**

Fraley, Chris; Raftery, Adrian E; Gneiting, Tilmann; Sloughter, J M; Aug 15, 2007; 14 pp.; In English

Contract(s)/Grant(s): N00014-01-10745

Report No.(s): AD-A478634; TR-516; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ensembleBMA is a contributed R package for probabilistic forecasting using ensemble postprocessing via Bayesian Model Averaging. It provides functions for parameter estimation via the EM algorithm for normal mixture models 'appropriate for temperature or pressure' and mixtures of gamma distributions with a point mass at 0 'appropriate for precipitation' from training data. Also included are functions giving quantile forecasts based on these models, as well as for verification.

DTIC

*Bayes Theorem; Forecasting; Statistical Distributions*

**20080023956** Washington Univ., Seattle, WA USA

**Predictive Model Assessment for Count Data**

Czado, Claudia; Gneiting, Tilmann; Held, Leonhard; Sep 5, 2007; 20 pp.; In English

Contract(s)/Grant(s): N00014-01-10745M; DMS-0706745

Report No.(s): AD-A478635; TR-518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We discuss tools for the evaluation of probabilistic forecasts and the critique of statistical models for ordered discrete data. Our proposals include a non-randomized version of the probability integral transform, marginal calibration diagrams and proper scoring rules, such as the predictive deviance. In case studies, we critique count regression models for patent data, and assess the predictive performance of Bayesian age-period-cohort models for larynx cancer counts in Germany. Key words: Calibration; Forecast verification; Model diagnostics; Predictive deviance; Probability integral transform; Proper scoring rule; Ranked probability score.

DTIC

*Forecasting; Mathematical Models; Predictions; Statistical Analysis*

**20080024010** NASA Langley Research Center, Hampton, VA, USA

**CART Raman Lidar Aerosol and Water Vapor Measurements in the Vicinity of Clouds**

Clayton, Marian B.; Ferrare, Richard A.; Turner, David; Newsom, Rob; Sivaraman, Chitra; June 23, 2008; 3 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, Co, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 281945.02.20.01.22; Copyright; Avail.: CASI: A01, Hardcopy

Aerosol and water vapor profiles acquired by the Raman lidar instrument located at the Climate Research Facility (CRF) at Southern Great Plains (SGP) provide data necessary to investigate the atmospheric variability in the vicinity of clouds near the top of the planetary boundary layer (PBL). Recent CARL upgrades and modifications to the routine processing algorithms afforded the necessarily high temporal and vertical data resolutions for these investigations. CARL measurements are used to investigate the behavior of aerosol backscattering and extinction and their correlation with water vapor and relative humidity.

Author

*Aerosols; Water Vapor; Planetary Boundary Layer; Atmospheric Moisture; Backscattering; Optical Radar*

**20080024015** NASA Langley Research Center, Hampton, VA, USA

**Aerosol Profile Measurements from the NASA Langley Research Center Airborne High Spectral Resolution Lidar**

Obland, Michael D.; Hostetler, Chris A.; Ferrare, Richard A.; Hair, John W.; Roers, Raymond R.; Burton, Sharon P.; Cook, Anthony L.; Harper, David B.; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, CO, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 534173.02.07.9T17.04; Copyright; Avail.: CASI: [A01](#), Hardcopy

Since achieving first light in December of 2005, the NASA Langley Research Center (LaRC) Airborne High Spectral Resolution Lidar (HSRL) has been involved in seven field campaigns, accumulating over 450 hours of science data across more than 120 flights. Data from the instrument have been used in a variety of studies including validation and comparison with the Cloud- Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) satellite mission, aerosol property retrievals combining passive and active instrument measurements, aerosol type identification, aerosol-cloud interactions, and cloud top and planetary boundary layer (PBL) height determinations. Measurements and lessons learned from the HSRL are leading towards next-generation HSRL instrument designs that will enable even further studies of aerosol intensive and extensive parameters and the effects of aerosols on the climate system. This paper will highlight several of the areas in which the NASA Airborne HSRL is making contributions to climate science.

Author

*CALIPSO (Pathfinder Satellite); Infrared Radiation; Optical Radar; High Resolution; Aerosols; Planetary Boundary Layer; Spectral Resolution*

**20080024094** Domaine Univ., Grenoble, France

**Summer Temperature Trend Over the Past Two Millennia Using Air Content in Himalayan Ice**

Hou, S; Chappellaz, J; Jouzel, J; Chu, P C; Masson-Delmotte, V; Qin, D; Raynaud, D; Mayewski, P A; Lipenkov, V Y; Kang, S; Feb 7, 2007; 8 pp.; In English

Report No.(s): AD-A478857; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two Himalayan ice cores display a factor-two decreasing trend of air content over the past two millennia, in contrast to the relatively stable values in Greenland and Antarctica ice cores over the same period. Because the air content can be related with the relative frequency and intensity of melt phenomena, its variations along the Himalayan ice cores provide an indication of summer temperature trend. Our reconstruction point toward an unprecedented warming trend in the 20th century but does not depict the usual trends associated with Medieval Warm Period (MWP), or Little Ice Age (LIA).

DTIC

*Atmospheric Temperature; Climate; Glaciers; Ice; Summer*

**20080024125** NASA Langley Research Center, Hampton, VA, USA

**Using Airborne High Spectral Resolution Lidar Data to Evaluate Combined Active Plus Passive Retrievals of Aerosol Extinction Profiles**

Burton, S. P.; Ferrare, R. A.; Kittaka, C.; Hostetler, C. A.; Hair, J. W.; Obland, M. D.; Rogers, R. R.; Cook, A. L.; Haper, D. B.; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, CO, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 281945.02.20.01.22; Copyright; Avail.: CASI: [A01](#), Hardcopy

Aerosol extinction profiles are derived from backscatter data by constraining the retrieval with column aerosol optical thickness (AOT), for example from coincident MODIS observations and without reliance on a priori assumptions about aerosol type or optical properties. The backscatter data were acquired with the NASA Langley High Spectral Resolution Lidar (HSRL). The HSRL also simultaneously measures extinction independently, thereby providing an ideal data set for evaluating the constrained retrieval of extinction from backscatter. We will show constrained extinction retrievals using various sources of column AOT, and examine comparisons with the HSRL extinction measurements and with a similar retrieval using data from the CALIOP lidar on the CALIPSO satellite.

Author

*Optical Radar; MODIS (Radiometry); Spectral Resolution; Aerosols; Backscattering; Imaging Spectrometers*

**20080024183** NASA Langley Research Center, Hampton, VA, USA

**Evaluation and Applications of Cloud Climatologies from CALIOP**

Winker, David; Getzewitch, Brian; Vaughan, Mark; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, Co, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Clouds have a major impact on the Earth radiation budget and differences in the representation of clouds in global climate models are responsible for much of the spread in predicted climate sensitivity. Existing cloud climatologies, against which these models can be tested, have many limitations. The CALIOP lidar, carried on the CALIPSO satellite, has now acquired over two years of nearly continuous cloud and aerosol observations. This dataset provides an improved basis for the characterization of 3-D global cloudiness. Global average cloud cover measured by CALIOP is about 75%, significantly higher than for existing cloud climatologies due to the sensitivity of CALIOP to optically thin cloud. Day/night biases in cloud detection appear to be small. This presentation will discuss detection sensitivity and other issues associated with producing a cloud climatology, characteristics of cloud cover statistics derived from CALIOP data, and applications of those statistics.

Author

*Optical Radar; Clouds (Meteorology); Climate Models; Aerosols; Cloud Cover*

**20080024192** Meteorological Satellite Center, Tokyo, Japan

**Meteorological Satellite Center Technical Note No. 50**

Kurino, Toshiyuki, Editor; Matsumoto, Takanori, Editor; Okuyama, Arata, Editor; Nishida, Toshihiro, Editor; Hatsuda, Toshio, Editor; Yamamoto, Masayuki, Editor; Masuda, Ryoichi, Editor; Kontani, Atsushi, Editor; Okazaki, Tsukasa, Editor; Noguchi, Kazuo, Editor, et al.; January 2008; ISSN 0388-9653; 79 pp.; In English; In Japanese; See also [20080024193](#) - [20080024197](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include; New Approach to Intercalibration Using High Spectral Resolution; Sounder Methodology of Extracting Sea Ice Motion Vectors from Geostationary Meteorological Satellite Data; Correction of HRIT Image Displacement Central Wavelengths and Wavenumbers and Sensor Planck Functions of the GMS and MTSAT Infrared Channels; and Calibration of GMS-5/VISSR VIS Band Using Radiative Transfer Calculation.

Derived from text

*Meteorological Satellites; Radiative Transfer; Geosynchronous Orbits; Visible Infrared Spin Scan Radiometer; Infrared Radiation*

**20080024193** Meteorological Satellite Center, Tokyo, Japan

**Correction of HRIT Image Displacement**

Tahara, Yoshihiko; Meteorological Satellite Center Technical Note No. 50; January 2008, pp. 31-50; In Chinese; See also [20080024192](#); Copyright; Avail.: Other Sources

Correction of HRIT image displacement using the landmark method started in June 2006. Pattern matching using correlation coefficients is applied for landmark analysis. The satellite images are overlapped on the map and shifted to obtain the maximum correlation coefficient. The shifted amount at the maximum correlation coefficient equals the amount of displacement at each calculated point. The displacement amounts are used to modify the 'Image Compensation Information Header' in HRIT data. The results of landmark analysis are also used to make a quick-look image which shows the image displacement, and to make the time sequence graph of image displacement. These pieces of information are provided to HRIT data users on the Internet.

Author

*Correlation Coefficients; Displacement; Pattern Recognition; Satellite Imagery; Landmarks*

**20080024194** Meteorological Satellite Center, Tokyo, Japan

**Calibration of GMS-5/VISSR VIS Band Using Radiative Transfer Calculation**

Hashimoto, Toru; Okuyama, Arata; Takenaka, Hideaki; Fukuda, Satoru; Meteorological Satellite Center Technical Note No. 50; January 2008, pp. 61-74; In Japanese; See also [20080024192](#); Copyright; Avail.: Other Sources

This report describes the methodology developed to calibrate GMS-5 visible channel data. This calibration method relies on calculated radiances over specific targets using a radiative transfer simulation package, RSTAR, based on the JRA-25 reanalysis data, ground observation, and MODIS data. The calibrated visible data improved the underestimated aerosol



product and cloud optical thickness. Additionally, sun observation images are also effective for making and verifying the calibrated data.

Author

*Aerosols; MODIS (Radiometry); Radiative Transfer; Visible Infrared Spin Scan Radiometer; Computerized Simulation; Calibrating; Radiance*

**20080024196** Meteorological Satellite Center, Tokyo, Japan

**Methodology of Extracting Sea Ice Motion Vectors from Geostationary Meteorological Satellite Data**

Matsumoto, Takanori; Imai, Takahito; Meteorological Satellite Center Technical Note No. 50; January 2008, pp. 15-30; In English; See also [20080024192](#); Copyright; Avail.: Other Sources

The Japan Meteorological Agency monitors sea ice in the Sea of Okhotsk every winter using a Geostationary Meteorological Satellite (GMS). There are not many observations on wind, sea surface currents and tidal waves on a local spacetime scale that can be used to estimate sea ice motion. Therefore, using satellite data is an effective way of measuring sea ice motion. This paper mentions the scheme of Sea Ice Motion Vector calculations from GMS and the elimination of other motion vectors, treating them as noise. By the thresholds of two statistical values, almost all the effects &om other motion vectors are eliminated. This paper is a review of Matsumoto 2000 and 2003. The scheme used in the research has been used in the Meteorological Satellite Center since January 2007. A newly defined value  $RL_j$  is used to confirm the width of the template, and the aim of this paper is to explain the ex.h.action of sea ice n~otionv ectors.

Author

*Sea Ice; Meteorological Satellites; Geosynchronous Orbits; Wind (Meteorology); Space-Time Functions; Ocean Surface*

**20080024197** Meteorological Satellite Center, Tokyo, Japan

**Central Wavelengths and Wavenumbers and Sensor Planck Functions of the GMS and MTSAT Infrared Channels**

Date, Kenji; Meteorological Satellite Center Technical Note No. 50; January 2008, pp. 51-59; In Japanese; In English; See also [20080024192](#); Copyright; Avail.: Other Sources

Satellite based imagers and soundeRs observe radiation from the Earth with specific band widths. Weinreb et al. (1981) and Planet (1988) propose a sensor Planck function to convert the observed radiance to brightness temperature and vice versa. Their method is to introduce band correction coefficients into the monochromatic Planck function, and this enables a conversion that is fast and accurate. Using this method, the sensor Planck functions for all infrared channels of the imagers aboard GMS and MTSAT satellites are generated.

Author

*Infrared Radiation; Sounding; Radiance; Brightness Temperature*

**20080024198** Meteorological Satellite Center, Tokyo, Japan

**Meteorological Satellite Center, Technical Note No. 51**

March 2008; ISSN 0388-9653; 77 pp.; In English; In Japanese; See also 20080024199 - 20080024202; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Introduction of RGB Composite Imagery Technique of MSG/SEVIRI in EUMETSAT, and Application to Satellite Imagery of MTSAT-1R; MTSAT-2 Visible Channel Calibration and Its Practical Application; Developments for Quality Improvement of Atmospheric Motion Vectors Product; Improvement of Satellite Cloud Grid Information Using a Distinction Algorithm for Snow and Sea Ice Areas.

Author

*Satellite Imagery; Atmospheric Circulation; Calibrating*

**20080024199** Meteorological Satellite Center, Tokyo, Japan

**Introduction of RGB Composite Imagery Technique of MSG/SEVIRI in EUMETSAT, and Application to Satellite Imagery of MTSAT-1R**

Shimizu, Akihiro; Meteorological Satellite Center, Technical Note No. 51; March 2008, pp. 1-23; In English; See also [20080024198](#); Original contains color illustrations; Copyright; Avail.: Other Sources

In the neph-analysis technique, the skills required for the interpretation and extraction of necessary information from the imagery include special knowledge and experience. On the other hand, the 'RGB composite imagery technique' used in Europe is a technique that can help us gasp the phenomenon that catch our attention more effectively and facilitate interpreting, by overlapping and displaying in color the satellite imagery of two or more channels. The knowledge about this technique

obtained at EUMETSAT is introduced in this report, and I applied that knowledge to the satellite image of MTSAT-1R and attempted to composite RGB imagery on SATAID. As a result, it was confirmed that the 'RGB composite imagery' of the MTSAT-1R imagery are effective for the identification of the cloud region and the phenomena. It is thought that 'RGB composite imagery technique' will contribute to the work of the neph-analysis because the composite imagery can be displayed by easy operations on SATAID.

Author

*Satellite Imagery; Extraction; Global Air Sampling Program*

**20080024200** Meteorological Satellite Center, Tokyo, Japan

#### **MTSAT-2 Visible Channel Calibration and Its Practical Application**

Kigawa, Seiichiro; Miyaoka, Kengo; Meteorological Satellite Center, Technical Note No. 51; March 2008, pp. 25-39; In English; See also [20080024198](#); Original contains color illustrations; Copyright; Avail.: Other Sources

Japanese Multi-functional Transport SATellite-2 (MTSAT-2) launched in February, 2006 has a special device called 'Albedo Monitor' in the imager to calibrate the visible channel of the imager. The Albedo Monitor device introduces sunlight into Imager optics, and then the sensitivity of the visible channel can be determined by the intensity of the sunlight. Visible calibration based on Albedo Monitor measurements was conducted during the post-launch on-orbit testing of MTSAT-2, and it was concluded that the sensitivity of the visible channel was stable and showed no degradation compared to prelaunch measurements. Lunar images were also taken during the MTSAT-2 post-launch testing. Since these images were calibrated by Albedo Monitor measurements, and it was from these that a visible channel calibration technique using the lunar images developed. The technique was applied to GMS, GOES, and METEOSAT on an experimental basis.

Author

*Meteosat Satellite; Calibrating; Degradation; Sunlight*

**20080024201** Meteorological Satellite Center, Tokyo, Japan

#### **Improvement of Satellite Cloud Grid Information Using a Distinction Algorithm for Snow and Sea Ice Areas**

Mouri, Kouki; Terasaka, Yoshiyuki; Meteorological Satellite Center, Technical Note No. 51; March 2008, pp. 57-72; In English; See also [20080024198](#); Original contains color illustrations; Copyright; Avail.: Other Sources

Satellite Cloud Grid Information Data (SCGID) has been developed and put to use in the Meteorological Satellite Center (MSC), Japan Meteorological Agency (JMA) since 1997 (except for a time for back-up operations by GOES9 from May 2003 to June 2005). The SCGID was a product that calculates total amount of clouds, type of clouds, amount of upper layer clouds, amount of convective clouds (Cumulus Nimbus), and altitude of the top of clouds in lattices within 20 h using IR1, IR2, IR3, and VIS data provided by GMS-5. During the same, SCGID distinguishes between low level clouds and the land or sea surface by using the reflectance from the VIS data. In this product, if the observed reflectance of a pixel is bigger than the threshold, the observed pixel is cloud. Conversely, if the observed reflectance of a pixel is smaller than the threshold, the observed pixel is clear. The threshold of pixels is decided based on the reflectance data of the past 10 days and the threshold is corrected by solar zenith angle. SCGID had a problem in which it calculated the wrong amount of clouds near sea ice areas or snow areas that had values of reflectance equal to low level clouds in spite of clear skies in the winter season. MSC began to operate the geostationary meteorological satellite (MTSAT-1R) on July 2005 and provide 3.8- $\mu$ m band channel (IR4) data besides the original four channel data (IR1, IR2, IR3, VIS). We adopted a method in which low level clouds and ice areas are classified by recognizing a pixel that has high reflectance, and a small difference of brightness temperature between IR4 and IR1 (IR4-IR1) is corresponding to sea ice or snow and tested. In the results, the amount of incorrect cloud calculations is reduced and we obtained amounts close to surface observation or the images from satellites.

Author

*Snow; Sea Ice; Meteorological Satellites; Algorithms; Synchronous Platforms; Satellite Observation; Ice Clouds; Geosynchronous Orbits*

**20080024202** Meteorological Satellite Center, Tokyo, Japan

#### **Developments for Quality Improvement of Atmospheric Motion Vectors Product**

Imai, Takahito; Oyama, Ryo; Meteorological Satellite Center, Technical Note No. 51; March 2008, pp. 41-55; In English; See also [20080024198](#); Original contains color illustrations; Copyright; Avail.: Other Sources

Meteorological Satellite Center (MSC) of Japan Meteorological Agency (JMA) has been producing Atmospheric Motion Vectors (AMVs) product by using successive images of geostationary satellites since 1978. The AMV data is important observational wind data for numerical prediction. Hence, the data is used in the numerical prediction model of JMA, and

foreign numerical prediction centers, the European Centre for Medium-Range Weather Forecasts (ECMWF), UK Meteorological Office (UKMO), National Centers for Environmental Prediction (NCEP) and so forth. This paper reports the developments for improving the quality of AMVs, which was achieved by MSC in 2006. The work was performed to improve two AMV derivation processes focusing on upper and middle level IR and WV AMV, that is, 1) the height assignment method, and 2) the determination of candidate points for AMV calculation. The negative bias of AMV wind speed against sonde observational wind, which has been in the upper and middle tropospheric layers in the northern and southern middle latitudes for the past few decades, was significantly reduced after introducing the first improvement. Moreover, the accuracy of tracking the movement of the uppermost clouds in IR images and features in WV images is improved by using the second improvement for some types of clouds. These improvements have been introduced into JMA's operational AMV calculation system at 06UTC on 30 May 2007.

Author

*Atmospheric Circulation; Wind Measurement; Geosynchronous Orbits; Meteorological Satellites; Synchronous Platforms; Weather Forecasting; Wind Velocity; Infrared Imagery; Quality Control*

**20080024203** NASA Langley Research Center, Hampton, VA, USA

**SAGE II Measurements of Stratospheric Aerosol Properties at Non-Volcanic Levels**

Thomason, Larry W.; Burton, Sharon P.; Luo, Bei-Ping; Peter, Thomas; February 2008; 37 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 23-621-60-01; Copyright; Avail.: CASI: [A03](#), Hardcopy

Since 2000, stratospheric aerosol levels have been relatively stable and at the lowest levels observed in the historical record. Given the challenges of making satellite measurements of aerosol properties at these levels, we have performed a study of the sensitivity of the product to the major components of the processing algorithm used in the production of SAGE II aerosol extinction measurements and the retrieval process that produces the operational surface area density (SAD) product. We find that the aerosol extinction measurements, particularly at 1020 nm, remain robust and reliable at the observed aerosol levels. On the other hand, during background periods, the SAD operational product has an uncertainty of at least a factor of 2 during due to the lack of sensitivity to particles with radii less than 100 nm.

Author

*Aerosols; Stratosphere; Sensitivity; Satellite Observation; Algorithms*

**20080024222** NASA Langley Research Center, Hampton, VA, USA

**Surface Ozone Measured at GLOBE Schools in the Czech Republic: A Demonstration of the Importance of Student Contribution to the Larger Science Picture**

Pippin, Margaret R.; Creilson, John K.; Henderson, Bryana L.; Ladd, Irene H.; Fishman, Jack; Votapkova, Dana; Krpcova, Ilona; April 2008; 32 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 389018.02.09.01.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

GLOBE (Global Learning and Observations to Benefit the Environment) is a worldwide hands-on, primary and secondary school-based education and science program, developed to give students a chance to perform real science by making measurements, analyzing data, and participating in research in collaboration with scientists. As part of the GLOBE Surface Ozone Protocol and with the assistance of the TEREZA Association in the Czech Republic, schools in the Czech Republic have been making and reporting daily measurements of surface ozone and surface meteorological data since 2001. Using a hand-held ozone monitor developed for GLOBE, students at several Czech schools have generated multiyear data records of surface ozone from 2001 to 2005. Analysis of the data shows surface ozone levels were anomalously high during the summer of 2003 relative to other summers. These findings are consistent with measurements by the European Environment Agency that highlights the summer of 2003 as having exceptionally long-lasting and spatially extensive episodes of high surface ozone, especially during the first half of August. Further analysis of the summer's prevailing meteorology shows not only that it was one of the hottest on record, a finding also seen in the student data, but the conditions for production of ozone were ideal. Findings such as these increase student, teacher, and scientist confidence in the utility of the GLOBE data for engaging budding scientists in the collection, analysis, and eventual interpretation of the data for inquiry-based education.

Author

*Education; Meteorological Parameters; Ozone*

**20080024225** NASA Langley Research Center, Hampton, VA, USA

**Characterization of Polar Stratospheric Clouds With Spaceborne Lidar: CALIPSO and the 2006 Antarctic Season**  
Pitts, Michael C.; Thomason, L. W.; Poole, Lamont R.; Winker, David M.; [2007]; 49 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 653967.04.12.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The role of polar stratospheric clouds in polar ozone loss has been well documented. The CALIPSO satellite mission offers a new opportunity to characterize PSCs on spatial and temporal scales previously unavailable. A PSC detection algorithm based on a single wavelength threshold approach has been developed for CALIPSO. The method appears to accurately detect PSCs of all opacities, including tenuous clouds, with a very low rate of false positives and few missed clouds. We applied the algorithm to CALIPSO data acquired during the 2006 Antarctic winter season from 13 June through 31 October. The spatial and temporal distribution of CALIPSO PSC observations is illustrated with weekly maps of PSC occurrence. The evolution of the 2006 PSC season is depicted by time series of daily PSC frequency as a function of altitude. Comparisons with virtual solar occultation data indicate that CALIPSO provides a different view of the PSC season than attained with previous solar occultation satellites. Measurement-based time series of PSC areal coverage and vertically-integrated PSC volume are computed from the CALIPSO data. The observed area covered with PSCs is significantly smaller than would be inferred from a temperature-based proxy such as TNAT but is similar in magnitude to that inferred from TSTS. The potential of CALIPSO measurements for investigating PSC microphysics is illustrated using combinations of lidar backscatter coefficient and volume depolarization to infer composition for two CALIPSO PSC scenes.

Author

*Stratosphere; Polar Meteorology; Atmospheric Composition; Depolarization; Optical Radar; Ozone; Opacity*

**20080024226** NASA Langley Research Center, Hampton, VA, USA

**Estimation of Asian Dust Aerosol Effect on Cloud Radiation Forcing Using Fu-Liou Radiative Model and CERES Measurements**

Su, Jing; Huang, Jianping; Fu, Qiang; Minnis, Patrick; Ge, Jinming; Bi, Jianrong; May 2008; 30 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG04GM23G; NSF 40628005; NSF 40633017; 206CB400501; WBS 921266.04.07.07; Copyright; Avail.: CASI: [A03](#), Hardcopy

The impact of Asian dust on cloud radiative forcing during 2003-2006 is studied by using the Earth's Radiant Energy Budget Scanner (CERES) data and the Fu-Liou radiative transfer model. Analysis of satellite data shows that the dust aerosol significantly reduced the cloud cooling effect at TOA. In dust contaminated cloudy regions, the 4-year mean values of the instantaneous shortwave, longwave and net cloud radiative forcing are -138.9, 69.1, and -69.7 Wm(sup -2), which are 57.0, 74.2, and 46.3%, respectively, of the corresponding values in more pristine cloudy regions. The satellite-retrieved cloud properties are significantly different in the dusty regions and can influence the radiative forcing indirectly. The contributions to the cloud radiation forcing by the dust direct, indirect and semi-direct effects are estimated using combined satellite observations and Fu-Liou model simulation. The 4-year mean value of combination of indirect and semi-direct shortwave radiative forcing (SWRF) is 82.2 Wm(sup -2), which is 78.4% of the total dust effect. The direct effect is only 22.7 Wm(sup -2), which is 21.6% of the total effect. Because both first and second indirect effects enhance cloud cooling, the aerosol-induced cloud warming is mainly the result of the semi-direct effect of dust.

Author

*Aerosols; Asia; Cloud Physics; Dust; Radiative Transfer; CERES (Experiment); Mathematical Models; Climatology; MODIS (Radiometry)*

**20080025041** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Effect of Aerosols and Clouds on the Retrieval of Infrared Sea Surface Temperatures**

Vazquez-Cuervo, Jorge; Armstrong, Edward M.; Harris, Andy; Journal of Climate; October 15, 2004; Volume 17, pp. 3921-3933; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40841>

Comparisons are performed between spatially averaged sea surface temperatures (ASST2) as derived from the second Along-Track Scanning Radiometer (ATSR-2) on board the second European Remote Sensing Satellite (ERS-2) and the NOAA-NASA Advanced Very High Resolution Radiometer (AVHRR) Oceans Pathfinder dataset (MPFSST). Difference maps, MPFSST 2 ASST2, along with the application of a simple statistical regression model to aerosol and cloud data from the Total Ozone Mapping Spectrometer (TOMS), are used to examine the impact of possible aerosol and cloud contamination. Differences varied regionally, but the largest biases were seen off western Africa. Nighttime and daytime differences off

western Africa were reduced from -0.5degrees to -0.2degreesC and from -0.1degrees to 0degreesC, respectively. Significant cloud flagging, based on the model, occurred in the Indian Ocean, the equatorial Pacific, and in the vicinity of the Gulf Stream. Comparisons of the MPFSST and the ASST2 with in situ data from the 2002 version of the World Oceanic Database (WOD02) off western Africa show larger mean differences for the MPFSST. The smallest mean differences occurred for nighttime ASST2 - WOD02 with a value of 0.0degrees +/- 0.4degreesC.

Author

*Aerosols; Clouds (Meteorology); Sea Surface Temperature; Ocean Models; In Situ Measurement; Advanced Very High Resolution Radiometer; Atmospheric Models; Satellite Observation*

**20080025198** National Renewable Energy Lab., Golden, CO USA

**Coastal and Marine Tall-Tower Data Analysis**

Schwartz, M.; Elliott, D.; Scott, G.; Jun. 2007; 13 pp.; In English

Report No.(s): DE2007-909660; NREL/CP-500-41858; No Copyright; Avail.: National Technical Information Service (NTIS)

This analysis emphasizes wind shear characteristics, similar to what was presented in the Central Plains tall-tower study, plus some information on the prevailing wind direction and diurnal and seasonal wind patterns.

NTIS

*Atmospheric Boundary Layer; Coasts; Towers; Wind Shear*

**20080025231** Minerals Management Service, New Orleans, LA USA

**Full-Water Column Current Observations in the Central Gulf of Mexico, Final Report**

Sheinbaum, J.; Badan, A.; Ochoa, J.; Candela, J.; Rivas, D.; Aug. 2007; 68 pp.; In English

Report No.(s): PB2007-112659; OCS/EIS/EA/MMS-2007-022; No Copyright; Avail.: National Technical Information Service (NTIS)

A full-water column mooring, instrumented with acoustic current profilers, current meters, and temperature and pressure sensors, was installed at 25o 5N; 90o 30W, in the central Gulf of Mexico. It successfully monitored current and temperature fluctuations from the near surface to the bottom from May, 2003 to August, 2004 (16 months). The velocity spectral density shows peaks at tidal and inertial bands with over 90% of the variance in subinertial motions. Bursts of inertial wave activity occur throughout the period of observations, possibly related to the passage of eddy-related fronts. A considerable portion of the subinertial current fluctuations are surface intensified, coherent throughout the water column, and geostrophically related to the sea surface slopes, as determined from satellite altimetry. The projection of the data shows that the barotropic and first baroclinic dynamical modes contribute 46% and 45% of the total variance. An EOF decomposition shows 49% and 24% of the variance in the first and second modes, both of them exhibiting the surface intensification. An intensification detected within the bottom boundary layer probably arises as an effect of bottom-trapped topographic waves. Most of the fluctuations are driven by eddies propagating to the west, away from their generation off the Loop Current. The temperature measurements combined with the measured vertical excursions of some instruments and the dynamical modes allow estimates of the full temperature and vertical displacement profiles. Temperature fluctuations are consistent with the passage of warm/cold anticyclonic/cyclonic eddies.

NTIS

*Gulf of Mexico; Mooring; Water Currents*

**20080025277** NASA Langley Research Center, Hampton, VA, USA

**Evaluation of Near-Tropopause Ozone Distributions in the Global Modeling Initiative Combined Stratosphere/Troposphere Model with Ozonesonde Data**

Considine, David B.; Logan, Jennifer A.; Olsen, Mark A.; May 2008; 51 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 281945.02.04.01.05; Copyright; Avail.: CASI: [A04](#), Hardcopy

The NASA Global Modeling Initiative has developed a combined stratosphere/troposphere chemistry and transport model which fully represents the processes governing atmospheric composition near the tropopause. We evaluate model ozone distributions near the tropopause, using two high vertical resolution monthly mean ozone profile climatologies constructed with ozonesonde data, one by averaging on pressure levels and the other relative to the thermal tropopause. Model ozone is high biased at the SH tropical and NH midlatitude tropopause by approx. 45% in a 4 deg. latitude x 5 deg. longitude model simulation. Increasing the resolution to 2 deg. x 2.5 deg. increases the NH tropopause high bias to approx. 60%, but decreases

the tropical tropopause bias to approx. 30%, an effect of a better-resolved residual circulation. The tropopause ozone biases appear not to be due to an overly vigorous residual circulation or excessive stratosphere/troposphere exchange, but are more likely due to insufficient vertical resolution or excessive vertical diffusion near the tropopause. In the upper troposphere and lower stratosphere, model/measurement intercomparisons are strongly affected by the averaging technique. NH and tropical mean model lower stratospheric biases are less than 20%. In the upper troposphere, the 2 deg. x 2.5 deg. simulation exhibits mean high biases of approx. 20% and approx. 35% during April in the tropics and NH midlatitudes, respectively, compared to the pressure averaged climatology. However, relative-to-tropopause averaging produces upper troposphere high biases of approx. 30% and 70% in the tropics and NH midlatitudes. This is because relative-to-tropopause averaging better preserves large cross-tropopause O<sub>3</sub> gradients, which are seen in the daily sonde data, but not in daily model profiles. The relative annual cycle of ozone near the tropopause is reproduced very well in the model Northern Hemisphere midlatitudes. In the tropics, the model amplitude of the near tropopause annual cycle is weak. This is likely due to the annual amplitude of mean vertical upwelling near the tropopause, which analysis suggests is approx. 30% weaker than in the real atmosphere.

Author

*Stratosphere; Tropopause; Mathematical Models; Troposphere; Data Acquisition; Climatology; Ozonesondes*

**20080025286** Naval Postgraduate School, Monterey, CA USA

**Severe Particulate Pollution in Lanzhou China**

Chu, Peter C; Chen, Yuchun; Lu, Shihua; Li, Zhenchao; Lu, Yaqiong; Jan 2008; 38 pp.; In English

Report No.(s): AD-A478881; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478881>

Concentrations of total suspended particles (TSP) and PM(sub 10) in Lanzhou China have been kept high for the past two decades. During intensive observational period from October 1999 to April 2001, the concentrations of TSP and PM(SUB 10) are even increasing and becoming major air pollutants; the temporally total mean PM(SUB 10) concentration is 2.56 mg m<sup>-3</sup>. The rate of PM(SUB 10) polluted-day occurrence is 71% in a year, 89% in the winter, and 79% in the spring. Starting from November, the PM(SUB 10) pollution intensifies, and reaches mid to high alert level of air pollution, continues until April next year, and is at low alert level in the summer. The temporally total mean TSP concentration is 5.92 mg m<sup>-3</sup>. In the winter and spring, the TSP concentration is 2-10 times higher than the third-level criterion of air quality (severe pollution). Intrinsic factors (sources of pollution) and exterior preconditions (propagation of dust storms) for severe PM(SUB 10) and TSP pollution are investigated.

DTIC

*Air Pollution; Air Quality; China; Dust Storms; Maintainability; Particulates*

**20080025292** Naval Postgraduate School, Monterey, CA USA

**On Long Baroclinic Rossby Waves in the Tropical North Atlantic Observed From Profiling Floats**

Chu, P C; Ivanov, L M; Melnichenko, O V; Wells, N C; May 16, 2007; 25 pp.; In English

Report No.(s): AD-A478897; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478897>

Argo float data (subsurface tracks and temperature profiles collected from March 2004 through May 2005) are used to detect signatures of long Rossby waves in the velocity of the currents at 1000-m depth and temperature, between the ocean surface and 950 m, in the zonal band of 4 N 24 N in the tropical North Atlantic. Different types of long Rossby waves (with the characteristic scales between 1000 and 2500 km) are identified in the western [west of the Mid-Atlantic Ridge (MAR)] and eastern [east of the MAR] subbasins. Along-shore wind fluctuations and an equatorially forced coastal Kelvin wave were found to be responsible for the excitation of annual- and semiannual-propagating Rossby waves in the eastern subbasin. These waves are transmitted along a waveguide formed by the African shelf and the MAR. The speed of their propagation varies in magnitude and direction because of bottom topography and irregularity of the coastline. Unstable standing Rossby waves with annual and semiannual periods are shown in both the subbasins. All unstable waves, decaying, radiate shorter free Rossby waves propagating both westward and northwestward, with speeds of up to 10 cm/s. The standing Rossby waves are probably excited by the wind-driven Ekman pumping alone or in combination with linear and nonlinear resonance mechanisms. The additional analysis of subsurface float tracks from May 2005 through May 2006 supports the obtained results.

DTIC

*Atlantic Ocean; Atmospheric Pressure; Baroclinic Waves; Floats; Ocean Surface; Planetary Waves; Tropical Regions*

**20080025305** Woods Hole Oceanographic Inst., MA USA

**Quantifying, Predicting, and Exploiting (QPE) Uncertainty in the Southern East China Sea: A Climatological and Observational Approach**

Gawarkiewicz, G; Mar 31, 2008; 3 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0482; Proj-13748200

Report No.(s): AD-A478935; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478935>

In this project we used data from the national hydrographic database in Taiwan to create climatological fields over the outer shelf and upper continental slope northeast of Taiwan. These fields have been used in helping to plan the field work for the DRI. In addition, Gawarkiewicz served as lead scientist for the DRI and organized and led three international workshops focused on planning the integrated international and multi-disciplinary field work in 2008 (pilot study) and 2009 (main experiment). Both field programs will be in late summer.

DTIC

*China; Climatology; Predictions; Seas*

**20080025319** Miami Univ., FL USA

**Documenting Hurricane Impacts on Coral Reefs Using Two-Dimensional Video-Mosaic Technology**

Gleason, Arthur C; Lirman, Diego; Williams, Dana; Gracias, Nuno R; Gintert, Brooke E; Madjidi, Hossein; Reid, R P; Boynton, G C; Negahdaripour, Shahriar; Miller, Margaret; Nov 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NA17RJ1226; NA030AR00088

Report No.(s): AD-A478962; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478962>

Four hurricanes impacted the reefs of Florida in 2005. In this study, we evaluate the combined impacts of hurricanes Dennis, Katrina, Rita, and Wilma on a population of *Acropora palmata* using a newly developed video-mosaic methodology that provides a high-resolution, spatially accurate landscape view of the reef benthos. Storm damage to *A. palmata* was surprisingly limited; only 2 out of 19 colonies were removed from the study plot at Molasses Reef. The net tissue losses for those colonies that remained were only 10% and mean diameter of colonies decreased slightly from 88.4 to 79.6 cm. In contrast, the damage to the reef framework was more severe, and a large section (6 m in diameter) was dislodged, overturned, and transported to the bottom of the reef spur. The data presented here show that two-dimensional video-mosaic technology is well-suited to assess the impacts of physical disturbance on coral reefs and can be used to complement existing survey methodologies.

DTIC

*Coral Reefs; Damage; Hurricanes; Mosaics*

**20080025360** Naval Postgraduate School, Monterey, CA USA

**Satellite Data Assimilation for Improvement of Naval Undersea Capability**

Chu, Peter C; Perry, Michael D; Gottshall, Eric L; Cwalina, David S; Jan 2004; 13 pp.; In English

Report No.(s): AD-A479149; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479149>

Impact of satellite data assimilation on naval undersea capability is investigated using ocean hydrographic products without and with satellite data assimilation. The former is the Navy's Global Digital Environmental Model (GDEM), providing a monthly mean; the latter is the Modular Ocean Data Assimilation System (MODAS) providing synoptic analyses based upon satellite data. The two environmental datasets are taken as the input into the Weapon Acoustic Preset Program to determine the suggested presets for an Mk 48 torpedo. The acoustic coverage area generated by the program will be used as the metric to compare the two sets of outputs. The output presets were created for two different scenarios, an anti-surface warfare (ASUW) and an anti-submarine warfare (ASW); and three different depth bands, shallow, mid, and deep. After analyzing the output, it became clear that there was a great difference in the presets for the shallow depth band, and that as depth increased, the difference between the presets decreased. Therefore, the MODAS product, and in turn the satellite data assimilation, had greatest impact in the shallow depth band. The ASW presets also seemed to be slightly less sensitive to differences than did presets in the ASUW scenario.

DTIC

*Assimilation; Meteorological Parameters*

**20080025367** Naval Postgraduate School, Monterey, CA USA

**Evaluation of the U.S. Navy's Modular Ocean Data Assimilation System (MODAS) Using South China Sea Monsoon Experiment (SCSMEX) Data**

Chu, Peter C; Guihua, Wang; Fan, Chenwu; Jan 2004; 46 pp.; In English

Report No.(s): AD-A479173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479173>

The Navy's Modular Ocean Data Assimilation System (MODAS) is an oceanographic tool used to create high-resolution temperature and salinity data on three-dimensional grids by assimilating a wide range of ocean observations into a starting field. The MODAS products are used to generate the sound speed for ocean acoustic modeling applications. Hydrographic data acquired from the South China Sea Monsoon Experiment (SCSMEX) from April through June 1998 are used to verify the MODAS model. MODAS has the capability to provide reasonably good temperature and salinity nowcast fields. The errors have a Gaussian-type distribution with mean temperature nearly zero and mean salinity of -0.2 ppt. The standard deviations of temperature and salinity errors are 0.98 deg. C and 0.22 ppt, respectively. The skill score of the temperature nowcast is positive, except at depth between 1750 and 2250 m. The skill score of the salinity nowcast is less than that of the temperature nowcast, especially at depth between 300 and 400, where the skill score is negative. Thermocline and halocline identified from the MODAS temperature and salinity fields are weaker than those based on SCSMEX data. The maximum discrepancy between the two is in the thermocline and halocline. The thermocline depth estimated from the MODAS temperature field is 10-40 m shallower than that from the SCSMEX data. The vertical temperature gradient across the thermocline computed from the MODAS field is around 0.14 deg. C/m, weaker than that calculated from the SCSMEX data (0.19 deg. -0.27 deg. C/m). The thermocline thickness computed from the MODAS field has less temporal variation than that calculated from the SCSMEX data (40-100 m). The halocline depth estimated from the MODAS salinity field is always deeper than that from the SCSMEX data. Its thickness computed from the MODAS field varies slowly around 30 m, which is generally thinner than that calculated from the SCSMEX data (28-46 m).

DTIC

*Assimilation; China; Climatology; Data Processing; Monsoons; Nowcasting; Ocean Data Acquisitions Systems; Oceanographic Parameters; Salinity; Seas*

**20080025378** Naval Postgraduate School, Monterey, CA USA

**Interannual SST Variability in the Japan/East Sea and Relationship with Environmental Variables**

Park, Sunghyea; Chu, Peter C; Jan 2006; 19 pp.; In English

Report No.(s): AD-A479215; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479215>

Interannual variability of the Japan/East Sea (JES) sea surface temperature (SST) is investigated from the reconstructed NOAA/AVHRR Oceans Pathfinder best SST data (1985 - 2002) using the complex empirical function (CEOF) analysis. The iterative empirical function analysis is used for the SST data reconstruction. The first two leading CEOFs account for 86% of total variance with 66.4% for the first mode and 19.6% for the second mode. The first CEOF mode represents a standing oscillation and a maximum belt in the central JES. There are two near-7-year events and one 2-3-year event during the period of 1985-2002. The first mode oscillates by adjacent atmospheric systems such as the Aleutian Low, the North Pacific High, the Siberian High, and the East Asian jet stream. Positive correlation in a zonal belt between the first mode JES SST anomaly and the background surface air temperature/SST anomaly reveals intensive ocean-atmosphere interaction near the Polar Front in the North Pacific. The second CEOF mode represents two features: standing oscillation and propagating signal. The standing oscillation occurs in the northern (north of 44 deg N) and southern (south of 39 N and west 136 deg E) JES with around 180 deg phase difference. A weak southwestward propagating signal is detected between the two regions. The eastward propagating signal is detected from the East Korean Bay to near 135 deg E. The second mode contains 4-5-year periodicity before 1998 and 2-3-year periodicity thereafter. It is associated with the Arctic Oscillation, which leads it by 1-5-year. Furthermore, a strong correlation with the background surface air temperature/SST anomaly is detected in the tropical to subtropical western Pacific.

DTIC

*Air Water Interactions; Japan; Seas; Variability*

**20080025471** Naval Research Lab., Bay Saint Louis, MS USA

**Nesting the Gulf of Mexico in Atlantic HYCOM: Oceanographic Processes Generated by Hurricane Ivan**

Zamudio, Luis; Hogan, Patrick J; Jan 2008; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479248; NRL/JA/7320-07-7185; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The HYbrid Coordinate Ocean Model (HYCOM) has been configured for the Gulf of Mexico (GOM) at 1/250 horizontal



grid resolution and has been nested inside a basin-scale 1/120 Atlantic version of HYCOM. The 1/250 nested GOM model is used to study temperature variations, current patterns, transport variations, and two coastal-trapped waves (CTWs) generated by Hurricane Ivan during mid September 2004. The model results indicate that the winds generated by Ivan: (1) induced a transport variation of approximately 2 Sv/ day along the Yucatan Channel, (2) enhanced the oceanic mixing lowering the sea surface temperature more than 3 C along Ivan's path, (3) produced a thermocline vertical velocity of >100m/day, and (4) generated a westward transport of 8 Sv along the northern coast of the GOM that was redirected by the Louisiana coastline inducing a southward transport of 6 Sv. Throughout its passage over the Caribbean Sea Ivan generated first a CTW along the south east coast of Cuba. After its generation this wave propagated along the coast and partially propagated along the western tip of the Cuban Island and continued its propagation along the northern coast of the Island. The model existence of CTWs along the coast of Cuba is reported for the first time. Later on, over the Florida-Alabama- Mississippi-Louisiana coast, Ivan's westward winds drove a model oceanic onshore transport and generated a strong coastal convergence. The convergence raised the sea surface height 90 cm generating a second CTW, which is characterized by alongshore and cross-shore scales of 700 and 80 km, respectively. The CTW current pattern includes westward surface currents of more than 2.0 m/s. After its generation, the wave weakened rapidly due to Ivan's eastward winds, however a fraction of the CTW propagated to the west and was measured by a tide gauge at Galveston, Texas. The descriptions, hypothesis, and discussions presented in this study are based on model results and those

DTIC

*Gulf of Mexico; Hurricanes; Ocean Models; Ocean Surface; Oceanography*

**20080025535** World Health Organization, London, UK

**Summary for Policymakers IPCC Fourth Assessment Report, WorkingGroup III. Climate Change 2007: Mitigation of Climate Change**

Barker, T.; Bashmakov, I.; Bernstein, L.; Bogner, J.; Bosch, P.; Apr. 30, 2007; 36 pp.; In English

Contract(s)/Grant(s): DE-AC02-05CH11231

Report No.(s): DE2007-910225; LBNL--62688; No Copyright; Avail.: National Technical Information Service (NTIS)

The Working Group III contribution to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) focuses on new literature on the scientific, technological, environmental, economic and social aspects of mitigation of climate change, published since the IPCC Third Assessment Report (TAR) and the Special Reports on COB2B Capture and Storage (SRCCS) and on Safeguarding the Ozone Layer and the Global Climate System (SROC). The following summary is organized into six sections: Greenhouse gas (GHG) emission trends; Mitigation in the short and medium term, across different economic sectors (until 2030), Mitigation in the long-term (beyond 2030); Policies, measures and instruments to mitigate climate change; Sustainable development and climate change mitigation; Gaps in knowledge. References to the corresponding chapter sections are indicated at each paragraph in square brackets. An explanation of terms, acronyms and chemical symbols used can be found in the glossary to the main report.

NTIS

*Climate Change; Exhaust Emission; Exhaust Gases; Greenhouse Effect*

**20080025553** Naval Postgraduate School, Monterey, CA USA

**The Role of the Halted Baroclinic Mode at the Central Equatorial Pacific in El Nino Event**

Sun, Jilin; Chu, Peter; Liu, Qinyu; Jan 2005; 10 pp.; In English

Report No.(s): AD-A479547; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The role of halted 'baroclinic modes' in the central equatorial Pacific is analyzed. It is found that dominant anomaly signals corresponding the 'baroclinic modes' occur in the upper layer of the equatorial Pacific, in a two-and-a-half layer oceanic model, in assimilated results of a simple OGCM and in the ADCP observation of TAO. A second 'baroclinic mode' is halted in the central equatorial Pacific corresponding to a positive SST anomaly while the first 'baroclinic mode' propagates eastwards in the eastern equatorial Pacific is explained by a staged ocean-atmosphere interaction mechanism in the formation of El Nino: the westerly bursts in boreal winter over the western equatorial Pacific generate the halted second 'baroclinic mode' in the central equatorial Pacific, leading to the increase of heat content and temperature in the upper layer of the central Pacific which induces the shift of convection from over the western equatorial Pacific to the central equatorial Pacific; another wider, westerly anomaly burst is induced over the western region of convection above the central equatorial Pacific and the westerly anomaly burst generates the first 'baroclinic mode' propagating to the eastern equatorial Pacific, resulting in a warm event in the eastern equatorial Pacific. The mechanism presented in this paper reveals that the central equatorial Pacific is a

key region in detecting the possibility of ENSO and, by analyzing TAO observation data of ocean currents and temperature in the central equatorial Pacific, in predicting the coming of an El Nino several months ahead.

DTIC

*Baroclinity; El Nino; Ocean Currents*

**20080025927** Global Change Research Program, Washington, DC, USA

**Preview of Our Changing Plant. The U.S. Climate Change Science Program for Fiscal Year 2008. A Supplement to the President's Budget for Fiscal Year 2008**

January 2007; 32 pp.; In English

Report No.(s): PB2007-113077; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This FY 2008 Preview highlights recent advances supported by CCSP-participating agencies in each of the programs research and observational elements, as called for in the Strategic Plan for the U.S. Climate Change Science Program. The Preview includes an analysis of the significant recent progress that CCSP has made toward its overarching goals. The document describes the coordination of research and overall program management, and the eight key interagency implementation priorities for FY 2008. The document also outlines how CCSP plans to continue implementation of the Strategic Plan during FY 2008, emphasizing work on 21 scientific synthesis and assessment reports integrating research results focused on key issues and related questions of interest to decisionmakers.

NTIS

*Climate Change; Decision Making; Coordination*

**20080025957** Geological Survey, Reston, VA USA; Bureau of Reclamation, Washington, DC, USA

**Relation Between Selected Water-Quality Variables, Climatic Factors, and Lake Levels in Upper Klamath and Agency Lakes, Oregon, 1990-2006**

Morace, J. L.; January 2007; 64 pp.; In English

Report No.(s): PB2007-114048; USGS-SIR-2007-5117; No Copyright; Avail.: National Technical Information Service (NTIS)

Growth and decomposition of dense blooms of *Aphanizomenon flos-aquae* in Upper Klamath Lake frequently cause extreme water-quality conditions that have led to critical fishery concerns for the region, including the listing of two species of endemic suckers as endangered. The Bureau of Reclamation has asked the U.S. Geological Survey (USGS) to examine water-quality data collected by the Klamath Tribes for relations with lake level. This analysis evaluates a 17-year dataset (1990-2006) and updates a previous USGS analysis of a 5-year dataset (1990-94). Both univariate hypothesis testing and multivariable analyses evaluated using an information-theoretic approach revealed the same results--no one overarching factor emerged from the data. No single factor could be relegated from consideration either. The lack of statistically significant, strong correlations between water-quality conditions, lake level, and climatic factors does not necessarily show that these factors do not influence water-quality conditions; it is more likely that these conditions work in conjunction with each other to affect water quality. A few different conclusions could be drawn from the larger dataset than from the smaller dataset examined in 1996, but for the most part, the outcome was the same.

NTIS

*Climate; Climatology; Lakes; Q Factors; Water Quality*

**20080025962** Geological Survey, Reston, VA USA

**Rainfall and Seasonal Movement of the Weeks Creek Landslide, San Mateo County, California**

Wieczorek, G. F.; Reid, M. E.; Jodicke, W.; Pearson, C.; Wilcox, G.; January 2007; 73 pp.; In English

Report No.(s): PB2007-114052; USGS-DS-276; No Copyright; Avail.: National Technical Information Service (NTIS)

Many different types of landslide occur in the Santa Cruz Mountains of San Mateo County, Calif. (Brabb and Pampeyan, 1972); most slope movement is triggered by strong earthquakes, heavy rainfall, or shoreline erosion. In this area, shallow landslides of loose soil and rock, which may transform into debris flows, commonly occur during individual storms when rainfall exceeds a threshold of intensity and duration (Cannon and Ellen, 1985; Wieczorek and Sarmiento, 1988; Wilson and Wieczorek, 1995). In contrast, deeper rotational and translational slides (Varnes, 1978) typically begin to move only after days to weeks or months of heavy rain. Once started, they can continue to move for months during and after a heavy rainfall season, for example, the Scenic Drive landslide at La Honda, Calif. (Jayko and others, 1998; Wells and others, 2005, 2006). Although

the rainfall characteristics triggering rapid, shallow landslides have been documented (Wieczorek, 1987; Cannon and Ellen, 1988), the rainfall conditions leading to repeated deeper-seated slope movements are less well known.

NTIS

*Annual Variations; California; Landslides; Rain*

**20080026095** NASA Goddard Space Flight Center, Greenbelt, MD, USA

#### **Absorption in Extended Inhomogeneous Clouds**

Joiner, Joanna; Vasilkov, Alexander; Spurr, Robert; Bhartia, P. K.; Krotkov, Nick; January 2008; 1 pp.; In English; International Radiation Symposium, 3-8 Aug. 2008, Foz do Iguacu, Brazil; Original contains black and white illustrations; No Copyright; Avail.: Other Sources; Abstract Only

The launch of several different sensors, including CloudSat, into the A-train constellation of satellites allows us for the first time to compute absorption that can occur in realistic vertically inhomogeneous clouds including multiple cloud decks. CloudSat data show that these situations are common. Therefore, understanding vertically inhomogeneous clouds is important from both climate and satellite atmospheric composition remote sensing perspectives. Satellite passive sensors that operate from the near IR to the UV often rely on radiative cloud pressures derived from absorption in oxygen bands (A, B, gamma, or O<sub>2</sub>-O<sub>2</sub> bands) or from rotational-Raman scattering in order to retrieve information about atmospheric trace gases. The radiative cloud pressure is distinct from the physical cloud top derived from thermal infrared measurements. Therefore, the combination of information from different passive sensors yields some information about the cloud vertical profile. When either or both the clouds or atmospheric absorbers (trace gases and aerosols) are vertically inhomogeneous, the use of an effective cloud pressure derived from these approaches may lead to errors. Here, we focus on several scenarios (deep convective clouds and distinct two layer clouds) based on realistic cloud optical depth vertical profiles derived from the CloudSat/MODIS combination. We focus on implications for trace-gas column amount retrievals (specifically ozone and NO<sub>2</sub>) and derived surface UV irradiance from the Ozone Monitoring Instrument (OMI) on the Atrain Aura platform.

Author

*Absorption Spectra; CloudSat; Inhomogeneity; Remote Sensing; MODIS (Radiometry)*

## 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*.

**20080025042** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

#### **Ultra Stable Microwave Radiometers for Future Sea Surface Salinity Missions**

Wilson, William J.; Tanner, Alan B.; Pellerano, Fernando A.; Horgan, Kevin A.; April 2005; 185 pp.; In English; Original contains color and black and white illustrations

Report No.(s): JPL Report D-31794; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40833>

The NASA Earth Science System Pathfinder (ESSP) mission Aquarius will measure global sea surface salinity with 100-km spatial resolution every 8 days with an average monthly salinity accuracy of 0.2 psu (parts per thousand). This requires an L-band low-noise radiometer with the long-term calibration stability of less than 0.1 K over 8 days. This three-year research program on ultra stable radiometers has addressed the radiometer requirements and configuration necessary to achieve this objective for Aquarius and future ocean salinity missions. The system configuration and component performance have been evaluated with radiometer testbeds at both JPL and GSFC. The research has addressed several areas including component characterization as a function of temperature, a procedure for the measurement and correction for radiometer system non-linearity, noise diode calibration versus temperature, low noise amplifier performance over voltage, and temperature control requirements to achieve the required stability. A breadboard radiometer, utilizing microstrip-based technologies, has been built to demonstrate this long-term stability. This report also presents the results of the radiometer test program, a detailed radiometer noise model, and details of the operational switching sequence optimization that can be used to achieve the low noise and stability requirements. Many of the results of this research have been incorporated into the Aquarius radiometer design and will allow this instrument to achieve its goals.

Author

*Microwave Radiometers; Ocean Surface; Salinity; Microelectromechanical Systems*

**20080025048** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Antarctic Circumpolar Current Transport Variability during 2003-05 from GRACE**

Zlotnicki, Victor; Wahr, John; Fukumori, Ichiro; Song, Yuhe T.; Journal Of Physical Oceanography; June 6, 2006; Volume 37, No. 2, pp. 230-244; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources  
ONLINE: <http://dx.doi.org/10.1175/JPO3009.1>; <http://hdl.handle.net/2014/40844>

Gravity Recovery and Climate Experiment (GRACE) gravity data spanning January 2003 - November 2005 are used as proxies for ocean bottom pressure (BP) averaged over 1 month, spherical Gaussian caps 500 km in radius, and along paths bracketing the Antarctic Circumpolar Current's various fronts. The GRACE BP signals are compared with those derived from the Estimating the Circulation and Climate of the Ocean (ECCO) ocean modeling-assimilation system, and to a non-Boussinesq version of the Regional Ocean Model System (ROMS). The discrepancy found between GRACE and the models is 1.7 cm(sub H2O) (1 cm(sub H2O) similar to 1 hPa), slightly lower than the 1.9 cm(sub H2O) estimated by the authors independently from propagation of GRACE errors. The northern signals are weak and uncorrelated among basins. The southern signals are strong, with a common seasonality. The seasonal cycle GRACE data observed in the Pacific and Indian Ocean sectors of the ACC are consistent, with annual and semiannual amplitudes of 3.6 and 0.6 cm(sub H2O) (1.1 and 0.6 cm(sub H2O) with ECCO), the average over the full southern path peaks (stronger ACC) in the southern winter, on days of year 197 and 97 for the annual and semiannual components, respectively; the Atlantic Ocean annual peak is 20 days earlier. An approximate conversion factor of 3.1 Sv (Sv equivalent to  $10(\text{exp } 6) \text{ m}(\text{exp } 3) \text{ s}(\text{exp } -1)$ ) of barotropic transport variability per cm(sub H2O) of BP change is estimated. Wind stress data time series from the Quick Scatterometer (QuikSCAT), averaged monthly, zonally, and over the latitude band 40 de - 65 deg S, are also constructed and subsampled at the same months as with the GRACE data. The annual and semiannual harmonics of the wind stress peak on days 198 and 82, respectively. A decreasing trend over the 3 yr is observed in the three data types.

Author

*Gravitational Fields; Ocean Currents; Ocean Bottom; Water Pressure; Barotropic Flow; 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*.

**20080023794** Massachusetts General Hospital, Boston, MA USA

**Caffeine, Adenosine Receptors and Estrogen in Toxin Models of Parkinson's Disease**

Schwarzschild, Michael A; Oct 2007; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0881

Report No.(s): AD-A478278; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478278>

Continued progress has been made toward each of the 3 Specific Aims (SAs) of our research project, Caffeine, adenosine receptors and estrogen in toxin models of Parkinson's disease (PD). The overarching hypothesis of the project is that multiple environmental protectants and toxins interact to influence of the health of the dopaminergic neurons lost in PD. To that end we are characterizing the interplay between several environmental agents (pesticides, caffeine and estrogen) that are leading candidate modulators of PD risk. Main accomplishments during the Year 3 of the project: 1) Demonstration that neuronal forebrain A2A receptors can play a critical role in dopaminergic neuron injury in the MPTP model of neurodegeneration in Parkinson's disease. 2) Using a powerful newly Cre/LoxP conditional knockout system, we have obtained evidence that it is the neuronal forebrain A2A receptors in the striatum that are responsible for this toxicity. Thus it is through these receptors that caffeine and more specific antagonists of the adenosine A2A receptor may offer neuroprotection against the development or progression of PD. 3) Demonstration for the first time that caffeine's neuroprotective effect extends to the dual pesticide paraquat plus maneb model of PD, a chronic, potentially more environmentally relevant model of the disease. 4) Demonstration for the first time that urate -- a caffeine analog and antioxidant linked to slower PD progression and risk -- can be neuroprotective in an in vivo model of PD. This finding may have a particularly rapid translational impact as urate-elevating therapy is now being pursued as potential neuroprotectant for PD patients. 5) Methodological advances were achieved with a viral vector-based Cre/LoxP conditional knockout system. It will allow us to dissect caffeine and A2A receptor involvement

in neurotoxin models of PD with an unprecedented combination of anatomical and molecular precision in different brain structures.

DTIC

*Adenosines; Caffeine; Diseases; Estrogens; Toxicity; Toxins and Antitoxins*

**20080023795** Colorado Univ., Aurora, CO USA

**Signaling Pathways that Mediate Neurotoxin-Induced Death of Dopamine Neurons**

Heidenreich, Kem A; Nov 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0001

Report No.(s): AD-A478281; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478281>

Parkinson's disease (PD) is characterized by progressive loss of dopaminergic neurons in the nigrostriatal pathway resulting in significant motor dysfunction. The pathology of PD is mimicked by exposure to 1-methyl-4-phenyl-1,2,3,4-tetrahydropyridine (MPTP) or the pesticide rotenone. These neurotoxins inhibit complex I of the mitochondrial respiratory chain resulting in the production of reactive oxygen species (ROS) and increased cytosolic calcium. We hypothesize that ROS promotes opening of the mitochondrial permeability transition pore which triggers the death pathway. In parallel, increases in cytosolic calcium leads to oxidative stress and activation of c-Jun-NH<sub>2</sub>-terminal kinase (JNK). JNK/c-Jun signaling augments activation of the mitochondrial apoptotic cascade by suppressing Bcl-2 pro-survival signals via phosphorylation of Bcl-2 or transcription of the BH3-only, Bcl-2 antagonist Bim. The interactions between the oxidative stress pathway, the JNK/c-Jun signaling cascade, and the mitochondrial apoptotic machinery ultimately determine the fate of dopamine neurons. We will utilize primary ventral mesencephalic cultures obtained from E15 embryonic rats to investigate our hypothesis. The data obtained should lead to the identification of promising therapeutic strategies to slow or halt the dopaminergic neurodegeneration that occurs during progression of PD.

DTIC

*Death; Dopamine; Mitochondria; Neurons*

**20080023796** California Univ., San Francisco, CA USA

**Reduction of Racial Disparities in Prostate Cancer**

Daniels, Nicholas; Dec 2007; 16 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0113

Report No.(s): AD-A478285; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478285>

Prostate inflammation or infection may increase the risk of prostate cancer. As antibiotics and non-steroidal anti-inflammatory drugs (NSAIDs) are used to treat prostatitis and urinary tract infections (UTIs) our objective was to assess whether their use decreases the risk of prostate cancer. We conducted a case-control study among men with incident prostate cancer (N=65 cases) and without prostate cancer (N=195 controls) at the San Francisco Veteran Affairs medical center (VAMC) between June 1996 and June 2006. Neither total antibiotic use nor total anti-inflammatory use reduces the risk of prostate cancer (P>0.05). Our analysis did not reveal a relation between use of antibiotics or NSAIDs and the risk of prostate cancer but the width of the confidence intervals does not rule out a strong protective effect. A larger sample size is needed to determine whether antibiotics or NSAIDs use decreases the risk of prostate cancer.

DTIC

*Antibiotics; Cancer; Drugs; Infectious Diseases; Prostate Gland; Sites; Steroids; Urology*

**20080023797** Roswell Park Memorial Inst., Buffalo, NY USA

**Prostate Derived Ets Factor, An Immunogenic Breast Cancer Antigen**

Sood, Ashwani; Sep 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-W81XWH-05-1-0524

Report No.(s): AD-A478286; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478286>

The goal of the proposed research was to test the following concept: Due to the prostate restricted expression of Pse in normal tissues of mice Pse is likely to be immunogenic in female mice. T cell responses of male and female mice to Pse and a control antigen Her2neu were compared. Two different assays were used for this purpose; the ELISpot assay and the Cytotoxicity assay. We found that in the FVB and C57BL16 strains of mice immunization with Pse induced specific T cell

responses in the female mice but showed no or weak responses in the male mice. In contrast the difference in T cell responses of male and female mice to immunization with Her2/neu antigen was relatively small. These results are novel and highly significant and they support our concept that uncharacteristically high difference in responsiveness to Pse of female mice in comparison to male mice is due to the lack of significant expression of Pse as a self-antigen in female mice. Further these results suggest that PDEF (the human homologue of Pse) is likely to be significantly immunogenic in female breast cancer patients. The observed poor immunogenicity of Pse in the male mice is probably due to some mechanism of tolerance against this protein due to its strong expression in the prostate gland.

DTIC

*Antigens; Breast; Cancer; Lymphocytes; Mammary Glands; Prostate Gland*

**20080023798** Washington Univ., Seattle, WA USA

**Stromal Mesenchyme Cell Genes in Prostate Cancer Development: Epigenetic Markers for Cancer and Potential Targets for Therapy**

Goo, Young A; Dec 2007; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0108

Report No.(s): AD-A478287; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478287>

Functional development of the prostate is governed by stromal induction and epithelial response. Given the importance of this communication it is possible that cancer could arise from a loss of this communication. We carried out comparative proteomic and transcriptome analyses to identify organ-specific stromal signaling factors from prostate and bladder stromal cells. Secreted proteins were identified by glycopeptide-capture followed by mass spectrometry. Protein quantification was done by PICA (Peptide Ion Current Area) method. A list of 116 prostate and 84 bladder glycoproteins was identified. The prostate proteins include cathepsin L, neuroendocrine convertase and tumor necrosis factor receptor involved in signal transduction extracellular matrix interaction and differentiation. For the transcriptome analysis cells were isolated by CD49a for prostate and CDI 3 for bladder. In a comparative analysis 91 bladder and 288 prostate genes were identified. Further subtractive analysis resulted in a list of 50 prostate stromal cell-specific genes. Interesting genes were CNTN1, SPOCK3 and MAOB which are known to be involved in cell interactions and organogenesis. Expression analysis showed that these genes are down-regulated in cancer suggesting their function is required in normal development.

DTIC

*Cancer; Diseases; Genes; Genetics; Markers; Prostate Gland; Targets; Therapy*

**20080023823** Pittsburgh Univ., Pittsburgh, PA USA

**Epigenetic Regulation of Chemokine Expression in Prostate Cancer**

Shurin, Michael R; Dec 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0151

Report No.(s): AD-A478394; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478394>

Chemokines play an important role in initiating immune responses by regulating attraction and homing of immune cells to the lymphoid tissues. Breast and kidney-expressed chemokine (BRAK; CXCL14) is known to be selective for monocytes and dendritic cells (DC). CXCL14 is expressed ubiquitously in normal tissues, but, as has been recently shown, absent in a variety of cancer tissues and tumor cell lines. However, the mechanisms responsible for CXCL14 loss in malignant tissues and cells are unknown. The main goal of this proposal is to determine the mechanisms of the regulation of CXCL14 expression by prostate cancer and test whether recovery of CXCL14 expression on tumor cells will be accomplished by attraction of DC and boosting of antitumor immune responses. During the first year of support, we evaluated chemoattractive properties of CXCL14 towards DC and demonstrated that human prostate cancer tissues and prostate cancer cell lines LNCaP, PC3, and DU145 do not express CXCL14 protein and mRNA and do not chemoattract DC in vitro and in vivo. The focus of Task 2 was to determine whether the restoration of CXCL14 expression on tumor cells might be associated with DC attraction in vitro and in vivo. Our data are briefly summarized below.

DTIC

*Cancer; Prostate Gland*

**20080023824** Hawaii Univ., Honolulu, HI USA

**Neurotoxins and Neurodegenerative Disorders in Japanese-American Men Living in Hawaii**

Webster, Ross, G; Apr 2007; 72 pp.; In English

Contract(s)/Grant(s): DAMD17-98-1-8621

Report No.(s): AD-A478395; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478395>

Results from the Honolulu-Asia Aging Study (HAAS) supported by this project showed Parkinson's disease (PD) risk increased with milk consumption, olfactory dysfunction, excessive daytime sleepiness, and low LDL cholesterol. Olfactory dysfunction and constipation were found to be associated with incidental Lewy bodies. A polymorphism of the MDR1 transporter gene was associated with PD. The supplement aim was to measure organochlorine levels in all brains from the HAAS archive and to examine the association of brain organochlorine levels with clinical and pathological endpoints obtained through prior and ongoing research. Frozen occipital blocks from 421 brains were sent to Dr. E.D. Pellizzari of Research Triangle Institute for organochlorine level assays. These are complete. Preliminary analyses demonstrate that measurable A-chlordane, T-nonachlor, or Methoxychlor levels were found significantly more frequently in brains with Lewy bodies (including PD cases) than in those without Lewy bodies ( $p < 0.04$ ). A meeting is planned for February 2008 to finalize plans for presentation and publication of these data.

DTIC

*Diseases; Human Beings; Japan; Males; Nervous System*

**20080023828** California Univ., San Francisco, CA USA

**Preclinical Mouse Models of Neurofibromatosis**

Shannon, Kevin; Oct 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0265

Report No.(s): AD-A478416; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478416>

This report describes the seventh year of research, and the second under this award, by a Consortium of investigators who have been continuously funded by this Program to develop, characterize, and utilize strains of mice that accurately model tumors found in persons with NF1 and NF2. This Consortium has generated many novel models of NF1 and NF2-associated tumors and has exploited these strains to investigate biologic and preclinical questions. These strains are a cornerstone of a recent initiative by the Children's Tumor Foundation to organize and support a preclinical network for testing therapeutics that might benefit persons with NF1 and NF2 disease. The investigators collaborate closely and share expertise and reagents extensively. This NF Consortium is a member of the Mouse Models of Human Cancer Consortium of the National Cancer Institute and is participating fully in the activities of the group.

DTIC

*Cancer; Children; Mice; Organizations*

**20080023829** Texas Univ., Houston, TX USA

**DNA Methylation as an Epigenetic Factor in the Development and Progression of Polycythemia Vera**

Issa, Jean-Pierre; Nov 2007; 54 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0535

Report No.(s): AD-A478417; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478417>

Polycythemia vera (PV) is the most common myeloproliferative disorder with a yearly incidence of 28 per 1 million people and a slightly higher prevalence in males PV is characterized by clonal expansion of erythroid, myelomonocytic, and megakaryocytic lineages, erythrocytosis being the most prominent clinical manifestation of PV The disease is associated with a significant morbidity and mortality, including thrombotic and/or hemorrhagic events, and a risk of an evolution into myelofibrosis and leukemia An acquired activating V617F (1849G>T) mutation of JAK2 tyrosine kinase has been recently found in the majority of patients with polycythemia vera (PV), in about half of those with essential thrombocythemia (ET) and myelofibrosis (MF), and in 10-20% patients with chronic myelomonocytic leukemia, Philadelphia-negative CML, atypical or unclassified myeloproliferative diseases (MPD) and megakaryocytic leukemia It is not known what other factors determine the disease phenotype of PV, MF, and other MPD, and what factors other than JAK2 lead to disease progression Very little is known about epigenetic changes in PV Epigenetic lesions have been recognized to be important in cancer, in particular in older individuals Methylation of cytosines in the CpG sites clustered in the gene promoter regions results in epigenetic gene silencing, and acts as one of possible mechanisms of tumor suppressor inactivation in cancer Diverse myeloproliferative

phenotypes caused by a single point mutation of JAK2 tyrosine kinase, lack of other genetic specific lesions in PV, and its association with higher age lead us to propose the hypothesis that epigenetic silencing may play a role in the pathogenesis of PV.

DTIC

*Deoxyribonucleic Acid; Methylation; Pathogenesis; Polycythemia*

**20080023832** Howard Univ., Washington, DC USA

**Mechanisms Down-Regulating Sprouty1, a Growth Inhibitor in Prostate Cancer**

Kwabi-Addo, Bernard; Oct 2007; 63 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0878

Report No.(s): AD-A478427; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478427>

The Sprouty gene family negatively regulates growth factor-induced receptor tyrosine kinase signaling with a potential tumor suppressor function in cancer. I have demonstrated that Sprouty1 is down-regulated in human prostate cancer. The purpose of the present study is to elucidate the relative contribution of transcription regulation and epigenetic DNA methylation changes in regulating Sprouty1 expression in human prostate cancer. Using transient transfection analysis in prostate cancer cell lines; I have shown that gene knockdown of two transcription factor families: EGR (1 and 2), and GATA (2 and 4) induced Sprouty1 protein expression as determined by western blot analysis suggesting that these transcription factors may negatively regulate Sprouty1 expression. In addition, methylation modification of the Sprouty1 promoter by treatment with SssI methylase abolished promoter activity in transiently transfected prostate cancer cells, whereas global demethylation induced Sprouty1 expression. Observations reported here demonstrate transcriptional repression and/or epigenetic inactivation of Sprouty1 expression in prostate cancer cells. I have observed strong transcriptional activity in the prostate cancer cell lines even though Sprouty1 expression is down-regulated, suggesting that epigenetic modification of the binding sites for transcription factors such as Sp1 may result in a refractory transcriptional response even in the presence of necessary trans-acting activities.

DTIC

*Cancer; Genetic Engineering; Inhibitors; Prostate Gland*

**20080023833** TRUE Research Foundation, San Antonio, TX USA

**Hepatitis C. Virus Infection: Mechanisms of Disease Progression**

Sjogren, Maria H; Huntley, Brooke; Oct 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0719

Report No.(s): AD-A478436; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478436>

An estimated 4.1 million individuals in the USA are chronically infected with the hepatitis C virus. Annually 8,000 to 10,000 of these subjects will die of liver-related complications and approximately 1,000 will require liver transplantation. The USA military have rates of HCV infection similar to the general US population (1.6%). However, it is a younger population and its natural history of HCV infection has not been studied. Therefore, the clinical outcome of HCV-infected military subjects and risk factors contributing to disease progression are largely unknown. Such knowledge is essential for decisions regarding optimal management and prevention of the disease. This study focuses on active duty military subjects infected with HCV, who will be enrolled and observed prospectively over four years (48 months). Liver biopsies are to be performed at initiation if needed and at completion of study to observe for disease progression. Lab evaluation of virologic and biochemical indicators of the disease and detailed information about risk factors, and quality of life are collected by questionnaire every six months. Currently, 95 subjects have been enrolled, 29 have completed all observations, 12 are still under observation, 3 died (unrelated causes) and the rest stopped their participation in the trial early. We report conclusions on the data in terms of disease progression and potential contributing factors to disease progression specific to this population on the entire cohort, although data collection are incomplete.

DTIC

*Diseases; Hepatitis; Military Personnel; Viral Diseases*



**20080023839** Pittsburgh Univ., Pittsburgh, PA USA

**Modulation of TRAIL Cytotoxicity by Amiloride in Prostate Cancer**

Kim, Ki Mo; Kim, Young-Ho; Nov 2006; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0064

Report No.(s): AD-A478465; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478465>

The challenge today is to develop a cytotoxic agent that selectively induces cytotoxicity in prostate cancer cells but avoids significant toxicity to the normal tissues. In this study, we will develop a novel strategy by using TRAIL in combination with amiloride.

DTIC

*Cancer; Modulation; Pigments; Prostate Gland; Proteins; Therapy*

**20080023840** Texas Univ., Dallas, TX USA

**Critical Contribution of RAL GTPases to Growth and Survival of Breast Cancer Cells**

Cheng, Tzuling; Apr 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0389

Report No.(s): AD-A478473; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478473>

The monomeric Ral GTPases, RalA and RalB have been recognized as core components of the regulatory framework supporting tumorigenic transformation. Specifically, RalA is required to maintain anchorage independent proliferation while RalB is required to suppress apoptotic checkpoint activation. Here, we have defined the mechanistic contribution of RalB to cancer cell survival. We find that in normal human epithelia, a RalB/Sec5/TBK1 signal transduction cascade connects viral surveillance receptors to activation of host defense gene expression. We find that this pathway is aberrantly engaged by oncogene activation in tumors with the consequence of deflecting programmed cell death pathways that would normally engage in response to oncogene-induced stress. The obligate chronic activation of TBK1 kinase in breast cancer cells coupled with the absence of toxicity upon TBK1 inactivation in normal breast epithelia suggests this protein represents a facile therapeutic target.

DTIC

*Breast; Cancer; Mammary Glands; Survival*

**20080023841** California Univ., Davis, CA USA

**Identifying Molecular Targets for Chemoprevention in a Rat Model. Addendum**

deVere White, Ralph W; Dec 2007; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0081

Report No.(s): AD-A478475; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478475>

The purpose of this grant was to determine the molecular events that occur in the dorsal and ventral lobes of the rat prostate gland after 20 weeks of exposure to PhIP (2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine). Our Final Report was submitted July 2007 and summarized our data from the completion of Task 1 and Task 2 (published in Neoplasia). Task 3 was still pending at that time. This Final Addendum Report includes data from Task 3. A manuscript is being prepared and will be submitted to the DOD upon completion.

DTIC

*Cancer; Identifying; Prostate Gland; Rats; Targets*

**20080023842** Maryland Univ., Baltimore, MD USA

**Advanced Technologies in Safe and Efficient Operating Rooms**

Park, Adrian E; Feb 2008; 179 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-2-0001

Report No.(s): AD-A478481; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478481>

The three major research targets of this study are (a) OR informatics, (b) simulation research, and (c) smart image. The purpose of the OR informatics program is to develop, test, and deploy technologies to collect real-time data about key tasks and process elements in clinical operating rooms. The objective of simulation research is to create a system where a user can

interact with a virtual human model in cognitive simulation and have the virtual human respond appropriately to user queries and interventions in clinical situations, with a focus on cognitive decision making and judgment. The objective of smart image is to use real-time 3D ultrasonography and 40-slice high-framerate computed tomography (CT) for intra-operative imaging to volume rendered anatomy from the perspective of the endoscope. The overall project reported here has proceeded under the mantle of Operating Room of the Future research. We are replacing that theme with the more appropriate Innovations in the Surgical Environment. The period of performance of this contract was extended to February 28, 2009. Based on the extended period of performance, this project is on time, on schedule, and within performance parameters.

DTIC

*Medical Equipment; Medical Science; Rooms; Surgery; Technology Assessment*

**20080023843** Wake Forest Univ., Winston-Salem, NC USA

**Fatty Acid Synthase Inhibitors Engage the Cell Death Program Through the Endoplasmic Reticulum**

Kridel, Steven J; Dec 2007; 106 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0024

Report No.(s): AD-A478482; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478482>

Fatty acid synthase (FAS), the enzyme that synthesizes the 16-carbon fatty acid palmitate, is highly expressed in prostate cancer. Because of a corresponding lack of expression in normal prostate, FAS is an attractive drug target. We have described the endoplasmic reticulum (ER) stress response as a critical mediator of the anti-tumor effects of FAS inhibitors. In this report we also describe a novel connection between the FAS pathway and the proteasome pathway. This feedback between the two pathways can further be antagonized by co-treatment with the FDA-approved proteasome inhibitor Velcade. Velcade synergizes with FAS inhibitors to induce cell death and increase ER stress related signaling. These aspects will be followed up in vitro and in vivo. The importance of these studies is underscored by the potential relevance of FAS as a drug target in prostate cancer. Several FAS inhibitors have been developed, but none have been translated into the clinic thus far. These studies will be valuable as FAS inhibitors move toward a clinical setting.

DTIC

*Cancer; Death; Endoplasmic Reticulum; Enzyme Inhibitors; Fatty Acids; Inhibitors; Prostate Gland*

**20080023844** Georgetown Univ., Washington, DC USA

**Induction of the p75NTR by Aryl Propionic Acids in Prostate Cancer Cells**

Quann, Emily; Dec 2007; 30 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0063

Report No.(s): AD-A478484; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478484>

The p75 neurotrophin receptor (p75NTR) is a tumor suppressor in the prostate whose expression decreases as prostate cancer progresses. The purpose of this project is to investigate the role of p75NTR in the observed anticancer activity of aryl propionic acids in the prostate. I have found that treatment of prostate cancer cells with the aryl propionic acids R-flurbiprofen and ibuprofen induces reexpression of p75NTR, decreases cell survival, and increases apoptosis. In addition, p75NTR was the only apoptosis inducing death receptor that was significantly upregulated by treatment. Transfection of two different dominant negative forms of p75NTR or p75NTR siRNA before treatment partially rescued the cells from decreased cell survival. Therefore, induction of p75NTR by R-flurbiprofen and ibuprofen is at least partially causal of the observed decreased survival. Investigation into the mechanism of p75NTR induction by R-flurbiprofen and ibuprofen revealed a strong correlation between increased p75NTR protein level and increased p75NTR mRNA level. In addition, the increase in mRNA appears to be the result of increased mRNA stability. Finally, induction of p75NTR seems to be dependent on the p38 MAPK pathway, which is involved in regulating mRNA stability of a subset of transcripts.

DTIC

*Cancer; Drugs; Hydrocarbons; Propionic Acid; Prostate Gland; Proteins*

**20080023859** California Univ., Berkeley, CA USA

**Functional Analysis of BORIS, a Novel DNA Binding Protein**

Yaswen, Paul; Apr 1, 2007; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0283

Report No.(s): AD-A478556; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478556>

BORIS (CTCFL) is a paralogue of the gene encoding CTCF, a multifunctional DNA binding protein that utilizes different

sets of zinc fingers to mediate distinct gene regulatory functions, including those involved in cell growth regulation. Unlike CTCF, the expression of BORIS is normally restricted to specific cells in testes (the only cells where CTCF is not expressed), where it may play a role in reprogramming the methylation pattern of male germ line DNA. To define the possible consequences of aberrant BORIS expression in human breast cancers, we have used a well-characterized human mammary epithelial cell (HMEC) culture model. Our results indicate that in most breast cancer cells, endogenous BORIS is unlikely to be expressed at sufficient levels to interfere with CTCF functions, and that BORIS expression alone is not an efficient immortalizing factor. However, under certain conditions BORIS may cooperate with other changes (e.g. p53 inactivation) to destabilize the genomes of the cells in which it is aberrantly expressed. BORIS expression may cause genomic instability through aberrant effects on centrosome duplication during the cell cycle, and through effects on the regulation of several key early growth response genes.

DTIC

*Breast; Cancer; Deoxyribonucleic Acid; Functional Analysis; Gene Expression; Genes; Mammary Glands; Proteins*

**20080023930** Minnesota Univ., Minneapolis, MN USA

**Regularization for Inverting the Radon Transform with Wedge Consideration (PREPRINT)**

Aganj, I; Bartesaghi, A; Borgnia, M; Liao, H Y; Sapiro, G; Subramaniam, S; Nov 2006; 6 pp.; In English

Report No.(s): AD-A478583; IMA-PREPRINT-SER-2144; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In limited angle tomography, with applications such as electron microscopy, medical imaging, and industrial testing, the object of interest is scanned over a limited angular range, which is less than the full 180 deg mathematically required for density reconstruction. The use of standard full-range reconstruction algorithms produces results with notorious 'butter-fly' or 'wedge' artifacts. In this work we propose a reconstruction technique with a regularization term that takes into account the orientation of the missing angular range, also denoted as missing wedge. We show that a regularization that penalizes non-uniformly in the orientation space produces reconstructions with less artifacts, thereby improving the recovery of the 'invisible' edges due to the missing wedge. We present the underlying framework and results for a challenging phantom and real cryo-electron microscopy data.

DTIC

*Algorithms; Electron Microscopy; Radon; Tomography; Wedges*

**20080023933** Minnesota Univ., Minneapolis, MN USA

**Sparse Representations for Limited Data Tomography (PREPRINT)**

Liao, Hstau Y; Sapiro, Guillermo; Nov 2007; 6 pp.; In English

Report No.(s): AD-A478588; IMA-PREPRINT-SER-2182; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In limited data tomography, with applications such as electron microscopy and medical imaging, the scanning views are within an angular range that is often both limited and sparsely sampled. In these situations, standard algorithms produce reconstructions with notorious artifacts. We show in this paper that a sparsity image representation principle, based on learning dictionaries for sparse representations of image patches, leads to significantly improved reconstructions of the unknown density from its limited angle projections. The presentation of the underlying framework is complemented with illustrative results on artificial and real data.

DTIC

*Algorithms; Electron Microscopy; Tomography*

**20080023943** Minnesota Univ., Minneapolis, MN USA

**An Image Processing Approach to Computing Distances Between RNA Secondary Structures Dot Plots (PREPRINT)**

Ivry, Tor; Michal, Shahar; Barash, Danny; Sapiro, Guillermo; Mar 2007; 30 pp.; In English

Report No.(s): AD-A478608; IMA-PREPRINT-SER-2163; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Computing the distance between two RNA secondary structures can contribute in understanding the functional relationship between them. When used repeatedly, such a procedure may lead to finding a query RNA structure of interest in a database of structures. Several methods are available for computing distances between RNAs represented as strings or graphs, but none utilize the RNA representation with dot plots. Since dot plots are essentially digital images, there is a clear motivation to devise an algorithm for computing the distance between dot plots based on image processing methods. Results:

We have developed a new metric dubbed 'DoPloCompare', which compares two RNA structures. The method is based on comparing dot plot diagrams that represent the secondary structures. When analyzing two diagrams and motivated by image processing, the distance is based on a combination of histogram correlations and a geometrical distance measure. We illustrate the procedure by an application that utilizes this metric on RNA sequences in order to locate peculiar point mutations that induce significant structural alternations relative to the wild type predicted secondary structure. The method was tested on several RNA sequences with known secondary structures to affirm their prediction, as well as on a data set of ribosomal pieces. These pieces were computationally cut from a ribosome for which an experimentally derived secondary structure is available, and on each piece the prediction conveys similarity to the experimental result. The new algorithm shows benefit when compared to standard methods used for assessing the distance similarity between two RNA secondary structures. Conclusions: Inspired by image processing, we have managed to provide a conceptually new and potentially beneficial metric for comparing two RNA secondary structures, and illustrated it on an application that utilized the measurement to detect conformational rearranging point mutations on an RNA sequence.

DTIC

*Distance; Image Processing; Ribonucleic Acids*

**20080023966** Old Dominion Univ., Norfolk, VA USA

**Subcellular Responses to Narrowband and Wideband Radiofrequency Radiation**

Schoenbach, Karl H; Tseng, Charles C; Feb 15, 2008; 52 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0320

Report No.(s): AD-A478651; ODU-220131; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The interest in subcellular effects of radiofrequency radiation has led to the establishment of a Multidisciplinary University Research Initiative (MURI) with scientists from six academic institutions (Old Dominion University, Eastern Virginia Medical School, Massachusetts Institute of Technology, Washington University, University of Wisconsin and University of Texas Health Science Center) participating. The ODU-led MURI worked closely with its sister MURI, led by Purdue Calumet University. The research work in the ODU MURI has led to the establishment of a new field in the area of pulsed electric field interactions with cells and tissues 'Intracellular Electromanipulation' - with important biomedical applications. In particular, the research has (a) led to a better understanding of the effect of nanosecond pulses on cellular and subcellular membranes through experimental and modeling results, (b) has revealed the effect of such pulses on cell functions, such as apoptosis and calcium release from internal stores, (c) has provided important information about nanosecond pulsed electric field effects on genes and proteins, (d) has demonstrated the use of nanopulses for the treatment of tumors and the activation of platelets (for advanced wound healing), and (e) has opened the possibility of using antennas with intense electrical pulses in the subnanosecond range, instead of electrodes, for medical treatments.

DTIC

*Broadband; Narrowband; Radio Frequencies; Responses*

**20080023970** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Protection of Hamsters by Venezuelan Equine Encephalitis Virus Candidate Vaccine V3526 Against Lethal Challenge by Mosquito Bite and Intraperitoneal Injection**

Turell, Michael J; Parker, Michael D; Jan 2008; 7 pp.; In English

Report No.(s): AD-A478656; RPP-06-140; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In an attempt to improve upon the current live, attenuated vaccine (TC-83) for Venezuelan equine encephalitis virus (VEEV), the V3526 vaccine candidate strain of VEEV was prepared by site-directed mutagenesis. Because studies indicate that virus introduced by mosquito bite may be more pathogenic than the same virus introduced by needle inoculation, there were concerns that the presence of mosquito saliva, or changes in the virus due to replication in a mosquito, might allow the virus to overcome the protective effects of prior vaccination with V3526. Therefore, we determined if hamsters vaccinated with V3526 were protected from challenge with virulent Trinidad donkey strain of VEEV. All non-vaccinated hamsters succumbed after intraperitoneal challenge or after being fed on by VEEV-inoculated *Ochlerotatus taeniorhynchus*. In contrast, hamsters vaccinated with V3526 were resistant to intraperitoneal challenge and infection by VEEV-infected *Oc. taeniorhynchus*. Therefore, the V3526 candidate vaccine elicits protection against VEEV infection by mosquito bite. In efforts to develop an improved live-attenuated vaccine for Venezuelan equine encephalitis virus (VEEV), specific mutations associated with attenuation of VEEV in rodent models were identified and inserted into a full-length cDNA clone of VEEV to produce selected isogenic strains containing one or more attenuating mutations. These were evaluated for their potential as a live, attenuated VEEV vaccine, and the V3526 strain, containing a deletion of the furin cleavage site in PE2 as well as a suppressor mutation in E1, was shown to protect mice, hamsters, and nonhuman primates challenged either by intraperitoneal

(I.P.) inoculation or by aerosol. In addition, this strain replicates less efficiently in potential mosquito vectors and does not revert to virulence after multiple passages in mosquitoes. In nature, most infections are caused by the bite of an infective mosquito.

DTIC

*Diseases; Encephalitis; Hamsters; Injection; Protection; Vaccines; Viruses*

**20080023973** Hutchinson (Fred) Cancer Research Center, Seattle, WA USA

**Deregulated Wnt Signaling in Prostate Cancer**

Houghtaling, Scott; Jan 2008; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0039

Report No.(s): AD-A478660; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The PCRP Prostate Cancer Training Award has supported my training for the past 12 months. During this time, I have continued to work towards attaining a better understanding of (a) the biology of prostate cancer, (b) the biology of the Wnt/beta-catenin signaling pathway, (c) the principle and application of cutting edge techniques in modern molecular and cellular biology, and (d) the principle and application of genetically engineered mouse (GEM) models, with the intent of becoming uniquely positioned to investigate the role of Wnt/beta-catenin signaling in the initiation, progression and metastasis of spontaneous autochthonous prostate cancer and the emergence of the androgen depletion independent phenotype. In addition to this rigorous technical training, I have continued to attend weekly lab meetings, division wide Cancer Biology Seminar series, and the Pacific Northwest SPORE in Prostate Cancer meetings. In addition, I attended the PCRP's Innovative Minds in Prostate Cancer Today (IMPACT) meeting in Atlanta, Georgia.

DTIC

*Cancer; Prostate Gland; Proteins*

**20080023974** Illinois Univ. at Urbana-Champaign, Urbana, IL USA

**Small Molecule Activation of Procaspase-2 for the Selective Induction of Apoptotic Death in Breast Cancer Cells**

Hergenrother, Paul J; Aug 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0608

Report No.(s): AD-A478661; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have synthesized a library of compounds based on a previously identified procaspase-2 activator. These compounds were then tested for their ability to activate procaspase-2 in vitro. The results from these tests indicated that several of the compounds did indeed activate procaspase-2. Testing of these active compounds against a panel of enzymes then revealed, surprisingly, that the compounds are general enzyme activators. We have now explored this phenomena of general enzyme activation more thoroughly and have submitted a manuscript on the topic. The data and knowledge acquired through this work now allows us to move confidently to a high-throughput screen to identify truly specific procaspase-2 activators.

DTIC

*Apoptosis; Breast; Cancer; Cells (Biology); Death; Mammary Glands*

**20080023975** Evanston Northwestern Healthcare Research Inst., Evanston, IL USA

**Interaction Between Cry61 and avbeta3 in Breast Cancer: Role in Texan Resistance**

Lupu, Ruth; Sep 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0703

Report No.(s): AD-A478662; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The angiogenic factor Cyr61 (also known as CCN1) plays a key role in both the maintenance and the enhancement of a malignant phenotype in breast cancer. Cyr61 is overexpressed in about 30% of triple negative breast carcinomas, whereas Cyr61 expression levels in normal breast tissues are negligible. Our recent studies showed that Cyr61 overexpression renders human breast cancer cells highly resistance to the microtubule-interfering agent paclitaxel (Taxol), a current drug of choice for the treatment of metastatic breast cancer. We have confirmed that expression of alphavbeta3, a Cyr61 receptor, is markedly upregulated in breast cancer cells expressing alphavbeta3 Cyr61. Our most recent data demonstrate that functional blockade of with a synthetic chemical peptidomimetic based upon the the RGD (Arg-Gly-Asp) motif, is specifically cytotoxic towards Cyr61- overexpressing breast cancer. Pharmacological interference with the Cyr61/ interaction restores Taxol efficacy, implying that a previously unrecognized Cyr61/alphavbeta3 -driven cellular signaling actively modulates breast cancer cell growth, apoptosis and Chemosensitivity.

DTIC

*Breast; Cancer; Mammary Glands*

**20080023976** Evanston Northwestern Healthcare Research Inst., Evanston, IL USA

**Identification of the Her-2 Functional Site: Blockage of Receptor Heterodimerization**

Lupu, Ruth; Sep 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0686

Report No.(s): AD-A478663; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Targeting HER2 is not as straightforward as it was originally predicted since many breast tumors express multiple HER receptors and co-express one or more HER ligands. This cross-talk network negatively impacts the response to the currently used HER2-targeted agents, highlighting the urgent need for a novel anti-HER2 molecule(s) presenting a combination strategy. Activation of the HER2 receptor is attained by several means: 1) receptor overexpression leads to homodimerization; 2) EGF induces EGFR-HER2 hetero-dimerization by binding to EGFR and inducing HER2 activation via crosstalk; and 3) Heregulin (HRG) induces HER3-HER2 hetero-dimerization by activating HER2 via its binding to the HER3 and HER4 receptors, in turn inducing receptor crosstalk and activation of a signaling cascade. In short, our preliminary study reveals that the specific disruption of an essential activating sequence existing on HER2 ECD domain III is capable of disabling the HER2 homo- and hetero-dimerization, thus blocking activation of HER2-driven oncogenic signaling and generating a dominant-negative Peptides or compounds with specificity for this functional site should add a previously unrecognized molecular approach to our therapeutic arsenal for the management of HER2-overexpressing carcinomas.

DTIC

*Blocking; Genes; Sense Organs*

**20080023977** Armed Forces Research Inst. of Medical Sciences, Bangkok, Thailand

**Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to the USA Army and the Royal Thai Army**

Duangurai, Krisada; Nitayaphan, Sorachai; Jan 2008; 118 pp.; In English

Contract(s)/Grant(s): W81XWH-06-2-0012

Report No.(s): AD-A478664; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Cooperative agreement # DAMD17-01-2-0005 was implemented January 1, 2001 to provide funding support for Royal Thai Army at Armed Forces Research Institute of Medical Sciences (AFRIMS) engaged in research activities in collaboration with US Army. Administrative, logistical and scientific personnel required to support the ongoing U.S. Army AFRIMS research efforts, and utilities and maintenance required to support the U.S. Army AFRIMS research effort.

DTIC

*Breast; Cancer; Infectious Diseases; Mammary Glands; Military Personnel; United States*

**20080023978** Baylor Coll. of Medicine, Houston, TX USA

**Forkhead Box Protein 1 (Foxa1) and the Sumoylation Pathway that Regulates Foxa1 Stability are Potential Targets for Breast Cancer Treatment**

Belaguli, Narasimhaswamy S; Sep 2007; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0653

Report No.(s): AD-A478665; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to determine the mechanisms by which the posttranslational SUMO modification regulates the activity of the forkhead box protein A1 (Foxa1). Major findings: We have demonstrated the sumoylation of Foxa1 in several breast cancer cell lines. Analysis of the Foxa1 protein sequence identified two potential sumoylation sites. Lysine to arginine substitution of the conserved lysine (K6) abolished Foxa1 sumoylation suggesting that the K6 is the primary sumoylation site. In contrast to the related forkhead box protein A2 (Foxa2) in which the K6R mutation induced protein destabilization, mutation of the conserved K6 sumoylation site did not strongly affect the stability of the Foxa1 protein. In transfection experiments, Foxa1 induced activation of the p27Kip1 promoter activity was downregulated by SUMO-1 demonstrating that SUMO-1 negatively regulates Foxa1 activity. On the contrary, the nonsumoylatable mutant of Foxa1 (Foxa1K6R) activated the p27Kip1 promoter to a lower extent compared with the wild type Foxa1 suggesting that the K6 and its modification/s are required for the transcriptional activity of Foxa1. Together, our results show that Foxa1 is modified by sumoylation on lysine, K6, and the SUMO modification of Foxa1 modulates the activity of Foxa1 on its target genes in breast cancer cells.

DTIC

*Breast; Cancer; Estrogens; Genes; Mammary Glands; Proteins; Stability; Targets*

**20080023979** California Univ., Los Angeles, CA USA

**A Genetic Approach to Define the Importance of Rheb in Tuberous Sclerosis**

Tamanoi, Fuyuhiko; Jan 2008; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0164

Report No.(s): AD-A478667; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes our accomplishments in characterizing the TSC/Rheb/mTOR signaling pathway that is altered in tuberous sclerosis. We have generated mice with decreased expression of Rheb1. We have succeeded in raising an antibody against mouse Rheb2. Effects of the TSC/Rheb/mTOR signaling on cell cycle progression have been investigated and we have obtained results suggesting the involvement of p27 and AMPK. Novel activating mutations of mTOR have been identified and they were used to investigate the consequences of the activation of the TSC/Rheb/mTOR signaling pathway on cell physiology. Our study makes significant contribution to understand how the TSC/Rheb/mTOR signaling pathway is regulated. The results we obtained make important contribution to the understanding of tuberous sclerosis.

DTIC

*Antibodies; Diseases; Genetics; Mutations; Proteins*

**20080023994** Minnesota Univ., Minneapolis, MN USA

**A Model DoD Systems Approach for Tobacco Cessation**

Lando, Harry; Oct 2007; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0586

Report No.(s): AD-A478689; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Military personnel have a smoking rate of approximately 30%, and recent evidence indicates this rate is no longer decreasing. Given the costs in terms of health care expenditures and decreased troop readiness, more must be done to decrease smoking in the military. The primary objective of the study was to evaluate whether implementation of a specialized intervention program based on the recommendations of the DoD Tobacco Cessation Policy Working Group and the VHA/DoD Clinical Practice Guidelines for tobacco interventions would result in lower smoking cessation rates among active duty personnel and TRICARE Prime beneficiaries (i.e., individuals who receive their medical care primarily from military installations). The project intervention combined state-of-the-art components from community trials with empirically supported clinical interventions to form a unique, comprehensive tobacco control program for military installations. Specifically, it focused on three areas of intervention: expanding pharmacotherapy as a benefit, providing training to both medical and non-medical personnel regarding brief interventions with tobacco users, and using a social marketing approach to develop a targeted media campaign to reduce tobacco use among junior enlisted personnel.

DTIC

*Chemotherapy; Clinical Medicine; Management Systems; Medical Services; Tobacco*

**20080024032** Minnesota Univ., Minneapolis, MN USA

**Statistical Characterization of Protein Ensembles (PREPRINT)**

Rother, Diego; Sapiro, Guillermo; Pande, Vijay; Mar 2006; 32 pp.; In English

Report No.(s): AD-A478740; IMA-PREPRINT-SER-2103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

When accounting for structural fluctuations or measurement errors, a single rigid structure may not be sufficient to represent a protein. One approach to solve this problem is to represent the possible conformations as a discrete set of observed conformations, an ensemble. In this work, we follow a different richer approach, and introduce a framework for estimating probability density functions in very high dimensions, and then apply it to represent ensembles of folded proteins. This proposed approach combines techniques such as kernel density estimation, maximum likelihood, cross-validation, and bootstrapping. We present the underlying theoretical and computational framework and apply it to artificial data and protein ensembles obtained from molecular dynamics simulations, and compare the results with those obtained experimentally, illustrating the potential and advantages of this representation.

DTIC

*Probability Density Functions; Proteins*

**20080024037** Pennsylvania State Univ., Hershey, PA USA

**Structural, Thermodynamic, and Functional Mechanisms of Adaptations WrbA and AdoMetDC Proteins in Extremophilic Organisms**

Makhatadze, George; Aug 15, 2007; 21 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0159

Report No.(s): AD-A478746; No Copyright; Avail.: Defense Technical Information Center (DTIC)

One of the open questions of structural biology is the understanding of the mechanisms by which enzymes adapt to extreme temperatures, both high (thermophilic) and low (psychrophilic). A model protein used in this study, S-adenosyl-methionine decarboxylase (AdoMetDC), is a key enzyme in the polyamine biosynthesis and thus its activity should be strongly dependent on the environmental variables such as temperature. To date we completed the experimental characterization of the thermophilic AdoMetDC from *Thermatoga maritima*. The processing of TmAdoMetDC that leads to catalytically active enzyme is undetectable at room temperature, but increases with the increase in temperature ( $k=0.41\pm 0.08 \text{ h}^{-1}(\text{exp}^{-1})$  at 65C). The binding constant for MMTA, an inhibitor that mimics natural substrate S adenosyl-methionine, was found to be on the order of 1 micron. A paper that summarizes these results is currently in preparation. The genes for AdoMetDC from five different bacteria have been cloned: *Leptospira interrogans* (psychrophile), *Exiguobacterium sibiricum*, (psychrophile), *Petrogoga mobilis* (thermophilic anaerobe), and *Oceanobacillus iheyensis* (halophilic). All these proteins have been expressed and purified, and structural (crystallization for x-ray analysis), biophysical (e.g. stability, oligomerization) and biochemical (activity profile as a function of temperature and salt concentrations, activation energy) experiments are currently in progress. DTIC

*Bacteria; Biosynthesis; Genes; Oligomers; Organisms; Polymerization; Proteins; Thermodynamics*

**20080024040** Washington Univ., Seattle, WA USA

**Model-Based Region-of-Interest Selection in Dynamic Breast MRI**

Forbes, Florence; Peyrard, Nathalie; Fraley, Chris; Georgian-Smith, Dianne; Goldhaber, David M; Raftery, Adrian E; Dec 2004; 36 pp.; In English

Contract(s)/Grant(s): N00014-01-10745; N00014-96-1-0192

Report No.(s): AD-A478754; TR-472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Magnetic Resonance Imaging (MRI) is emerging as a powerful tool for the diagnosis of breast abnormalities. Dynamic analysis of the temporal pattern of contrast uptake has been applied in differential diagnosis of benign and malignant lesions to improve specificity. Selecting a region of interest 'ROI' is an almost universal step in the process of examining the contrast uptake characteristics of a breast lesion. We propose an ROI selection method that combines modelbased clustering of the pixels with Bayesian morphology, a new statistical image segmentation method. We then investigate tools for subsequent analysis of signal intensity time course data in the selected region. Results on a data base of 19 patients are promising. The method provides informative segmentations and good detection rates are obtained.

DTIC

*Breast; Cancer; Imaging Techniques; Magnetic Resonance; Mammary Glands*

**20080024071** Baylor Coll. of Medicine, Houston, TX USA

**Novel Strategies for the Treatment of Estrogen Receptor-Negative Breast Cancer**

Speers, Corey; Oct 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0715

Report No.(s): AD-A478800; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Using Affymetrix gene expression profiling on 2 independent sets of human breast tumor samples with known ER, PR, and Her2/neu status, we were able to molecularly profile breast tumors and identify a list of kinases that were differentially expressed in ER-negative tumors. Supervised clustering analysis based on ER status was performed and a gene expression profile was generated using 779 known and putative human kinases. Analysis in two independent sets of tumor samples identified 70 and 84 differentially expressed kinases, respectively (2.3 fold higher in ER-negative tumors, p-value <.05). The intersection of these lists contained 37 kinases. Additionally, unsupervised clustering analysis in both sets seemed to identify kinases that defined ER-negative, Her2/neu positive tumors as well as ER-negative, Her2/neu negative tumors. Overexpression of kinases was confirmed and siRNA knockdown of kinases identified in the microarray analysis identifies several kinases that are critical for ER-negative, but not ER-positive breast cancer cell growth.

DTIC

*Breast; Cancer; Enzymes; Estrogens; Mammary Glands; Phosphorus*



**20080024073** Health Research, Inc., Rensselaer, NY USA  
**PCBs Alter Dopamine Mediated Function in Aging Workers**

Seegal, Richard F; Jan 2008; 14 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0173

Report No.(s): AD-A478812; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major hypothesis is that prior occupational exposure to polychlorinated biphenyls (PCBs) results in decrements in neuropsychological and neurological performance and the number of dopamine (DA) terminals in the basal ganglia determined by -CIT SPECT imaging. At the conclusion of data collection 241 former capacitor workers have completed neuropsychological and neurological examinations, a comprehensive questionnaire, a blood draw to measure serum PCB and thyroid hormone concentrations, and a non-invasive test to determine bone-lead concentrations. This latter measure will allow us to control for exposure to lead--a potential confounder. 89 subjects have undergone brain imaging at the Institute for Neurodegenerative Disorders in New Haven, CT to determine the relationship between serum PCBs and the number of basal ganglia DA terminals. Serum PCB concentrations have been determined at Mt. Sinai School of Medicine and thyroid hormone concentrations have been determined at the Wadsworth Center. All data collection is complete; data analysis and manuscript preparation continues. Secure electronic databases have been created for all data.

DTIC

*Dopamine; Neurology; Personnel; Polychlorinated Biphenyls*

**20080024076** California Univ., Los Angeles, CA USA

**Microlocalization and Quantitation of Risk Associated Elements in Gleason Graded Prostate Tissue**

Eckhart, Curtis D; Mar 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0067

Report No.(s): AD-A478817; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Epidemiological studies show that B Se and Zn reduce prostate cancer risk whereas Ca and Cd increase risk. The objective of this proposal was to determine the concentration and location of these elements in normal and tumor tissue. Specific aims included: (1) preparation of Gleason graded prostate tissue (2) determination of tissue concentrations of: B Ca Cd Se and Zn; and (3) determination of tissue and cellular distribution of these elements using a NanoSIMS ion microscope at Lawrence Livermore National Laboratory (LLNL). Specific aims 1 & 2 were accomplished and showed that B was unique in its variability. Further study identified B as a chemopreventative agent and a clinical trial has been designed to determine if it lowers PSA level in men. Aim 3 was accomplished but future studies are needed to improve the resolution of intracellular mapping of the elements. The work on B provided important insights on how the movement of calcium from the endoplasmic reticulum into the cytoplasm can be modulated by chemopreventative agents to reduce cell proliferation. This finding opens new opportunities for cancer prevention and control.

DTIC

*Cancer; Prostate Gland; Risk*

**20080024078** California Univ., Los Angeles, CA USA

**Molecular Engineering of Vector-Based Oncolytic and Imaging Approaches for Advanced Prostate Cancer**

Wu, Lily; Feb 2007; 57 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0095

Report No.(s): AD-A478820; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hormone refractory and metastatic prostate cancer are not well understood. Better animal models, diagnostic and treatment modalities are sorely needed for these advanced stages of disease. We have developed metastatic prostate cancer animal models that can be monitored by molecular imaging. To target metastatic disease, we have incorporated a highly potent and prostate-specific transcriptional regulatory system (TSTA) in adenoviral vectors such that the expression of imaging reporter gene and therapeutic gene is restricted to prostate cancer cells. Using the prostate-specific TSTA vectors, we were able to map the presence of lymph node metastases by optical or PET imaging. An extension of the TSTA technology is to regulate the expression of viral (E1) replication control gene products such that the lytic viral replicative process is directed at prostate-specific tumor lysis. With extensive molecular engineering, we have demonstrated the feasibility and the functionality of the prostate-targeted oncolytic system. The immediate future plan is to apply the oncolytic viruses in an image guided oncolytic viral therapy to treat metastatic disease in pre-clinical models of prostate cancer.

DTIC

*Cancer; Diseases; Imaging Techniques; Metastasis; Prostate Gland*

**20080024080** Washington Univ., Seattle, WA USA

**Bayesian Robust Inference for Differential Gene Expression in cDNA Microarrays with Multiple Samples**

Gottardo, Raphael; Raftery, Adrian E; Yeung, Ka Y; Bumgarner, Roger E; Jul 5, 2004; 26 pp.; In English

Contract(s)/Grant(s): N00014-01-10745

Report No.(s): AD-A478831; UW-STAT-TR-455; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We consider the problem of identifying differentially expressed genes under different conditions using cDNA microarrays. Standard statistical methods cannot be used because typically there are thousands of genes and few replicates. Because of the many steps involved in the experimental process, from hybridization to image analysis, cDNA microarray data often contain outliers. For example, an outlying data value could occur because of scratches or dust on the surface, imperfections in the glass, or imperfections in the array production. We develop a robust Bayesian hierarchical model for testing for differential expression. Outliers are modeled explicitly using a t-distribution. The model includes an exchangeable prior for the variances which allow different variances for the genes but still shrink extreme empirical variances. Our model can be used for testing for differentially expressed genes among multiple samples, and can distinguish between the different possible patterns of differential expression when there are three or more samples. Parameter estimation is carried out using a novel version of Markov Chain Monte Carlo that is appropriate when the model puts mass on subspaces of the full parameter space. The method is illustrated using two publicly available gene expression data sets. We compare our method to five other commonly used techniques, namely the one-sample t-test, the Bonferroni-adjusted t-test, Significance Analysis of Microarrays (SAM), and EBarrays in both its Lognormal-Normal and Gamma-Gamma forms. In an experiment with HIV data, our method performed better than these alternatives, on the basis of between-replicate agreement and disagreement.

DTIC

*Bayes Theorem; Complementary DNA; Gene Expression; Genetics; Inference; Statistical Analysis*

**20080024085** California Univ., San Diego, La Jolla, CA USA

**Regulation of Akt/Protein Kinase B Signaling by a Novel Protein Phosphatase in Breast Cancer Cells**

Brognaard, John; Newton, Alexandra; Jan 2008; 60 pp.; In English

Contract(s)/Grant(s): W81XH-05-1-0275

Report No.(s): AD-A478839; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major purpose of the proposed research was to determine if a novel phosphatase, entitled PHLPP2, negatively regulates the protooncogene Akt, by dephosphorylating this kinase at a key residue, Ser 473, where phosphorylation is required for maximal activity. Furthermore, we sought to determine if this phosphatase played a role in regulating downstream physiological effects of Akt signaling including: cell proliferation, growth, and apoptosis. Finally, since this phosphatase resides in a location of frequent loss of heterozygosity in breast cancer, we sought to determine if this phosphatase played a role in breast tumorigenesis. Major findings, are consistent with originally proposed research, I was able to successfully clone the full length PHLPP2 protein and determine phosphatase activity in vitro and in vivo. Full length PHLPP2 is a functional phosphatase that preferentially dephosphorylates Akt at Ser 473, thereby decreasing kinase activity, promoting apoptosis, and inhibiting cellular proliferation. Consistent with these results, siRNA mediated knockdown of endogenous PHLPP2 increases phosphorylation of Akt at Ser 473, and promotes cellular proliferation and survival. Finally, we have distinguished functional roles for PHLPP1 and PHLPP2 by examining downstream signaling of the Akt kinase. PHLPP2 preferentially regulates the cell cycle inhibitor p27, while PHLPP1 regulates GSK-3 $\alpha$ , and HDM2. Both phosphatases regulate the phosphorylation status of GSK- $\beta$ , TSC-2 and FoxO1. We have elucidated the molecular mechanism where PHLPP phosphatases regulate unique downstream substrates of Akt: by interacting with and dephosphorylating specific isoforms of Akt. PHLPP2 regulates Akt1 and Akt3 while PHLPP1 regulates Akt2 and Akt3.

DTIC

*Breast; Cancer; Mammary Glands; Proteins*

**20080024086** Melbourne Univ., Victoria, Australia

**Regulation of Leukocyte Infiltration into Ovarian Cancer by Tumor-Stroma Interactions, a Microarray View of Cancer Microenvironment**

Haviv, Izhak; Smyth, Mark; Cullinane, Carleen; Kershaw, Michael; Russell, Sarah; Mar 2007; 59 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0336

Report No.(s): AD-A478840; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Despite compelling cell biological studies and histopathological observations incriminating stromal cells in tumorigenesis, our knowledge of the genes that mediate changes in the tumor microenvironment and interactions among

various cell types in epithelial cancer and their role in tumorigenesis is limited. Here, we describe a comprehensive molecular characterization of stromal-epithelial cell interactions, using microarray analysis of co-cultured cell pairs. We further show that these gene expression changes indeed are common feature of in vivo profiles of invasive epithelial cancers. Using In situ hybridization and laser capture microdissection, we confirmed previous assignment of which cells express which genes in response to co-culture. We provide proof of principle evidence that the in vitro system recapitulates some aspects of cancer cell biology and may contribute new markers to the invasive events. We directly demonstrate that events in the interaction of epithelial cells and their neighboring fibroblasts play initial role in recruiting inflammatory cells and provoking immune surveillance. We found the Epithelial-to-Mesenchymal Transition of the cancer cells (shRNA-mediated E-Cadherin knock down) attenuates the co-culture reaction, suggesting a mechanism for cancer cell evasion of immune surveillance.

DTIC

*Cancer; Genes; Histology; Infiltration; Leukocytes; Ovaries; Pathology; Ribonucleic Acids; Tumors*

**20080024087** Hutchinson (Fred) Cancer Research Center, Seattle, WA USA

**Prostate Expression Databases: Gene Expression Resources for Comparative Studies of Prostate Carcinogenesis**

Nelson, Peter S; Jan 2008; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0110

Report No.(s): AD-A478841; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This proposal aims to test the hypothesis that integrating observations derived from mouse model systems with observations from human prostate cancers will define relevant and consistent molecular alterations critical to the development and progression of prostate carcinoma. The research accomplished to date has: 1) assembled the requisite mouse models to enable the generation of tumor gene expression data; 2) produced a second-generation mouse prostate microarray that will allow for deeper profiling of mouse prostate gene expression; 3) identified a specific gene (osteopontin) commonly associated with multiple mouse prostate cancer models; 4) developed the methods/techniques that will enable precise dissection of mouse prostate epithelium; 5) expanded the Prostate Expression Database to archive microarray data; 6) determined strain-specific gene expression differences in the mouse prostate that could contribute to phenotypic differences on prostate cancer development and progression; and 7) identified developmental pathways altered in the Pten<sup>-/-</sup> prostate cancer model that could contribute to the process of carcinogenesis.

DTIC

*Cancer; Carcinogens; Gene Expression; Genes; Prostate Gland; Tumors*

**20080024088** Kimmel (Sidney) Cancer Center, San Diego, CA USA

**Identification of Novel Retinoid Targets in Prostate Cancer**

Piedrafito, F J; Nov 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0073

Report No.(s): AD-A478842; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Retinoids function upon binding to nuclear retinoid receptors (RARs, RXRs) and have shown promise for the chemoprevention and treatment of prostate cancer. Novel synthetic retinoid-related molecules (RRMs) that function as RAR gamma/beta-selective agonists (MX3350-1, CD2325) or antagonists (MX781) were discovered with strong anticancer activity. These RRM induce apoptosis independently of RARs. The cellular targets that mediate RRM-anticancer activity are unknown and their mechanism of action is currently under investigation. The main goal of this project was to identify genes that mediate RRM anticancer activity upon selection of Genetic Suppressor Elements (GSE) that confer resistance to RRM treatment in prostate cancer cells. We have performed several screenings in the presence of toxic amounts of MX781 and MX3350-1. GSEs have been subsequently rescued from surviving cells by PCR amplification using primers specific for the GSE library, followed by DNA sequencing and BLAST homology search for the identification of the corresponding genes. The results of the initial screenings have not been completely reproduced in subsequent experiments and most of the genes tested in functional validation studies have proved to be unnecessary for RRM-induced apoptosis. Our conclusion is that RRM could activate several independent pathways that converge in apoptosis. Targeting of individual genes may not be sufficient to completely abrogate RRM-mediated cell death.

DTIC

*Cancer; Deoxyribonucleic Acid; Genes; Prostate Gland; Targets*

**20080024089** General Accounting Office, Washington, DC USA

**VA Health Care. Additional Efforts to Better Assess Joint Ventures Needed**

Mar 2008; 49 pp.; In English

Report No.(s): AD-A478843; GAO-08-399; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Veterans Affairs (VA) and the Department of Defense (DOD) have a long history of partnering to achieve more cost effective use of health care resources. Their partnerships have evolved to include joint ventures joint efforts to construct or share medical facilities. VA has maintained eight joint ventures with DOD across the country. VA has also developed partnerships, or affiliations, with university medical schools to obtain health care services for veterans and provide training to medical residents. VA has not entered into a joint venture with an academic affiliate to date. However, several proposals for such joint ventures have surfaced in the last decade. This congressionally requested report discusses the (1) potential benefits and concerns associated with joint ventures and the extent to which they are documented and measured, (2) lessons learned from existing and proposed VA joint ventures, and (3) steps VA has taken to evaluate proposed joint ventures. To address these issues, GAO conducted site visits to and interviews with officials from all existing and proposed joint venture sites.

DTIC

*Health; Medical Services*

**20080024090** Medical Univ. of South Carolina, Charleston, SC USA

**Pim Protein Kinase-Levels Correlate With Prostate Tumor Growth and Chemo Resistance-Potential Mechanisms**

Kraft, Andrew; Dec 2007; 17 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0126

Report No.(s): AD-A478844; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Pim is a protein kinase that has been implicated to play a role in prostate cancer. Kaplan-Meier analysis demonstrated that those patients with high Pim-1 expression are at a significantly greater risk for developing metastatic cancer. In transgenic animal models, the levels of Pim-1 protein kinase are elevated in prostate tumors caused by over expression of the c-myc oncoene, a gene overexpressed in human prostate cancer. In this proposal, we will examine whether Pim mimics Akt and TOR or modulates additional biochemical pathways and use knockout mice to dissect how myc and Pim collaborate to induce transformation and growth or prostate cancers. Pim inhibitors alone or in combination with TOR inhibitors will make a powerful chemotherapeutic strategy.

DTIC

*Cancer; Prostate Gland; Proteins; Tumors*

**20080024091** Johns Hopkins Univ., Baltimore, MD USA

**Antineoplastic Efficacy of Novel Polyamine Analogues in Human Breast Cancer**

Huang, Yi; Jun 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-00376

Report No.(s): AD-A478848; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Naure polyamines play an important role in cell proliferation and differentiation. Synthetic polyamine analogues can mimic natural polyamines in the down-regulation of polyamine biosynthesis, but analogues cannot promote cell growth. Our previous results show that polyamine analogues also down-regulate estrogen receptor (ER ), the principle target in human breast cancer therapy. This proposal was designed to investigate the molecular mechanisms and the therapeutic efficacy of oligomines in the treatment of human breast cancer. In the fourth year of this award, we investigated the possible roles of the polyamines biosynthetic pathway in polyamine analogues mediated repress on ER . In our latest studies, we demonstrated that ER expression was repressed after ornithine decarboxylase (ODC), the polyamines biosynthetic key enzyme, was downregulated by siRNA in several human breast cancer cell lines. Apoptosis and cell cycle arrest were also induced. These results indicated that the polyamine synthetic pathway is a key mediator of polyamine analogue induced ER alpha suppression.

DTIC

*Analogs; Breast; Cancer; Mammary Glands*

**20080024092** Naval Postgraduate School, Monterey, CA USA

**Marine Mammal Acoustic Monitoring and Habitat Investigation, Southern California Offshore Region**

Hildebrand, John; Nov 2007; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478849; NPS-OC-08-002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The echolocation clicks of five dolphin species found off southern California are described and the use of clicks for

species classification is investigated. Spectral and temporal properties are analyzed for the echolocation clicks from short-beaked common, long-beaked common, Risso's, Pacific white-sided and bottlenose dolphins. Two of the species exhibit unique spectral peaks and notches when the complete click is analyzed. A nested ANOVA analysis indicates that spectral peaks and notches occurring between 24 and 35 kHz are distinct between the two species and exhibit low variation within each species. Also, two subgroups are distinguished within Pacific whitesided dolphin recordings, possibly representing two overlapping populations in the region. Bottlenose and common dolphin clicks do not exhibit consistent patterns of spectral peaks or notches. Visual and acoustic line-transect surveys during four CalCOFI cruises (July 2006 April 2007) were conducted to understand cetacean ecology and habitat. The most commonly sighted mysticetes were blue, fin, gray and sperm whales; most commonly sighted odontocetes were short-beaked common dolphins and Dall's porpoise. By integrating CalCOFI environmental and cetacean data, ecological models for cetacean habitat in the region off southern California can be developed to improve predictive models for their presence in the SCORE range.

DTIC

*Acoustics; Animals; Dolphins; Habitats; Marine Biology; Marine Mammals; Spectrograms; Whales*

**20080024093** Emory Univ., Atlanta, GA USA

#### **Early Detection of Breast Cancer Using Molecular Beacons**

Yang, Lily; Jan 2008; 129 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0665

Report No.(s): AD-A478855; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this research project was to develop a novel fluorescence cell imaging method for the early detection of breast cancer. We proposed to use molecular beacon technology to detect the level of expression of several biomarker genes that are highly expressed in breast cancer cells but not in normal breast epithelial cells. As the result of this DOD Idea Award, we have developed molecular beacons that detect the level of expression of survivin, cyclin D1, HIF-1 and Her-2/Neu genes in breast cancer cells. This method can also be used to examine the level of gene expression in real time within living breast cancer cells such that changes in the expression of specific biomarker genes can be monitored. To increase the specificity and sensitivity of cancer cell detection, we further developed a multicolor fluorescent cell imaging approach that detects the expression of biomarker genes and proteins simultaneously at the single cell level using combination of molecular beacon and fluorescence quantum dots conjugated to antibodies against these biomarkers. Our results show that the fluorescence cell imaging methods and tumor cell targeted nanoparticle imaging probes we have developed have potential to be used for the detection of breast cancer cells in clinical samples obtained from breast cancer patients and for in vivo non-invasive imaging of breast cancers using optical and MR imaging approaches.

DTIC

*Beacons; Breast; Cancer; Detection; Epithelium; Fluorescence; Mammary Glands*

**20080024685** Feng Chia Univ., Taichung, Taiwan, Province of China

#### **A New Noninvasive Assessment for Measuring the Instantaneous Intra-Arterial Blood Pressure via Tissue Control Method**

Lin, Albert Chin-Yuh; Shiu, Chih-Yuan; Tung, Hung; Huang, H. N.; Su, Yi-Chang; Lin, Jui-Shan; Wang, Yao-Horng; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 261-270; In English; See also [20080024669](#); Copyright; Avail.: Other Sources

This paper presents a noninvasive approach to measure the instantaneous intra-arterial blood pressure based upon the Tissue Control Method. According to animal experiments, there exists a pressed location where the mean blood pressure in an artery is equivalent to the mean pressure measured on the skin, and forms a simple compliance circuit model. At this location, the compliance measured on the skin is simply the compliance of tissue, but the blood vessel is not involved. By using control means to decouple the pulsation of an artery from tissue, and then to identify the compliance of a blood vessel, the instantaneous intra-arterial blood pressure can be estimated. The experimental results show that the errors of MBP, SBP and DBP are less than 2.5%, thereby validating the Tissue Control Method as a feasible technique to measure the intra-arterial blood pressure.

Author

*Blood Pressure; Blood Vessels; Arteries; Tissues (Biology); Errors*

**20080025033** Michigan Univ., Ann Arbor, MI USA

**Mechanisms in Chronic Multisymptom Illnesses**

Clauw, Daniel J; Oct 2007; 212 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-2-0018

Report No.(s): AD-A478811; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall objective of this cooperative agreement are to conduct research in pursuit of identifying the physiologic mechanisms responsible for the symptoms of pain, fatigue, and memory difficulties commonly seen in patients with Chronic Multisymptom Illnesses (CMI) (i.e., fibromyalgia, chronic fatigue syndrome, Gulf War Illnesses, etc.); to identify the risk factors for developing these syndromes as well as programs aimed at both preventing these illnesses and treating established cases. These objectives will be achieved through multiple research studies using innovative, technologically advanced (e.g., functional MRI and telemedicine) methodologies in a multidisciplinary environment. Various studies will be conducted to explore all aspects of pain processing, the effects of exercise deprivation and sleep reduction on symptomatology, the ability of exercise and/or cognitive behavioral therapies to alter patients' locus of control for pain, the neurobiological mechanism(s) of acupuncture on analgesia, the presence of hypersensitivity to auditory stimuli, and the effectiveness of cognitive behavioral therapy delivered via telemedicine and the internet. These studies will be conducted on well-characterized cohorts of CMI subjects and healthy controls taken from our burgeoning subject registry. Research continues at the University of Michigan, Ann Arbor, MI and Avera Research Institute, Sioux Falls, SD.

DTIC

*Sicknesses; Signs and Symptoms*

**20080025072** USA Environmental, Inc., Oldsmar, FL USA

**Alaska Native Parkinson's Disease Registry**

Trimble, Brian A; Nov 2007; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0001

Report No.(s): AD-A478553; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478553>

This registry initiates a program of epidemiological assessments of PS among Alaska Natives to study the natural history and clinical management of PS and establishes a database of Alaska native people with PS for public health research and educational purposes. As feasible the prevalence of PS in Alaska Natives may be estimated as well. This registry not only would facilitate future research into PS etiology but also guide health care planning and community education efforts in this population. The proposal takes advantage of a case control study of PS that is commencing in the same population. The registry is designed in two phases. Phase I is a developmental period and is well underway at this time. During this phase we are establishing the data collection and dissemination protocols regulatory submissions are under review for the registry to obtain necessary approvals the registry database is under development and a pilot project in Anchorage will be initiated pending approvals. Phase 2 has not yet begun. It is a period of educational outreach and active statewide data collection on prevalent and incident cases of PS. After Phase 2 ends the registry will be sustained through the Alaska Native Medical Center.

DTIC

*Diseases; Medical Services; Public Health; Clinical Medicine*

**20080025279** Wake Forest Univ., Winston-Salem, NC USA

**Inhibition of Fatty Acid Synthase in Prostate Cancer by Orlistat, a Novel Therapeutic**

Kridel, Steven J; Nov 2007; 66 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0065

Report No.(s): AD-A478538; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478538>

The basic premise of this proposal was based on two important findings. The first was the discovery that fatty acid synthase (FAS) is overexpressed in prostate cancer as well as in many other cancers. FAS is the enzyme that catalyzes the synthesis of fatty acid from the precursors acetyl-CoA and malonyl-CoA. The fatty acids are then utilized for subsequent phospholipid synthesis and membrane biogenesis. A body of literature has demonstrated that tumor cells are addicted to FAS derived fatty acids as inhibition of FAS activity induces cell death in tumor cells. The second was the initial discovery of the FDA-approved drug Orlistat as an inhibitor of FAS. Orlistat targets the thioesterase domain of FAS and induces cell death specifically in prostate tumor cells and inhibits the growth of prostate tumor xenografts in mice. Based on these discoveries, three specific aims were proposed. They were as follows: (1) to determine the cellular consequences of FAS inhibition by Orlistat, (2) to analyze the molecular basis for FAS inhibition by Orlistat, and (3) to select and characterize novel FAS inhibitor

scaffolds using peptide phage display. The overall goal of this project was to understand the anti-tumor effects of FAS inhibitors. The authors have followed up the endoplasmic reticulum (ER) stress response. Moreover, they have identified crosstalk between the FAS and proteasome pathway that, when perturbed, enhances ER stress signaling. In addition, preliminary data suggests that the ER stress and autophagy pathways may be acting in concert when FAS activity is reduced in tumor cells. In another line of investigation, they solved the first crystal structure of a FAS domain bound to ligand as well as the structure of the thioesterase domain of FAS bound to Orlistat, in two states. Together, these data provide a framework, or blueprint, for the design of novel FAS inhibitors and an understanding of their anti-tumor mechanisms and their future translation into the clinic.

DTIC

*Apoptosis; Cancer; Chemotherapy; Crystal Structure; Endoplasmic Reticulum; Enzyme Inhibitors; Fatty Acids; Prostate Gland; Therapy*

**20080025280** Cincinnati Univ., OH USA

**BAF57 Modulation of Androgen Receptor Action and Prostate Cancer Progression**

Link, Kevin A; Dec 2007; 23 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0098

Report No.(s): AD-A478539; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478539>

Given the requirement of the androgen receptor (AR) activation pathway for prostate cancer growth and progression, it is necessary to identify alternative means of targeting this pathway for the treatment of prostate cancer. The work herein has examined the role of BAF57 in its ability to activate the androgen receptor. The research carried out under this proposal has finely mapped the AR binding site on BAF57 to the N-terminus (proline-rich region). Furthermore, the DBD and hinge region of AR also appear to play a significant role in the ability of BAF57 to activate AR. Together, these data present the idea of targeting the interaction between AR and BAF57 at the N-terminus for the possibility of using this as a therapeutic for prostate cancer. Additional studies will determine the actual function of BAF57 as well as the efficacy of targeting this interaction.

DTIC

*Activation; Cancer; Hormones; Males; Modulation; Prostate Gland; Target Acquisition; Tumors*

**20080025295** California Univ., San Francisco, CA USA

**Killing Breast Cancer Cells With a VEGF-Triggered Cell Death Receptor**

Quinn, Timothy; Apr 2006; 16 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0745

Report No.(s): AD-A478905; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478905>

Many breast cancers overexpress the tumor angiogenesis factor VEGF (vascular endothelial growth factor). Consequently numerous VEGF inhibitors are being studied. Some such as bevacizumab extend progression-free survival but have not yet been shown to extend overall survival in breast cancer patients. We are pursuing a totally different approach to targeting VEGF: rather than inhibit VEGF our goal is to convert VEGF to act as a cell death factor. Toward this aim we created a chimeric receptor (R2Fas) composed of domains from VEGF receptor 2 fused to the intracellular domain of the Fas cell death receptor. As controls we generated two inactive versions of R2Fas with mutations in the VEGF receptor 2 domain or the Fas domain. Replication-defective adenoviruses expressing each of the receptors were generated and used to direct expression of the receptors in human breast cancer cell lines. We found that expression of the R2Fas chimeric receptor but not the inactive control receptors could induce apoptosis in several human breast cancer cell lines in vitro. These studies suggest that a receptor such as R2Fas which converts VEGF to act as a cell death factor could yield a new and more aggressive approach to targeting overexpressed VEGF in breast cancer.

DTIC

*Breast; Cancer; Death; Mammary Glands*

**20080025306** Wayne State Univ., Detroit, MI USA

**Analysis of Ethnic Admixture in Prostate Cancer**

Bock, Cathryn; Dec 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0181

Report No.(s): AD-A478938; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478938>

Evidence for a genetic component to prostate cancer is strong, however few genes have been identified, and most of the

genetic risk remains undefined. To date, multiple traditional genome scans have been performed, and several susceptibility loci have been identified. Traditional genome scans using familial data have generally not included enough African Americans to provide adequate statistical power to detect linkage. Our project uses a novel approach to gene discovery with greater power to detect genetic effects, admixture mapping, to identify prostate cancer susceptibility loci in a sample of African American men. Freedman et al. reported a susceptibility region on chromosome 8q24, detected by admixture mapping in 1,597 African American men. In the current study, approximately 800 samples from 2 case-control study of prostate cancer were genotyped for ancestry informative markers across the genome. Admixture mapping analyses were performed using ADMIXMAP and ANCESTRYMAP statistical programs. The prostate cancer susceptibility locus on 8q24 identified by Freedman et al. was confirmed, with a peak lod score estimated using ANCESTRYMAP of 1.54 between markers rs12547950 and rs4367565. A new prostate cancer susceptibility locus on chromosome 5q35 was identified, with a maximum lod score of 3.16 detected at marker rs7729084 using ADMIXMAP. This new region is actively being explored via fine mapping and candidate gene approaches.

DTIC

*Admixtures; Africa; Cancer; Ethnic Factors; Genetics; Prostate Gland*

**20080025320** George Mason Univ., Manassas, VA USA

**Rapid Active Assay for the Detection of Antibodies to West Nile Virus in Chickens**

Groves, Stephanie S; Turell, Michael J; Bailey, Charles L; Morozov, Victor N; Jan 1, 2008; 8 pp.; In English  
Report No.(s): AD-A478963; TR-07-018; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478963>

To reduce the assay time for detecting virus-specific antibodies in serum, we developed microarray-based active immunoassay techniques for detecting West Nile virus (WNV)-specific IgM molecules in chicken blood. The assay uses electrophoretic concentration of IgM molecules onto WNV antigens arrayed on a dialysis membrane followed by detection of bound IgM molecules with functionalized magnetic beads as active labels. This assay takes only 15 minutes and has the same sensitivity as a commercially available human WNV IgM antibody-capture enzyme-linked immunosorbent assay (commonly called a MAC-ELISA) modified for use with chicken sera.

DTIC

*Antibodies; Assaying; Chickens; Enzymes; Viruses*

**20080025324** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Functional CD8+ T Cell Responses in Lethal Ebola Virus Infection**

Bradfute, Steven B; Warfield, Kelly L; Bavari, Sina; Mar 15, 2008; 10 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478979; TR-07-075; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478979>

Ebolavirus (EBOV) causes highly lethal hemorrhagic fever that leads to death in up to 90% of infected humans. EBOV infection induces massive lymphocyte apoptosis, which is thought to prevent a functional adaptive immune response. In addition, in vitro studies show that EBOV induces aberrant responses in dendritic cells, which is thought to contribute to a failed adaptive immune response. In this study we show that in a lethal mouse model of EBOV infection there is an increase in expression of the activation marker CD44 in CD4+ and CD8+ T cells late in infection. This precedes a dramatic rebound of lymphocyte numbers in the blood. Surprisingly, adoptive transfer of splenocytes from moribund infected animals protected naive animals from EBOV but not marburgvirus (MARV) challenge. In addition, we observed EBOV-specific CD8+ T cell responses in moribund EBOV-infected mice, and adoptive transfer of these cells alone could transfer protection to EBOV-challenged naive mice. Therefore, despite significant lymphocyte apoptosis, a functional and specific adaptive immune response is made in lethal EBOV infection. This data suggests that anti-EBOV therapeutics may curtail the progression of the disease long enough to allow the adaptive immune response to respond and minimize or obviate pathology.

DTIC

*Infectious Diseases; Lethality; Lymphocytes; Viruses*



**20080025326** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA  
**Complex of a Protective Antibody with its Ebola Virus GP Peptide Epitope: Unusual Features of a Lambda Light Chain**

Lee, Jeffrey E; Kuehne, Ana; Abelson, Dafna M; Fusco, Marnie L; Hart, Mary K; Saphire, Erica O; Jan 2008; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478981; TR-07-058; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478981>

13F6-1-2 is a murine monoclonal antibody that recognizes the heavily glycosylated mucin-like domain of the Ebola virus virion-attached glycoprotein (GP) and protects animals against lethal viral challenge. Here we present the crystal structure, at 2.0 Å, of 13F6-1-2 in complex with its Ebola virus GP peptide epitope. The GP peptide binds in an extended conformation, anchored primarily by interactions to the heavy chain. Two GP residues, Gln P406 and Arg P409, make extensive side-chain H-bond and electrostatic interactions to the antibody and are likely critical for recognition and affinity. The 13F6-1-2 antibody utilizes a rare LAMADA(SUB X) light chain. Surprisingly, the three CDR light chain loops do not adopt canonical conformations and represent new classes of structures distinct from LAMADA kappa and lamada(sub X) light chains. The light chain makes five hydrogen bonds to the peptide, but interestingly, all contacts are mediated through germ line-encoded residues. The 13F6-1-2 lamada(sub X) light chain shares strong sequence identity to human lamada(sub X) subgroup VIII, thus providing a framework for humanization. This first structure of a V kappa light chain and Ebola virus-neutralizing antibody is an exciting step towards the development of a postexposure therapeutic antibody.

DTIC

*Antibodies; Crystal Structure; Peptides; Proteins; Viruses*

**20080025327** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA  
**Targeting Mucosal Dendritic Cells with Microbial Antigens from Probiotic Lactic Acid Bacteria**

Mohamadzadeh, Mansour; Duong, Tri; Hoover, Timothy; Klaenhammer, Todd; Mar 1, 2008; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478982; TR-07-093; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478982>

Using vaccines against infectious microbes has been critical to the advancement of medicine. Various vaccine strategies combined with or without adjuvants have been established to eradicate various bacterial and viral pathogens. A new generation of vaccines is being developed using specific strains of the gram-positive lactic acid bacteria, and notably some probiotic lactobacilli. These bacteria have been safely consumed by humans for centuries in fermented foods. Therefore, they can be orally administered, are well-tolerated by recipients, and could easily and economically be provided to large populations. In this overview, we focus on mucosal immunity and how its cellular component(s), particularly dendritic cells (DCs), can be specifically targeted to deliver immunogenic subunits like the protective antigen (PA) from *Bacillus anthracis* (causative agent of anthrax). An antigen-specific immune response can be elicited by using various strains of *Lactobacillus* expressing PA. A mucosal, DC targeting approach increases the bio-availability of an immunogen of interest, when delivered orally by *Lactobacillus*. This provides an efficiently elegant natural strategy and serves a dual function as an immune-stimulating adjuvant in vivo.

DTIC

*Antigens; Bacteria; Infectious Diseases; Lactic Acid; Microorganisms; Pathogens; Vaccines*

**20080025328** International Agency for Research on Cancer, Lyon, France  
**Prostate Cancer Risk in Relation to IGF-1 and its Genetic Determinants: A Case Control Study Within the Cancer Prostate Sweden Project (CAPS)**

Kaaks, Rudolf J; May 2007; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0374

Report No.(s): AD-A478983; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478983>

A large genetic association study was conducted to examine relationships of prostate cancer risk with polymorphic variation in a series of selected candidate genes that are involved in pathways determining the synthesis of IGF-I and IGF-binding proteins, as well as biological response to IGF-I. The study is being performed within a large Swedish case-control study (CAPS). Progress report: We have completed the selection of DNA and haplotype tagging SNPs to be analyzed for all candidate genes, and have completed about three quarters of all genotyping assays for the prostate cancer cases and control subjects. We have completed analysis of complete genetic variation in the IGF1, IGFBP3, IGFBP1,

IGFALS, SST, SSTR1, SSTR2, SSTR3, SSTR4, SSTR5 and GHR genes, as well as selected polymorphisms in the GHRL and GHSR using the linked database, containing data on tumour grade, stage and serum PSA levels, for all prostate cancer cases. Plasma assays of IGF-I and IGFBP-3 were performed and statistical analysis between circulating plasma levels and SNPs as well as prognostic factors, has been completed. Evidence was identified for associations between SNPs in IGF1, IGFBP3 and SSTR5 and circulating plasma levels. Evidence for association between genetic variation in the IGF1 gene and prostate cancer risk was identified. Concerning the construction of the study databases, the plasma measures, the genetic component of our project and statistical analysis, we have completed the project relatively on schedule. The delay in the genotyping aspect of the project was mainly due non-receipt of funds, a substantial amount is remains outstanding at this time.

DTIC

*Cancer; Genetics; Prostate Gland; Risk; Sweden*

**20080025334** Army War Coll., Carlisle Barracks, PA USA

**Strategic Medical Leadership in the Global War on Terrorism**

Homas, Dallas W; Mar 21, 2008; 33 pp.; In English

Report No.(s): AD-A479005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479005>

The Army Medical Department has served our Army's soldiers in the field for centuries. Today, we are engaged in a war on terror, currently focused in the U.S. Central Command's area of operations. Fundamental to winning the hearts and minds of the local populace in countries like Afghanistan and Iraq, and in regions like the Horn of Africa, is ensuring basic human needs. One such need is security, which our armed forces are working towards. Another is health. A person may well be disinterested in how he will be governed tomorrow if he is not sure of being alive and well tomorrow. Therefore, the role of the strategic medical leader is one key to stability in the region and ultimate victory there. This paper examines that medical leader's responsibilities and opportunities in helping to secure a stable environment in our current war on terror.

DTIC

*Leadership; Management Systems; Medical Services; Terrorism; Warfare*

**20080025467** Mei Technology Corp., San Antonio, TX USA

**Formative Evaluation of the MENTOR 2010 Courseware**

Wenzel, Brenda M; Christinaz, Daniel U; Kretschmer, Monika G; Escobar, Susan L; Garcia, Veronica; Jul 2002; 156 pp.; In English

Contract(s)/Grant(s): F41624-97-C-5031; Proj-1123

Report No.(s): AD-A479240; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes a formative evaluation of the Medical Education Network, Training for Operational Readiness (MENTOR) in 2010 courseware, which was designed to replace 100 hours of traditional lock-step instruction from the in-residence Flight Nurse/Aeromedical Evacuation Technician (FN/AET) Course as distributed, self-paced training. The MENTOR 2010 courseware was evaluated on training effectiveness, effeminacy, and instructional design. Fifty-six students participated in the evaluation. Each student was exposed to 9 of the 30 MENTOR 2010 modules. Training were measured as increases in scores on achievement tests, increases in self-ratings of levels of knowledge and confidence in specific areas of nursing assessment and aeromedical evacuation(AE) equipment, and positive attitudes toward using the courseware to learn FN/AET knowledge and skills. Results can be summarized as follows. The MENTOR 2010 courseware was able to produce knowledge gains in FN/AET students that equaled knowledge gains produced by traditional classroom instruction. Students receiving FN/AET training using the MENTOR 2010 courseware showed the same level of awareness of their AE knowledge and confidence in applying that knowledge as students trained in the classroom and they spent 14% less time in training than students receiving traditional instruction. However, exposure to the MENTOR 2010 courseware negatively affect students' attitude about MENTOR 2010, specifically, and computer-based training(CBT), in general. The results were compared to standard results obtained across many CBT studies(Kulik, 1994).

DTIC

*Education; Educational Resources*

**20080025484** Massachusetts General Hospital, Boston, MA USA

**Ovarian Cancer Training Program at the Dana Farber/Harvard Cancer Center**

Seiden, Michael; Apr 2007; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0161

Report No.(s): AD-A479287; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Award funded the initiation of a mentored research experience in ovarian cancer biology at the Dana Farber/Harvard

Cancer Center. The primary aims, articulated in the Statement of Work, included creating a mechanism to identify and select outstanding postdoctoral fellows who had a commitment to serious multi-year experience in research that was directly related to a topic in or immediately applicable to ovarian cancer. The second aim was to provide a mentored experience for selected fellows. The third aim specified the delivery of feedback to the trainees by mentors and the program PI. The final aim described a rigorous review process for the program. These aims are all being addressed. Of the four senior post doctoral fellows selected to work with Faculty at Harvard Medical School in the fields of oncogenesis, signal transduction, pathology and mouse models and cell biology, one fellow graduated from the program and is successfully transitioning towards an independent academic research career. The vacancy was competed for and filled successfully. A new faculty member with extensive training in biologic models was added to the program to mentor the fellows, who continue to pursue their research productively at 3 different institutions within the Dana Farber/Harvard Cancer Center.

DTIC

*Cancer; Education; Ovaries; Pathology; Tumors*

**20080025486** Queen's Medical Center, Honolulu, HI USA

**Cancer Localization in the Prostate with F-18 Fluorocholine Position Emission Tomography**

Kwee, Sandi; Jan 2008; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0056

Report No.(s): AD-A479289; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The project evaluated fluorine-18 (F-18) fluorocholine positron emission tomography (PET) as an imaging technique for delineating malignancy in the prostate gland. The technique measures tissue metabolism of fluorocholine, a substrate that is preferentially metabolized by cancer cells due to malignant over-expression of the choline transporter and choline kinase enzyme. Based on this measurement, it was proposed that cancerous tissue can be differentiated from benign tissue in the prostate. Project Scope: Men with prostate cancer undergoing treatment with radical prostatectomy surgery were recruited for pre-operative PET scanning to measure fluorocholine uptake in the prostate gland. Imaging results were compared to histopathologic analyses of the prostatectomy specimen to determine the accuracy of prostate cancer sextant localization on the basis of measured fluorocholine uptake. The data acquired thus far with conventional PET in 15 subjects (2 pilot subjects and 13 recruited by the study) was summarized in the 2006 final report. Since then, the project scope has been modified to incorporate the use of PET/CT and other new PET imaging technologies. A no-cost extension is being requested to continue the project using PET/CT with the goal of accruing at least ten additional subjects. Additional immunohistochemical analyses are planned once additional prostate specimens have been collected. To better facilitate this task, a method to establish spatial correspondence between histology slides and ex vivo MRI was developed this year to allow histological correspondence to be propagated to the in vivo imaging space. This latter project outcome should aid histopathologic correlations in future validation studies of fluorocholine PET and other prostate imaging techniques.

DTIC

*Cancer; F-18 Aircraft; Position (Location); Prostate Gland; Tomography*

**20080025488** Colorado Univ., Aurora, CO USA

**The Role of HOX Proteins in Androgen-Independent Prostate Cancer**

Daddario, Sunshine; Nov 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0064

Report No.(s): AD-A479291; No Copyright; Avail.: Defense Technical Information Center (DTIC)

HOX genes encode a large family of transcription factors involved in key developmental decisions, and are often aberrantly expressed in cancer. Our laboratory has previously shown that a subset of genes of the HOXC cluster are overexpressed in primary prostate tumors, metastases, and prostate cancer (PCa) cell lines. Increasing transient expression of HOXC8 in LNCaP PCa cells as well as HPr-1 AR non-tumorigenic prostate epithelial cells results in a progressive suppression of androgen responsive promoters. Transcription from both the mouse probasin promoter and the MMTV promoter is inhibited at levels of HOXC8 expression comparable to those seen in PCa cell lines. Other members of the HOX family also inhibit androgen signaling. We have created LNCaP and HPr-1 AR derived lines that stably overexpress HOXC8 and show that signaling through androgen responsive promoters is inhibited, and PSA mRNA levels are decreased in these cell lines. HOX proteins block the histone acetyltransferase activity of the coactivators CBP and p3002. As these are key mediators of steroid-dependent transcription, inhibition of these coactivators could account for the HOX-dependent suppression of androgen receptor-mediated transcription. We show that overexpression of CBP relieves the inhibition of androgen receptor-mediated transcription by HOXC8. Further, chromatin immunoprecipitation demonstrates that HOXC8 expression inhibits hormone-induced histone acetylation at MMTV. HOXC8 overexpression has been shown to correlate with higher

Gleason grade PCa3. Our preliminary studies demonstrate that stable overexpression of HOXC8 increases HPr-1 AR invasiveness in vitro. In contrast to androgens, the secosteroid vitamin D has been shown to have antiproliferative, prodifferentiation and antimetastatic properties in PCa. Increasing expression of HOXC8 also results in a progressive suppression of vitamin D-induced transcription in vitamin D-responsive ALVA-31 PCa cells.

DTIC

*Cancer; Hormones; Hydrogen Compounds; Males; Oxides; Prostate Gland; Proteins*

**20080025496** Children's Hospital, Boston, MA USA

**Angiogenesis Research to Improve Therapies for Vascular Leak Syndromes, Intra-abdominal Adhesions, and Arterial Injuries**

Folkman, Judah; Apr 1, 2008; 89 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0115

Report No.(s): AD-A479315; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The three goals of this project are: (i) to discover and develop novel drugs which could prevent or reverse the vascular leak syndrome; (ii) to develop angiogenesis inhibitors which would inhibit post-operative abdominal adhesions; and, (iii) to isolate endothelial progenitor cells from blood, capable of being expanded in vitro and applied to vascular grafts. Progress has been made in each category: we have demonstrated that the widely used antibiotic, doxycycline, is a potent inhibitor of VEGF-induced vascular leak, and that a combination of Lodamin and doxycycline have additive effects and inhibit vascular leakage by greater than 80%; we have established that sunitinib likely does prevent intra-abdominal postoperative adhesions in rabbits; and, we have isolated and characterized mesenchymal progenitor cells (MPCs) from human adult bone marrow and from human cord blood; showed expansion potential suitable for tissue engineering and tissue regeneration applications.

DTIC

*Abdomen; Adhesion; Angiogenesis; Arteries; Cardiovascular System; Injuries; Leakage; Signs and Symptoms; Stem Cells; Therapy*

**20080025497** Institute for Cancer Research, Philadelphia, PA USA

**A Mouse Model to Investigate Postmenopausal Biology as an Etiology of Ovarian Cancer Risk**

Xu, Xiangxi; Nov 2006; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0095

Report No.(s): AD-A479318; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project is to use a unique mouse model to study the interaction of reproductive factors and genetic mutations in the development of ovarian cancer. Ovarian cancer often develops in women of peri-menopausal age. We found that the germ cell deficient Wv mice mimics postmenopausal biology and develop benign ovarian tumors. We plan to test the hypothesis that a synergy exists between oncogenic mutations such as p53, pten, or p27kip1 and postmenopausal biology in ovarian cancer development. In the first year of the project, we completed Aim 1, the study of ovarian tumor phenotypes in mice of compound genotypes. We found that crossing of Wv mice into mutant p53, pten, or p27 background did not lead to a malignant tumor phenotype. Instead, the mutants rescue ovarian germ cells, a very interesting finding. The ovarian surface epithelia in these compound mutant mice develop unique lesions with peculiar morphology, which are undergoing analysis as planned in Aim 2. In future study, we plan to use flox-p53 mutant mice to create mutation only in ovarian surface epithelial but not in germ cells (Aim 3). In sum, the project progresses as planned. We have layered the basis and are posed to further advance.

DTIC

*Cancer; Etiology; Hormones; Mice; Ovaries; Risk*

**20080025499** Pittsburgh Univ., Pittsburgh, PA USA

**E-Design Environment for Robotic Medic Assistant**

Nnaji, Bartholomew O; Wang, Yan; Dec 2006; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0112

Report No.(s): AD-A479321; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This status report summarizes the research work of e-design environment for Robot Medic Assistant (RMA) conducted at the National Science Foundation Industry/University Cooperative Research Center for e-Design from Nov. 2005 to Nov. 2006. The major tasks performed include identification of stakeholders and technical challenges in collaborative RMA design,

research extension and collaboration with Army Research Laboratory, identification and implementation of collaborative technologies for e-design environment.

DTIC

*Computer Aided Design; Medical Personnel; Robotics*

**20080025500** Palo Alto Inst. for Research and Education, Inc., Palo Alto, CA USA

**Interchromosomal Associations that Alter Nf1 Gene Expression can Modify Clinical Manifestations of Neurofibromatosis 1**

Hoffman, Andrew R; Sep 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0695

Report No.(s): AD-A479323; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have described a new form of epistasis in which direct, long range, physical interactions between genes, or gene-gene interactions mediated by specialized DNA binding proteins such as CTCF, lead to modification of phenotypic read-out. Using the associated chromatin trap (ACT) and chromosome conformation capture (3C) assays which are designed to assess physical propinquity, we investigated long range interactions of the human NF1 gene that are mediated by CTCF in normal cultured cells. Using chromosome immunoprecipitation, we found multiple CTCF binding sites on NF1 in cultured cells. We explored long range chromatin associations with each of 7 CTCF binding sites and identified 14 distinct long range interactions. Among the genes that were physically associated with NF1 (which is on chromosome 17) was ARF4 (ADP-ribosylation factor 4, a member of the RAS superfamily involved in membrane traffic, signal transduction and organelle integrity on chromosome 3p14.3. The relative expression of ARF4 was increased several-fold in cells from patients with neurofibromatosis compared to normal cells, suggesting that the interchromosomal interactions of NF1 regulate gene expression on chromosome 3p14.3. It will be of interest to study the potential contribution of these associated genes to the pathophysiology and clinical manifestations of neurofibromatosis 1.

DTIC

*Fibrosis; Gene Expression; Genes*

**20080025501** Moffitt (H. Lee) Cancer Research Inst., Tampa, FL USA

**Project INSPIRE-HBCU Undergraduate Collaborative Summer Training Program to Inspire Students in Prostate Cancer Research**

Kumar, Nagi; Feb 2008; 92 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0295

Report No.(s): AD-A479325; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall goal of Project INSPIRE is to provide continuum of opportunities including didactic and meaningful research experience and training in basic, biomedical, clinical and/or population sciences research for promising undergraduate students enrolled at Florida A & M University (FAMU), who are at an important career-decision-making point, in a host institution such as the Moffitt Cancer Center (MCC), with an established record of achievement in prostate cancer research, that will lead to attracting this group into careers that focus on prostate cancer research. The objectives outlined for this project will be completed in three years. As proposed, we recruited 4 students from FAMU during the summer of 2007, which were matched with their mentors and all completed the program as proposed. Four pilot projects and research reports were completed by the interns in the program and 2 scholarly abstracts were presented at a National scientific meeting. All 4 students have demonstrated interest in graduate study to continue their work with prostate cancer and efforts continue to enable this endeavor.

DTIC

*Cancer; Death; Education; Estimates; Prostate Gland; Students; Summer*

**20080025502** New York Medical Coll., Valhalla, NY USA

**Estrogen Mobilizes Circulating Bone Marrow Progenitor Cells to Promote Tumor Neovasculture: Lessons from Ischemic Model Provide a Novel Breast Cancer Target**

Tiwari, Raj K; Sep 1, 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0684

Report No.(s): AD-A479328; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancer growth and metastases is dependent on neovasculture. The cells that actually trigger the formation of new blood vessels are poorly characterized but it has been hypothesized that some of the precursor blood vessel cells originate in

the bone marrow and then home to tumor tissues. Although estrogen is a major stimulus, its role as a bone marrow originating endothelial cell mobilizing agent has not been demonstrated. We propose to test the proposition whether estrogen can mobilize circulating bone marrow derived progenitor endothelial cells (EPCs) to the implanted tumor using Green fluorescence protein, GFP, tagged EPCs. The objectives of the proposed study are two fold: A) Establishment of proposed Animal model using normal and OVX (ovariectomized) female BALB/c mice and examine if estrogen can indeed mobilize the EPCs for the generation of new blood vessels. B) To elucidate the contribution of E2-mobilized, BM-derived EPC in promoting neo-vascularization in implanted breast tumor. The mechanism of E2-induced mobilization of EPC from the bone marrow will open a new area of BrCa research and hence novel targets. Moreover, BM-EPCS could potentially serve as the ‘Trojan horse’ to deliver bio-molecules that disrupt tumor vasculogenesis and/or induce targeted killing of tumor cells. Thus this novel basic concept has clinical potential.

DTIC

*Bone Marrow; Breast; Cancer; Circulation; Estrogens; Ischemia; Mammary Glands; Targets; Tumors*

**20080025503** Kenya Medical Research Inst., Nairobi, Kenya

**Military-Relevant Infectious Diseases Endemic to Kenya: Epidemiology, Immunology, Pathophysiology, Treatment, and Prevention**

Koech, Davy K; Mar 2007; 23 pp.; In English

Contract(s)/Grant(s): DAMD17-02-2-0022

Report No.(s): AD-A479334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The mission of USAMRU-K is to develop and test improved means for predicting, preventing and treating worldwide infectious disease threats to deployed U.S. military personnel. USAMRU-K is heavily involved in global surveillance, training, research in drug and vaccine development, and response to emerging infectious disease threats. These activities are undertaken in research laboratories and field stations in locations where Malaria, HIV/AIDS, leishmaniasis, Rift Valley Fever virus, Chikungunya virus, enteric pathogens, and other military-relevant infectious diseases are prevalent and their transmission rates are high. Malaria drug and vaccine trials executed at the Kombewa field site to provide valuable information to inform protective strategies for the warfighter. During this 2 year extension to the Cooperative Agreement, USAMRU-K's ability to successfully execute clinical studies has been enhanced by the utilization of new state-of-the-art laboratories. The co-location of these modern clinical research facilities within high disease endemicity areas has positioned USAMRU-K as a preferred site for future vaccine, drug, and other interventional trials.

DTIC

*Epidemiology; Health; Immunology; Infectious Diseases; Kenya; Military Personnel; Prevention*

**20080025504** Howard Univ., Washington, DC USA

**A Partnership Training Program in Breast Cancer Research Using Molecular Imaging Techniques**

Wang, Paul C; Jul 2007; 55 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0291

Report No.(s): AD-A479336; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the second year five faculty members and a research assistant were further trained in molecular imaging of breast cancer through seminars and workshops and are currently conducting two research projects with the faculty at Johns Hopkins University. We have perfected the technique of constructing a dual imaging probe for MRI and fluorescent imaging by linkage of near-infrared fluorescently labeled transferring on the surface of contrast agent encapsulated cationic liposomes. The dual probe not only enhances the tumor MR image contrast but is also an excellent probe for optical imaging. We have established three breast cancer tumor models including subcutaneous xenografts mammary gland xenografts and lung metastasis in nude mice using luciferase-expressing MDA-MB-231-luc cells. Metastatic lesion of 0.3-0.5 mm in diameter could be clearly detected by MRI or optical imaging in vivo. We have found that when MCF-7 cells are co-cultured with activated THP-1 macrophages they caused an increase in PTEN expression. MIF expression is dramatically induced in MCF-7 cells when they are co-cultured with macrophages. We have published three papers and another paper is in press. We have given six presentations in conferences. We received two new grants and five other grant applications are pending. We have recruited a new faculty member to join the project. A research assistant supported by this grant received her undergraduate degree in Biology at the Howard University with summa cum laude. The Molecular Imaging Lab continuously served as a synergic center on campus for promoting molecular imaging research. New research collaborations were established among the faculty at Howard as well as with the external scientists from Georgetown University and NIH.

DTIC

*Breast; Cancer; Education; Images; Imaging Techniques; Mammary Glands; Medical Science*

**20080025506** Wake Forest Univ., Winston-Salem, NC USA

**Contribution of AMACR and Phytanic Acid to Prostate Cancer Risk Among African Americans in North Carolina**

Chang, Bao-Li; Feb 14, 2008; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0245

Report No.(s): AD-A479339; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several lines of evidence have suggested genetic and dietary differences may be important in PCa particularly among AA (African American) men. In this study we aim to test the hypothesis that mutations/sequence variants in the AMACR gene and dietary intake of foods rich in phytanic acid increase the risk to PCa among AA men. We will conduct a population based study by ascertaining 250 AA men who have PCa and 250 race age and county-matched controls from eight counties of North Carolina. We are in the process of carrying out the 1st task study subject recruitment through the year 2008. In the past funding year we have expanded our study area and significantly increased our rate of subject recruitment. Additionally we have also obtained additional grant funding related to the science of this project which will help provide independent confirmation of the findings from this study in a different study population. The results from this study as well as other future studies based on this study population will greatly increase our knowledge for potential risk factors and suggest potential preventive strategies for prostate cancer in AA men.

DTIC

*Africa; Cancer; Prostate Gland; Risk*

**20080025510**

**JP8 Induced Mutagenesis and Hormesis**

Kale, Purushottam; Mar 13, 2008; 11 pp.; In English

Contract(s)/Grant(s): FA9550-05-01-0053

Report No.(s): AD-A479350; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In order to test the phenomenon of JP8 induced hormesis and mutagenesis in *Drosophila*, several experiments were performed using samples over 5000 individuals in each experiment. The JP8 doses were progressively decreased from 5 microliters to 0.5 microliters in 1000 milliliters of air. Exposures were for 12 hours and survival was counted after 10 days. At a dose of 5 microliters, the survival was 80% which increased (or lethality decreased) at lower doses. Below this dose, there was no significant decrease in the survival. Still lower doses need to be tested to investigate if there is a hormetic dose at lower levels. Mutagenicity experiments did demonstrate that the JP8 is mutagenic in all germ cell stages of *Drosophila*.

DTIC

*Aircraft Fuels; Mutagenesis; Mutagens*

**20080025515** Chicago Univ., Chicago, IL USA

**ProCEED Pilot Study (Prostate Cancer Study of Ethnicity, Exercise and Diet)**

Wallace, Katrine L; Dec 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W61XWH-06-1-0180

Report No.(s): AD-A479366; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The second year (2007) of ProCEED study funding was dedicated to subject enrollment. Interim results are available for most parameters except those that were planned to be analyzed at study end. At the end of the reporting period, there were 62 patients enrolled (56 prostate cancer cases and 6 controls). Among the 62 patients there was a 79% subject retention rate for the dietary follow-up calls. Interim analyses indicate that the study sample thus far is elderly, obese, and predominantly African-American. Among the prostate cancer cases most of the cases were diagnosed in stage T2 and had Gleason scores of 7 or less. The most frequently used prostate cancer treatment was hormonal therapy. The third year (2008) of funding will be dedicated to: continued subject enrollment, dietary analyses, laboratory assays, statistical analysis, and a written summary.

DTIC

*Cancer; Diets; Ethnic Factors; Physical Exercise; Prostate Gland*

**20080025516** Sloan-Kettering Inst. for Cancer Research, New York, NY USA

**Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer**

Robson, Mark E; Jul 1, 2005; 16 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0325

Report No.(s): AD-A479367; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Women with hereditary breast cancer are at high risk for contralateral breast cancer (CBC). To evaluate factors influencing

CBC risk in women with BRCA mutations the funded study was designed to assess the impact of tamoxifen and radiotherapy on CBC. Records from a total of 874 Ashkenazi women with breast cancer diagnosed between 1990 and 1996 were reviewed to expand the initial cohort of 305 women treated between 1980 and 1990. Changes in medical record storage and HIPAA privacy regulations prevented the gathering of required basic clinical and/or follow-up information for an unacceptably large proportion of subjects. Because of the significant loss of patients to follow-up and lack of pathology material for genotyping alternative methods of attaining the study goals were sought. Specifically concatenation of the original 1980-1990 data-set with a similar ascertainment from another institution was performed and suggested a 53% contralateral risk reduction with adjuvant tamoxifen. A further 103 patients undergoing breast-conserving treatment were analyzed. This clinical ascertainment did not clearly support a benefit from tamoxifen (HR 0.71, 95% C.I. 0.23-2.2). However an expansion of the clinical ascertainment did suggest a benefit from tamoxifen (HR 0.37, 95% C.I 0.35) and no negative effect from radiation.

DTIC

*Breast; Cancer; Estrogens; Females; Mutations; Pharmacology; Radiation Therapy; Risk*

**20080025522** Duke Univ., Durham, NC USA

**Novel Gbeta Mimic Kelch Proteins (Gpb1 and Gpb2 Connect G-Protein Signaling to Ras via Yeast Neurofibromin Homologs Ira1 and Ira2. A Model for Human NF1**

Heitman, Joseph; Harashima, Toshiaki; Mar 2007; 19 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0208

Report No.(s): AD-A479389; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Neurofibromatosis type 1 (NF1) gene encodes a large tumor suppressor protein neurofibromin which is a Ras GTPase-activating protein (RasGAP) activity. Although the NF1 gene was identified over a decade ago the biological roles of neurofibromin in cellular processes remain unclear. Therefore it is crucial for therapy and developing new drugs for NF1 patients to elucidate how the RasGAP activity of neurofibromin is controlled. To achieve this goal it is also important to identify regulatory elements for neurofibromin. We are investigating the molecular mechanisms by which the Ras GAP activity of the yeast neurofibromin homologs Ira1/2 is regulated as a model to understand human NFI. We have found that the kelch Gb subunit mimics Gpb1/2 interact with Ira1/2 and control the Ras GAP activity of Ira1/2. Hem we found that the Gpb1/2 proteins are localized to the cell membrane in a Gpa2 dependent manner and function at the cell membrane. Gpb1/2 bind to the C-terminus of Ira1/2 and stabilize the Ira1/2 proteins. Moreover we also identified a Gpb1/2 binding domain near the C-terminus of Ira1/2 (GBD) that is significantly conserved in neurofibromin homologs including a human counterpart. Therefore, similar regulatory mechanisms might be conserved in evolution.

DTIC

*Diseases; Genetics; Proteins; Yeast*

**20080025524** Colorado State Univ., Fort Collins, CO USA

**Prevention of Radiation-Induced Breast Cancer by Amifostine**

Weil, Michael M; Dec 2007; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0460

Report No.(s): AD-A479391; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project is a pre-clinical study designed to determine if amifostine might be effective in preventing breast cancer initiation by medical exposures to ionizing radiation. The experiments will determine if amifostine is protective in a murine model of breast cancer and, if so, determine the optimum dose, route and timing for its administration. The first year's objective was to test a high dose of amifostine administered I.P. prior to irradiation for reduction of ductal dysplasia in an outgrowth assay. Between September 2002 and May 2003, twenty-two donor mice were irradiated and 412 mammary fat pads were transplanted with mammary epithelial cells from these irradiated donors. Of these, 306 were harvested and examined as whole mounts. No dysplasias were seen, but due to the low outgrowth frequency no conclusions could be drawn on the effectiveness of amifostine. In August 2003 the PI moved from M.D Anderson Cancer Center to Colorado State University and experienced a delay of nearly 2 years in having the grant transferred. During this time, breeding pairs of mice aged past their useful age. The project resumed in August 2005 with the establishment of a new breeding colony. An additional 116 mice were transplanted (232 fat pads) and outgrowths prepared for histology. Once again, there were few outgrowths and it was decided to switch from ductal dysplasia to frank mammary tumors as the experimental endpoint. A new Statement of Work was submitted in January 2007 and approved mid-April 2007. 294 mice divided into three groups: irradiated, irradiated and amifostine treated and unirradiated, were set up on June 1, 2007 and are being followed for mammary tumor development.

DTIC

*Breast; Cancer; Drugs; Growth; Irradiation; Mammary Glands; Prevention*



**20080025525** Dana Farber Cancer Inst., Boston, MA USA

**Mouse Orthotopic Xenographs of Human Prostate Primary Tumors**

Loda, Massimo; Priolo, Carmen; Nov 2007; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0053

Report No.(s): AD-A479394; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We implanted human prostate carcinomas either shortly after collagenase digestion or as tissue fragments obtained at surgery. We also genetically characterized tumors at harvesting and after growth in the murine host to determine if the proposed model maintains its initial genetic characteristics. After several trials in the orthotopic and subrenal capsule loci, we have implanted and begun to characterize by TMPRSS-ERG FISH and aCGH, 22 human primary prostate tumors. Results thus far show that the tumor take of prostate cancer in the subrenal capsule of mice is about 60%. Almost 80% of high grade human prostate tumors grow, whereas tumors with intermediate grade of differentiation are favored to grow if they show a high proliferation rate. By measuring serum PSA levels we can discriminate mice in which tumor xenografts grow from those in which growth of xenografts failed. Preliminary results showed that subrenal capsule xenografts maintain the same genetic background of the original parental human tumors from which they are derived. We are currently in the process of completing the genetic analysis of human tumors (with relative normals) and xenografts, to finalize our results.

DTIC

*Cancer; Mice; Prostate Gland; Tumors*

**20080025527** Walter Reed Army Inst. of Research, Silver Spring, MD USA

**Mild Traumatic Brain Injury in U.S. Soldiers Returning from Iraq**

Hoge, Charles W; McGurk, Dennis; Thomas, Jeffrey L; Cox, Anthony L; Engel, Charles C; Castro, Carl A; Jan 31, 2008; 12 pp.; In English

Report No.(s): AD-A479403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Background: An important medical concern of the Iraq war is the potential long-term effect of mild traumatic brain injury, or concussion, particularly from blast explosions. However, the epidemiology of combat-related mild traumatic brain injury is poorly understood. Methods: We surveyed 2525 U.S. Army infantry soldiers 3 to 4 months after their return from a year-long deployment to Iraq. Validated clinical instruments were used to compare soldiers reporting mild traumatic brain injury, defined as an injury with loss of consciousness or altered mental status (e.g., dazed or confused), with soldiers who reported other injuries. Results: Of 2525 soldiers, 124 (4.9%) reported injuries with loss of consciousness, 260 (10.3%) reported injuries with altered mental status, and 435 (17.2%) reported other injuries during deployment. Of those reporting loss of consciousness, 43.9% met criteria for post-traumatic stress disorder (PTSD), as compared with 27.3% of those reporting altered mental status, 16.2% with other injuries, and 9.1% with no injury. Soldiers with mild traumatic brain injury, primarily those who had loss of consciousness, were significantly more likely to report poor general health, missed workdays, medical visits, and a high number of somatic and postconcussive symptoms than were soldiers with other injuries. However, after adjustment for PTSD and depression, mild traumatic brain injury was no longer significantly associated with these physical health outcomes or symptoms, except for headache. Conclusions: Mild traumatic brain injury (i.e., concussion) occurring among soldiers deployed in Iraq is strongly associated with PTSD and physical health problems 3 to 4 months after the soldiers return home. PTSD and depression are important mediators of the relationship between mild traumatic brain injury and physical health problems.

DTIC

*Brain Damage; Health; Iraq; Personnel*

**20080025528** Mount Sinai School of Medicine, New York, NY USA

**Prostate Cancer Survivors With Rising PSA and Their Spouses: Treatment Decision Making and Quality of Life**

Diefenbach, Michael A; Dec 2007; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0194

Report No.(s): AD-A479405; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study involves patients and their spouses/partners who are attending two cancer centers: the Deane Prostate Health and Research Center in the Department of Urology at Mount Sinai Hospital, New York City and the Department of Medical Oncology at Fox Chase Cancer Center, Philadelphia. Patients will have been diagnosed with rising PSA but have no clinical evidence of cancer. Eligible patients and their spouse/partners who have agreed to participate (n = 191) will take part in a 12-months long assessment study. During this time, they will be interviewed via questionnaires four times: at the beginning (baseline), at 6-months, at 12-months and when they have made a treatment decision. Our research focus and the measures used for data collection are guided by our cognitive-social health information processing (CSHIP) theoretical framework. This

framework incorporates individuals' experiences, expectations, beliefs, values, and emotional responses to a health threat, and sees these components as influential factors in treatment decision making. Both the patient and the spouse/partner will be assessed. Due to the limited patient enrollment, no significant findings can be reported at this time.

DTIC

*Cancer; Decision Making; Patients; Prostate Gland; Therapy*

**20080025530** Johns Hopkins Univ., Baltimore, MD USA

**Interaction Between Dietary Factors and Inflammation in Prostate Carcinogenesis**

De Marzo, Angelo M; Dec 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0138

Report No.(s): AD-A479408; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We are investigating whether inflammation can enhance prostate carcinogenesis in a rat model of dietary charred meat carcinogen induced cancers, and, whether antioxidant and other chemopreventative compounds can reduce prostate cancer in this model. In this period we have extended our rat studies to show that PhIP will cause prostatic intraepithelial neoplasia in the mouse, providing a greatly enhanced ability to study molecular mechanisms of PhIP induced prostate carcinogenesis and for prevention of prostate cancer induced by PhIP. We have also begun to extensively characterize another mouse model of prostate cancer that we will also be able to use in studies of PhIP induced prostate cancer and prevention. Finally, we have begun to extend our studies to understanding the molecular mechanisms of PhIP induced prostate cancer by developing an assay to detect CpG dinucleotide hypermethylation in the rat GSTP1 promoter. These studies set the stage for us to complete all of our stated aims in year 3 of this proposal.

DTIC

*Cancer; Carcinogens; Diets; Prevention; Prostate Gland; Tumors*

**20080025533** Brigham and Women's Hospital, Boston, MA USA

**Genomic Approaches for Detection and Treatment of Breast Cancer**

Elledge, Stephen J; Jul 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0197

Report No.(s): AD-A479428; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A key part of our research plan has been the development and use of retroviral vectors expressing RNA interference RNAs to identify human genes involved in causing or restraining cancer. In our first progress reports we described our efforts to develop shRNA libraries and showed they could be used to identify tumor suppressors. Ultimately our goal is to screen of complex pools of shRNA expressing retroviruses each marked with a bar code that allows the results of the screen to be read out by microarray hybridization. We demonstrated this could be accomplished in enrichment screens for shRNAs that caused cellular transformation and growth in soft agar. However, a key goal has been to identify shRNAs that debilitate or kill cancer cells. In order for this to be possible in complex pools, it is imperative that each vector knock down its target with high penetrance. We have successfully achieved this level of knockdown and can now see particular shRNA expressing viruses drop out of complex pools.

DTIC

*Breast; Cancer; Genome; Mammary Glands*

**20080025534** University of the Sciences in Philadelphia, Philadelphia, PA USA

**Enhancing Tumor Drug Delivery by Laser-Activated Vascular Barrier Disruption**

Chen, Bin; He, Chong; Dec 2007; 58 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0148

Report No.(s): AD-A479429; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An obstacle for successful drug therapy for cancer is the existence of drug delivery barriers, which causes insufficient drug delivery to the tumor tissue. Because of inadequate drug delivery to the tumor tissue, the drug dose has to be increased, which leads to normal tissue toxicity. This delivery problem not only limits the clinical application of existing chemotherapeutics, but also decreases the effectiveness of many new drugs under development for prostate cancer. We found that vascular targeting photodynamic therapy (PDT), a modality involving the combination of a photosensitizer and laser light, is able to disrupt tumor vascular barrier, a significant hindrance to drug delivery. Therefore, tumor accumulation of circulating molecules is significantly enhanced, as demonstrated by intravital fluorescence microscopy and whole-body fluorescence imaging techniques. Immunofluorescence staining of endothelial cytoskeleton structure further indicates microtubule

depolymerization, stress actin fiber formation and intercellular gap formation. Based on these results, we propose to use this laser-based therapy to enhance anticancer drug effectiveness. PDT is currently in worldwide multicenter clinical trials for the localized prostate cancer therapy. The available results indicate that PDT employing advanced laser fiber technology and sophisticated light dosimetry is able to treat localized prostate cancer in an effective and safe way. The combination of photosensitization with current chemotherapy or other new drug therapies will greatly improve clinical treatment for localized prostate cancer patients that accounts for more than 90% of total prostate cancer population.

DTIC

*Cardiovascular System; Chemotherapy; Drugs; Lasers; Tumors*

**20080025537** Iowa Univ., Iowa City, IA USA

**ErbB2 Trafficking and Signaling in Human Vestibular Schwannomas**

Hansen, Marlan; Nov 22, 2007; 5 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0673

Report No.(s): AD-A479433; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the first year of the award we have made substantial progress in achieving the aims of the proposal. I will discuss the progress for each aim of the proposal. Determine the ability of merlin to regulate ErbB2 localization and activity in vestibular schwannoma (VS) cells. Until recently we were unable to use human vestibular schwannoma (VS) specimens while we were working to obtain Human Subjects approval. During this period, we focused on correlating the status of merlin phosphorylation with ErbB2 trafficking in normal Schwann cells (SCs). First, we determined that the trafficking of ErbB2 into lipid rafts in SCs correlates with loss of axonal contact, phosphorylation of merlin on Serine 518, and proliferation (Figs 1 and 2). Thus, phosphorylation of merlin on Serine 518 (S518), which inhibits its growth suppressive function, is correlated with the movement of ErbB2 into lipid rafts in the cell membrane. We have previously shown that ErbB2 constitutively resides in lipid rafts in human vestibular schwannoma cells that lack functional merlin (Brown and Hansen, *Otology & Neurotology*, in press). Since we did not initially have approval to work with human VS specimens, we worked on subcloning various merlin constructs, including those with S518 mutations, into adenoviral vectors. This will allow us to directly test the role of merlin in regulating the trafficking of ErbB2 in human vestibular schwannoma cells. Recently the Dept. of Defense and the Univ. of Iowa concurred that the project did not require IRB approval since it did not qualify as Human Subjects research and in the coming year we will be able to determine the extent to which replacement of merlin in human vestibular schwannoma cells regulates the trafficking of ErbB2 within the cell membrane.

DTIC

*Adenoviruses; Phosphorylation; Vestibules*

**20080025558** Army War Coll., Carlisle Barracks, PA USA

**Injury Prevention as a Combat Multiplier**

Butler, Nikki L; Mar 24, 2008; 35 pp.; In English

Report No.(s): AD-A479579; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is no secret that health care costs in the USA are sky rocketing. Over 97% of those costs focus on the 'restorative' aspect of health care as opposed to the 3% spent on preventative measures. The Army mirrors society and therefore, the same statistics are applicable to the Army's health care dilemma. According to Keith Hauret, a leading epidemiologist for the Army's injury prevention program, overuse injuries across the military account for more than 8 million days of limited duty a year. With recruiting efforts falling short, the Army can ill-afford to have a significant portion of its members incapable of performing their duties due to injuries. Controlling injuries is a high priority across the Department of Defense (DoD) as evidenced by the emphasis on prevention in the 2006 Quadrennial Defense Review, the DoD Directive 6200.4 (Force Health Protection) and the DoD Force Health Protection Capstone Document. The purpose of this paper is to illustrate the importance of a comprehensive injury prevention program that studies potential recruits and their risk for injury, analyzes current injury rates, examines existing training programs and recommends system-wide changes to mitigate the impact of these injuries.

DTIC

*Combat; Injuries; Medical Services; Military Personnel; Multipliers; Prevention*

**20080025639** NASA, Washington, DC USA

**Method and apparatus to assess compartment syndrome**

Ueno, Toshiaki, Inventor; Hargens, Alan R., Inventor; Yost, William T., Inventor; June 3, 2008; 12 pp.; In English  
Patent Info.: Filed August 2, 2004; US-Patent-7,381,186; US-Patent-Appl-SN-10/911,755; No Copyright; Avail.: CASI:  
A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025639>

A method and apparatus for measuring pressure buildup in a body compartment that encases muscular tissue. The method includes assessing the body compartment configuration and identifying the effect of pulsatile components on at least one compartment dimension. This process is used in preventing tissue necrosis, and in decisions of whether to perform surgery on the body compartment for prevention of Compartment Syndrome. An apparatus is used for measuring excess pressure in the body compartment having components for imparting ultrasonic waves such as a transducer, placing the transducer to impart the ultrasonic waves, capturing the reflected imparted ultrasonic waves, and converting them to electrical signals, a pulsed phase-locked loop device for assessing a body compartment configuration and producing an output signal, and means for mathematically manipulating the output signal to thereby categorize pressure build-up in the body compartment from the mathematical manipulations.

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

*Compartments; Pressure Measurement; Phase Locked Systems; Tissues (Biology); Muscles*

**20080025664** Institute of Space Medico-Engineering, Beijing, China

**Space Medicine and Medical Engineering, Vol. 21, No. 2**

Wang, Yong-zhi, Editor; Grigoriev, A. I., Editor; White, Ronald J., Editor; Wang, Xi-ji, Editor; Yu, Meng-sun, Editor; Qi, Fa-ren, Editor; Wei, Jin-he, Editor; Chen, Shan-guang, Editor; Wang, Xian-min, Editor; Bai, Jing, Editor; Bai, Yan-qing, Editor; Sun, Xi-qing, Editor; Hong, Feng, Editor; Su, Hong-yu, Editor; Jiang, Shi-zhong, Editor; April 2008; ISSN 1002-0837; 84 pp.; In Chinese; See also 20080025665 - 20080025681; Original contains black and white illustrations; CN 11-2774/R; Copyright; Avail.: Other Sources

The contents include: 1) Analysis of Kaolin Intake in Rats Subjected to Different Motion Stimulations; 2) Effects of Short- and Mid-term Tail Suspension on Renin-Angiotensin System in Renal Tissue of Rat; 3) Ameliorated Effects of High Frequency Sinusoidal Vibration Given to Soleus Muscle on H Reflex in Rats under Tail Suspension; 4) Effects of Digoxin on Cardioventricular Function in Rats after Simulated Weightlessness; 5) Effects of Mild and Moderate Acute Hypobaric Hypoxia on Manual Performance; 6) Synthetic Evaluation Method of Mental Workload on Visual Display Interface in Airplane Cockpit; 7) Effects of Digestive Load from Senna on the Adaptive Thermogenesis in Hypothyroid Rat; 8) Effects of Matrigel on the Morphogenesis of Amniotic Fluid-Derived Mesenchymal Stem Cells in Vivo; 9) Construction and Identification of Interference Plasmid Targeting in RACK1; 10) Mechanism of Biological Effects of ELF Pulsed Electromagnetic Wave on Cells; 11) Study on the Method of Recurrence Quantification Analysis (RQA) to Recognize the Amount of Human Bodies in Bioradar Echo Signals; 12) Measurement of the Diffusion Property of Water Molecules Based on Magnetic Resonance Diffusion Weighted Spectroscopy; 13) Envelope Extraction of Heart Sounds Based on Hilbert-Huang Transform; 14) Circuit Simulation of Dynamic Model of Ca(2+) in Myocardial Cell; 15) Recognition and Removal of Artifacts in EEG Recording with Adaptive Infomax Algorithm of Independent Component Analysis; 16) A Programmable and Implantable Neuro-Stimulator; and 17) Design of Simple Integral Coefficient Notch Filter to Remove Power-Line Interference in High Sampling Rate.

CASI

*Aerospace Medicine; Bioengineering; Life Sciences; Pharmacology*

**20080025665** Xidian Univ., Xian, China

**Mechanism of Biological Effects of ELF Pulsed Electromagnetic Wave on Cells**

Zhou, Yong-jun; Niu, Zhong-qi; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 121-125; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

Objective: To meet the demand of ECG signal processing in high sampling rate, a simple and narrowband power-line interference notch filter: is designed. Methods: Based on the band elimination filter which was combined with counteraction of zeros and poles and the interpolation theory, we designed a simple, integral coefficient filter with adjustable filter bandwidth. To eliminate the Gibbs phenomena, we adopted the average filter in linear segments which was designed by the former. Results: With our designed filter, 50 Hz power-line interference in high sampling rate was efficiently removed, and the filter coefficients were simple, integral, and convenient. Conclusion: The new design can produce a narrowband notch filter in high

sampling rate, remove the 50 Hz powerline interference effectively, and retain the significant signal as much as possible to meet the needs of ECG analysis.

Author

*Electrocardiography; Biological Effects; Signal Processing; Bandwidth; Gibbs Phenomenon; Extremely Low Frequencies*

**20080025666** Institute of Space Medico-Engineering, Beijing, China

### **Construction and Identification of Interference Plasmid Targeting in RACK1**

Zou, Yan; Lu, Fang; Liu, Yan-you; Wang, Yu-hui; Gan, Lu; Fu, Tian-ming; Wang, Zheng-rong; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 117-120; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

To construct highly efficient interference plasmid targeting in RACK1 (Mouse Gnb211 gene), and make a basis for studying the function of RACK1. Two interference sites of mouse Gnb211 gene were selected by using M-folder bio-software, and two interference fragments according to the selected sequences and one negative-control fragment were synthesized, then they were cloned into the pGenesil-1 plasmid. After the plasmids were extracted and sequenced, they were subsequently transfected into NIH3T3 cells. The interference efficiency of the plasmid on the target gene was detected by RT-PCR. RT-PCR showed that the level of Gnb211 mRNA in NIH3T3 cells contained interference plasmids was 58% and 7% of no-load group, respectively, and mRNA expression in negative-control plasmid group and no-load group were coincidence. It was suggested that the interference efficiency was above 90% due to pGenesil-1/Gnb211- Pi interference plasmid. The highly efficient interference plasmid against Mice Gnb211 gene had been constructed and identified successfully, which may provide a basis for studying the functional connection between RACK1 and partner molecular.

Author

*Plasmids; Proteins; Genes; Receptors (Physiology); Sequencing; Gene Expression; Ribonucleic Acids*

**20080025667** Institute of Space Medico-Engineering, Beijing, China

### **Recognition and Removal of Artifacts in EEG Recording with Adaptive Infomax Algorithm of Independent Component Analysis**

Gao, Li; Huang, Li-yu; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 142-146; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

Objective: To find a new approach to recognize and remove the artifacts from different sources in EEG recording. Methods: Infomax algorithm of independent component analysis and threshold set of nonlinear parameters were combined. The self-adaptive algorithm was firstly improved, and nineteen-channel Electroencephalograms (EEGs) which included electromyogram, eye-movement and some other artifacts, were decomposed with self-adaptive infomax algorithm. Then three parameters were calculated with nonlinear analysis for all the independent components, and artifacts could be identified automatically by the threshold settings. At last, after all the artifacts were removed, the rest components were projected to the scalp electrodes, and the clear EEGs can be obtained. Results: It was showed that the various artifacts could be recognized and separated from the EEGs successfully with self-adaptive infomax algorithm on the basis of blind source separation technique, and removal of artifacts could be realized with signal reconstruction. Conclusion: Self-adaptive infomax algorithm is a potential approach to remove artifacts in physiological signal.

Author

*Electroencephalography; Algorithms; Eye Movements; Physiology; Electromyography*

**20080025668** Institute of Space Medico-Engineering, Beijing, China

### **Effects of Mild and Moderate Acute Hypobaric Hypoxia on Manual Performance**

Hu, Hui-min; Xiao, Hua-jun; Ding, Li; Chen, Shou-ping; Yang, Chun-xin; Qin, Zhi-feng; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 97-102; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

Objective: To explore the effects of mild and moderate acute hypobaric hypoxia on manual performance. Methods: Using hypobaric chamber to simulate hypoxia conditions and devising 4 kinds of objective ergonomic testing items (Insert kicks into holes-board, ISIHB; nut-bolt assembly task, NBAT; shape discrimination, SD; and Grip strength, GS including fatigue and tolerance) and one subjective research item (questionnaire subjective sense) to examine manual work efficiency varieties of 9 subjects exposed to a hypobaric chamber with 5 simulated altitudes (3500, 4,000, 4500, 5,000 and 5500 m), for (25+/-5) min. Results: Compared to control group (50 m, the altitude of Beijing): Accomplish time (AT) performance of ISIHB and NBAT significantly decreased ( $P < 0.01$ ) at five simulated altitudes. At 5,000 m and 5500 m they decreased further intensified ( $P < 0.001$ ). However, at 4500 m both of these two indexes were less decreased than that of 4 000 m; Reaction time (RT), RT performance and synthetical (correct reaction rate and RT, CR-RT) performance of SD changed significantly ( $P < 0.01$ ) at five

simulated heights; GS (maximal GS) performance only significantly decreased at 4,000 m and 5500 m. Fatigue performance never changed prominently. Tolerance (maximal GS and fatigue) performance decreased remarkably ( $P < 0.05$ ) at 5,000 m and 5500 m; Subjective Sense changed significantly at five simulated heights. With the altitude getting higher, the score of subjective sense increased steadily. Conclusion Mild and moderate acute hypobaric hypoxia significantly impairs manual performance. ISIHB, NBAT, SD and Subjective Sense are all more sensitive to hypoxia, and their work efficiency all significantly decreases at five simulated heights. Tolerance performance is less sensitive to hypoxia and significantly decreased only at 5,000 m and 5500 m.

Author

*Hypoxia; Reaction Kinetics; Reaction Time*

**20080025669** Peking Univ., China

### **Measurement of the Diffusion Property of Water Molecules Based on Magnetic Resonance Diffusion Weighted Spectroscopy**

Gao, Song; Zhang, Huai-ling; Bao, Shang-lian; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 130-133; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

Objective: To investigate the diffusion coefficient of water molecules using magnetic resonance (MR) diffusion weighted spectroscopy (DWS) with normal medical magnetic resonance device. Methods: Two powerful diffusion gradient magnetic fields were applied before the second and after the third  $\pi/2$  radio frequency pulses respectively in the stimulated echo acquisition mode (STEAM) pulse sequence. A MR spectroscopy phantom was scanned in a conventional 3.0 Tesla MR scanner. The different diffusion weighting values were achieved by keeping the strength of diffusion gradient magnetic fields fixed and varying the time between the two diffusion gradient magnetic fields. The water suppression process in STEAM sequence was ignored. Results: The signal/noise ratio of water signal in the spectra was high even with heavy diffusion weighting. The effect of diffusion weighting on the calculated apparent diffusion coefficients of water was not significant ( $P > 0.05$ ). Conclusion: It is feasible to implement the DWS pulse sequence in conventional MR system to investigate the diffusion property of water molecule, furthermore the results are not dependent on diffusion weighting.

Author

*Diffusion Coefficient; Molecules; Water; Signal to Noise Ratios; Radio Frequencies; Molecular Diffusion; Magnetic Resonance*

**20080025670** Fourth Military Medical Univ., Xi'an, China

### **Analysis of Kaolin Intake in Rats Subjected to Different Motion Stimulations**

Kang, Wen-bo; Dong, Yu-lin; Zhang, Fu-xing; Li, Jin-lian; Li, Yun-qing; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 79-83; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

Objective: To analyze the efficacy of kaolin intake amount as an index for motion sickness (MS) induced by different motion patterns stimulating the vestibular receptors of rats. Methods: Rats were randomly divided into 5 groups. Three groups were subjected to one of the following stimulations, respectively-linear acceleration along either the interaural axis (IA) or body axis (AP), and double rotation (DR) stimulation. Other 2 groups were used as control. Kaolin intake was recorded for consecutive 6 d, 3 d before and 3 d after stimulation, and the data were statistically analyzed. Results: It was found that :1) following IA, AP and DR stimulations, 25%, 17% and 58% of the rats in each group increased mean kaolin intake by 1 g in the 3 d phase post-stimulation compared with that in the same duration of pre-stimulation, respectively; 2) in contrast to some previous reports, the present observation showed that high level of kaolin intake post-stimulation may persist for more than one day. Conclusion: All 3 types of stimulation methods can serve as ways of specifically stimulating vestibular end-organs to induce kaolin intake increase, and double rotation is the most effective.

Author

*Motion Sickness; Rats; Stimulation; Rotation*

**20080025671** Institute of Space Medico-Engineering, Beijing, China

### **Ameliorated Effects of High Frequency Sinusoidal Vibration Given to Soleus Muscle on H Reflex in Rats under Tail Suspension**

Yang, Wei; Fan, Xiao-li; Zhang, Hao; Song, Xin-ai; Li, Qiang; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 88-92; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

Objective: To observe the changes in excitability of alpha-motoneuron responding to the muscle spindles afferent excitability in the model rats and explore whether the changes in this excitability to be changed as high frequency sinusoidal

vibration acted on the soleus muscle. Methods: The simulated weightlessness model was created by the tail-suspension. Mechanical vibrations at a frequency of 100 Hz with amplitude of 0.3 mm were acted on soleus muscle. The electromyogram of soleus muscle evoked by electrical stimulation of the sciatic nerve was recorded in control rats and HS rats. Results: It was showed that HS and HFV did not influence the tendency of changes in amplitude of H reflex when the stimulation intensity increased. However, after 14-day HS, mean maximal motor response ( $M(\text{sub max})$ ) and mean maximal monosynaptic reflex/ $M(\text{sub max})$ ( $H(\text{sub max})/M(\text{sub max})$ ) both significantly decreased, respectively ( $P < 0.05$ ). While  $H(\text{sub max})/M(\text{sub max})$  and  $M(\text{sub max})$  of HFV + HS rats were not statistically different from those of the control rats ( $P > 0.05$ ). Conclusion: It is suggested that HS should lead to the decrease in motoneurons excitability which is resulted from the reduction of muscle spindle afferent. HFV acted on soleus muscle of rats can improve the excitability of alpha-motoneurons in spinal cord during hindlimb suspension.

Author

*Neuromuscular Transmission; Weightlessness Simulation; High Frequencies; Muscular Function; Sine Waves; Reflexes; Electromyography; Muscles*

**20080025672** Institute of Space Medico-Engineering, Beijing, China

### **Circuit Simulation of Dynamic Model of $\text{Ca}^{2+}$ in Myocardial Cell**

Fan, Zhi-qin; Xie, Ming; Luo, Daisheng; He, Xiao-hai; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 137-141; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

Objective: Based on the analysis of three dimension (3-D) dynamic images of  $\text{Ca}^{2+}$  in myocardial cells and the circuit theories and technologies, the circuit model of  $\text{Ca}^{2+}$  dynamic transformation in myocardial cells is constructed and its circuit simulation is performed. Methods: Firstly, 3-D fluorescence images of  $\text{Ca}^{2+}$  in vivo myocardial cells were collected with laser scanning confocal microscope (LSCM) 3-D imaging system, and processed with image processing techniques to get 3-D dynamic images of  $\text{Ca}^{2+}$ . Then a circuit model was constructed through the study of simulated relationships between  $\text{Ca}^{2+}$  characteristic parameters and circuit components. Finally, the parameters of circuit components were calculated according to the information from the images, and these parameters were applied to the circuit model to conduct the circuit simulation. Results: The stimulated wave indicated that the constructed circuit model in this study was able to simulate the  $\text{Ca}^{2+}$  dynamic transformation effectively and reflect the electrophysiology of myocardial cell simultaneously. Conclusion: This study shows that it is feasible to apply circuit theories and technologies to research the  $\text{Ca}^{2+}$  dynamic transformation.

Author

*Circuits; Dynamic Models; Myocardium; Cells (Biology); Simulation; Fluorescence; Electrophysiology*

**20080025673** Institute of Space Medico-Engineering, Beijing, China

### **Effects of Matrigel on the Morphogenesis of Amniotic Fluid-Derived Mesenchymal Stem Cells in Vivo**

Du, Yu-feng; Geng, Hong-quan; Pan, Jun; Zhu, Zhe; Qi, Jun; Kang, Jian; Xie, Hua; Chen, Fang; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 112-116; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

To investigate the effect of Matrigel on the morphogenesis of amniotic fluid-derived mesenchymal stem cells in vivo. Amniotic fluid-derived mesenchymal stem cells (MSC) were mixed with Matrigel and injected into nude mice. 14 d later, new subcutaneous tissues were harvested. Gross appearances and tissue structures were observed. Negative and blank controls were set up by non-Matrigel mixed amniotic fluid-derived MSCs and Matrigel alone injected, respectively. Both the experimental group and the negative control group had subcutaneous tissues generated, though the gross appearances were similar, with ellipse-shaped tumor-like tissues, the tissue structures were obviously different. In the experimental group, blood supplies were abundant and gland-like structures were observed, some of which contained a lumen. There were differentiated smooth muscle cells, epithelial cells and early nerve cells distributed in tissues. In the negative control group, blood supplies were relatively rare, cells were simply tiled and remained undifferentiated, no special structures were observed. Matrigel was absorbed in the blank control group. Matrigel can promote the differentiation of amniotic fluid-derived MSCs and form simple gland-like structures.

Author

*Proteins; Gelatins; Cell Culturing; Stem Cells; In Vivo Methods and Tests; Differentiation (Biology); Culture Media; Tissue Engineering*

**20080025675** Tsinghua Univ., Beijing, China

### **A Programmable and Implantable Neuro-Stimulator**

Hao, Hong-wei; Li, Lu-ming; Ma, Bo-zhi; Chen, Zhao-yang; Liu, Fang-jun; Xue, Lin; Cao, Yang; Dong, Jie; Space Medicine

and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 147-151; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

**Objective:** To develop a programmable and, implantable neuro-stimulator for use in functional electrical stimulation therapy of neural diseases. **Methods:** The neuro-stimulator includes pulse generator, leads and electrodes implanted in the body, controller, personal digital assistant (PDA) and magnet outside the body for telemetry/programming. It provides electrical pulse stimulation to the target nerve, with adjustable pulse parameters such as pulse width, frequency, amplitude, on time and off time. **Results:** The implantable pulse generator weighs 34 g, with a size less than 47 mm x49 mm x 10 mm, and average power consumption of 54 pW under typical neuro-stimulation parameters. Its expected life is over 10 years. The neuro-stimulator was validated for safety and function during long-term implantation in animal experiments of vagus nerve stimulation using 20 rabbits. **Conclusion:** The developed neuro-stimulator can be used as an instrument platform for animal experimental studies of implantable neuro-stimulation, and fulfills the basic requirements of clinical applications.

Author

*Pulse Duration; Pulse Generators; Stimulation; Therapy; Rabbits; Implantation; Nerves*

**20080025676** Institute of Space Medico-Engineering, Beijing, China

#### **Design of Simple Integral Coefficient Notch Filter to Remove Power-Line Interference in High Sampling Rate**

Lan, Rui-fen; Hu, Guang-shu; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 148-152; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

**Objective:** To meet the demand of ECG signal processing in high sampling rate, a simple and narrowband power-line interference notch filter: is designed. **Methods:** Based on the band elimination filter which was combined with counteraction of zeros and poles and the interpolation theory, we designed a simple, integral coefficient filter with adjustable filter bandwidth. To eliminate the Gibbs phenomena, we adopted the average filter in linear segments which was designed by the former. **Results:** With our designed filter, 50 Hz power-line interference in high sampling rate was efficiently removed, and the filter coefficients were simple, integral, and convenient. **Conclusion:** The new design can produce a narrowband notch filter in high sampling rate, remove the 50 Hz powerline interference effectively, and retain the significant signal as much as possible to meet the needs of ECG analysis.

Author

*Signal Processing; Power Lines; Electrocardiography; Gibbs Phenomenon; Narrowband; Bandwidth; Coefficients*

**20080025677** Institute of Space Medico-Engineering, Beijing, China

#### **Effects of Digoxin on Cardioventricular Function in Rats after Simulated Weightlessness**

Zhang, Wenhui; Qi, Peng; Yang, Fen; He, Wei-wei; Wang, Hong-hui; Ling, Shu-kuan; Wang, Rui; Li, Ying-hui; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 93-96; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

To investigate the protective effects of Digoxin on cardioventricular function in rats after simulated weightlessness. Eighty rats were divided randomly into 5 groups: control (Con) group, tail-suspended + sham feeding (TS + SF) group, tail-suspended + Digoxin 2 wk (TS + D2) group and tail-suspended + Digoxin 3 wk (TS + D3) group. The TS + SF group was given the distilled water. At the end of tail-suspended for 3 weeks, the heart function of 10 rats in each group was examined with echocardiography. The level of atrial natriuretic polypeptide (ANP) in serum was measured with immunoradiometric assay in other 6 rats. Compared with TS + SF group, the contractile function of LV improved in TS + D2 and TS + D3 groups ( $P < 0.01$ ). The concentration of ANP increased significantly in TS + D3 group ( $P < 0.01$ ). There were no significant differences between TS + D2 group and TS + D3 group ( $P > 0.05$ ). Digoxin can improve muscle contractile and blood ejection of LV and retard the tendency of atrophy in simulated weightlessness.

Author

*Digitalis; Cardiac Ventricles; Heart Function; Weightlessness Simulation; Muscular Function; Blood Circulation; Bioassay; Aerospace Medicine*

**20080025679** Institute of Space Medico-Engineering, Beijing, China

#### **Effects of Digestive Load from Senna on the Adaptive Thermogenesis in Hypothyroid Rat**

Wang, Yong; Li, Wen-jing; Tang, Bing-hua; Zhang, Bao-chun; Li, Guo-zhang; Cai, Da-yong; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 108-111; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

To observe the effect of digestive load from senna on the adaptive thermogenesis in hypothyroid rats. After being born (d(sub 1)), rats were given the intraperitoneal injection with a series ratio of  $^{131}\text{I}$  at neutral temperature 28 C and a graded



developmental hypothyroidism resulted. Since d(sub 56) they were fed with higher lipid 24 h then fasted 24 h interval to make them sensitive to digestive load. Since d(sub 70), senna sides were given intragastrical administration for 14 d to result in the digestive load with its emptying function of the bowels. Pre-(d(sub 67-69)) and post- (d(sub 85-86) administration of senna under the neutral environmental temperature, all changes of rat temperature, included peaks (C) and areas under curve (C . h), were measured and recorded with physiography, 180 min after being injected with 106 micro-g . kg(exp -1) isoprenaline intravenously. The correlation between the effect and the logarithmic dose of (131)I (nCi . g(exp -1) was analyzed. As well as EC(sub 50), the decreased thermogenesis induced by (131)Iota was calculated with peaks and areas under curve respectively. The correlative analysis between the digestive load and the adaptive thermogenesis was performed especially with senna. Before and after administrated senna, there was a negative correlation between rat temperature change (peaks and areas under curve) induced with isoprenaline and the degree of hypothyroidism ( P < 0. 01 ). After administrated senna, the peaks of the colon temperature induced with isoprenaline in each (131)I group of rats were lower than those before, average 3.47% (1.26 C) range from 0.40 C to 1.56 C(P <0.01). So did the area under curve, average 4.95% (5.23 C . h) range from 0.88 C . h to 12.27 C . h (P < 0.01). The (131)I-EC(sub 50) of the peak and the area under curve of the colon temperature were decreased to 22. 75% (from 17 650 nCi . g(exp -1) to 4 016 nCi . g(exp -1), P < 0.01) and 22.43% (from 30 739 nCi . g(exp -1) to 6 895 nCi . g(exp -1), P < 0.01), respectively. The digestive load induced with sennosides aggravates the adaptive hypothermogenesis in the hypothyroid rats dealt with (131)I. Administration of senna sets up model stimulation for the systems biology of heat balance and Pi Yangxu Lihan Zheng (spleen yang deficient) cold syndrome in traditional Chinese medicine.

Author

*Digestive System; Thermoregulation; Plants (Botany); Medical Science; Adaptation; Thyroid Gland; Hypometabolism*

**20080025680** Fourth Military Medical Univ., Xi'an, China

#### **Effects of Short- and Mid-term Tail Suspension on Renin-Angiotensin System in Renal Tissue of Rat**

Jun-xiang; Yu, Jin-wen; Ma, Jin; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 84-87; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

To explore changes of local renin-angiotensin system (RAS) in renal tissue of rat during short-and mid-term tail suspension, as well as their relations with humoral regulation and renal function induced by real or simulated weightlessness. 1- and 4-week (wk) tail-suspended rat models were used to simulate short-and mid-term weightlessness, respectively. Reverse transcriptase polymerase chain reaction (RT-PCR) was carried out to examine the mRNA expression of components of local RAS in renal tissue. Except for angiotensin II receptor type 2 (AT(sub 2)), all of the other components of local RAS, including angiotensinogen (AGT), renin, angiotensin converting enzyme (ACE) , angiotensin II receptor type 1a (AT(sub 1a)) and angiotensin II receptor type 1b (AT(sub 1b)), were expressed in the renal tissue of Sprague-Dawley rats. After 1 wk of tail suspension, mRNA expression of renin in renal tissue increased significantly (P < 0.01) as compared with control level. There were no significant differences in mRNA expression of AGT, ACE, AT(sub 1a) and AT(sub 1b) between control and 1-wk tail suspended rat. After a 4-wk tail suspension, as compared with control level, mRNA expression of renin, AT(sub 1a) and AT(sub 1b) did not show any significant differences, but mRNA expression of AGT and ACE decreased significantly (P < 0.05, P < 0.01). The plasma renin activity (PRA) may increase within 1 wk, but will return to normal levels within 4 wks in tail-suspended rats. Additionally, the local RAS tone may decline in renal tissue of 4-wk tail-suspended rat.

Author

*Renin; Angiotensins; Tissues (Biology); Gene Expression; Weightlessness Simulation; Gravitational Effects; Gravitational Physiology; Aerospace Medicine*

**20080025681** Shandong Univ., Jinan, China

#### **Envelope Extraction of Heart Sounds Based on Hilbert-Huang Transform**

Xu, Xiao-fei; Lin, Yong; Yan, Bin-bin; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 134-136; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

Objective: Based on the analysis of time domain of heart sound with envelop to extract the envelope character of heart sounds. Methods: The envelope extraction of heart sounds based on Hilbert-Huang Transform was given. Firstly, the original heart sounds signal was preprocessed by Huang Transform. Secondly, the envelope of heart's sounds was got with Hilbert Transform. Results: The first heart sound and the second heart sound were extracted, and all kinds of characters in time domain of heart sound were acquired more accurately. Conclusion: The envelope of heart sound is extracted correctly. The foundation for further analysis of heart sounds is established.

Author

*Heart; Hilbert Transformation; Extraction*

**20080025689** NASA, Washington, DC USA

**Protective coating and hyperthermal atomic oxygen texturing of optical fibers used for blood glucose monitoring**

Banks, Bruce A., Inventor; June 3, 2008; 16 pp.; In English

Patent Info.: Filed July 14, 2006; US-Patent-7,382,944; US-Patent-Appl-SN-11/489,813; No Copyright; Avail.: CASI:

A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025689>

Disclosed is a method of producing cones and pillars on polymethylmethacrylate (PMMA) optical fibers for glucose monitoring. The method, in one embodiment, consists of using electron beam evaporation to deposit a non-contiguous thin film of aluminum on the distal ends of the PMMA fibers. The partial coverage of aluminum on the fibers is randomly, but rather uniformly distributed across the end of the optical fibers. After the aluminum deposition, the ends of the fibers are then exposed to hyperthermal atomic oxygen, which oxidizes the areas that are not protected by aluminum. The resulting PMMA fibers have a greatly increased surface area and the cones or pillars are sufficiently close together that the cellular components in blood are excluded from passing into the valleys between the cones and pillars. The optical fibers are then coated with appropriated surface chemistry so that they can optically sense the glucose level in the blood sample than that with conventional glucose monitoring.

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

*Blood; Coatings; Glucose; Optical Fibers; Oxygen Atoms; Protective Coatings*

**20080025692** NASA, Washington, DC USA

**System for the diagnosis and monitoring of coronary artery disease, acute coronary syndromes, cardiomyopathy and other cardiac conditions**

Schlegel, Todd T., Inventor; Arenare, Brian, Inventor; June 10, 2008; 32 pp.; In English

Patent Info.: Filed March 26, 2003; US-Patent-7,386,340; US-Patent-Appl-SN-10/402,866; No Copyright; Avail.: CASI:

A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025692>

Cardiac electrical data are received from a patient, manipulated to determine various useful aspects of the ECG signal, and displayed and stored in a useful form using a computer. The computer monitor displays various useful information, and in particular graphically displays various permutations of reduced amplitude zones and kurtosis that increase the rapidity and accuracy of cardiac diagnoses. New criteria for reduced amplitude zones are defined that enhance the sensitivity and specificity for detecting cardiac abnormalities.

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

*Coronary Artery Disease; Electrocardiography; Signs and Symptoms*

**20080026031** NASA Johnson Space Center, Houston, TX, USA

**International Space Station Crew Restraint Design**

Whitmore, M.; Norris, L.; Holden, K.; January 10, 2005; 1 pp.; In English; Bioastronautics Investigators' Workshop, 10-12 Jan. 2005, Galveston, TX, USA

Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: Other Sources; Abstract Only

With permanent human presence onboard the International Space Station (ISS), crews will be living and working in microgravity, dealing with the challenges of a weightless environment. In addition, the confined nature of the spacecraft environment results in ergonomic challenges such as limited visibility and access to the activity areas, as well as prolonged periods of unnatural postures. Without optimum restraints, crewmembers may be handicapped for performing some of the on-orbit tasks. Currently, many of the tasks on ISS are performed with the crew restrained merely by hooking their arms or toes around handrails to steady themselves. This is adequate for some tasks, but not all. There have been some reports of discomfort/calluses on the top of the toes. In addition, this type of restraint is simply insufficient for tasks that require a large degree of stability. Glovebox design is a good example of a confined workstation concept requiring stability for successful use. They are widely used in industry, university, and government laboratories, as well as in the space environment, and are known to cause postural limitations and visual restrictions. Although there are numerous guidelines pertaining to ventilation, seals, and glove attachment, most of the data have been gathered in a 1-g environment, or are from studies that were conducted prior to the early 1980 s. Little is known about how best to restrain a crewmember using a glovebox in microgravity. In 2004, The Usability Testing and Analysis Facility (UTAF) at the NASA Johnson Space Center completed development/evaluation of several design concepts for crew restraints to meet the various needs outlined above. Restraints were designed for general purpose use, for teleoperation (Robonaut) and for use with the Life Sciences Glovebox. All design efforts followed a human factors engineering design lifecycle, beginning with identification of requirements followed by an iterative prototype/test

cycle. Anthropometric modeling was completed for the 5th percentile Asian female and the 95th percentile American male for all restraints. A series of three evaluations was performed onboard NASA's reduced gravity aircraft (KC-135). For all evaluations, participants performed representative tasks while being videotaped, and then completed a questionnaire following each flight day. The questionnaire included ratings scales and free format questions to assess topics such as comfort, stability provided, flexibility provided, etc. Results from the three flight evaluations are being used to develop the human factors design requirements for crew restraint concepts for 1) general purpose restraints, 2) teleoperation restraints and 3) glovebox restraints. The poster presentation will describe the detailed methodology used, results from each of the three evaluations, and the resulting human factors recommendations for the design of these restraints.

Author

*C-135 Aircraft; International Space Station; Microgravity; Spacecrews; Constraints; Life Sciences; Human Factors Engineering*

**20080026046** NASA Johnson Space Center, Houston, TX, USA

**Iron-Tolerant Cyanobacteria: Ecophysiology and Fingerprinting**

Brown, I. I.; Mummey, D.; Lindsey, J.; McKay, D. S.; March 13, 2006; 1 pp.; In English; lunar and Planetary Sciences Conference, 13-17 Mar. 2006, League City, TX, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

Although the iron-dependent physiology of marine and freshwater cyanobacterial strains has been the focus of extensive study, very few studies dedicated to the physiology and diversity of cyanobacteria inhabiting iron-depositing hot springs have been conducted. One of the few studies that have been conducted [B. Pierson, 1999] found that cyanobacterial members of iron depositing bacterial mat communities might increase the rate of iron oxidation in situ and that ferrous iron concentrations up to 1 mM significantly stimulated light dependent consumption of bicarbonate, suggesting a specific role for elevated iron in photosynthesis of cyanobacteria inhabiting iron-depositing hot springs. Our recent studies pertaining to the diversity and physiology of cyanobacteria populating iron-depositing hot springs in Great Yellowstone area (Western USA) indicated a number of different isolates exhibiting elevated tolerance to Fe(3+) (up to 1 mM). Moreover, stimulation of growth was observed with increased Fe(3+) (0.02-0.4 mM). Molecular fingerprinting of unialgal isolates revealed a new cyanobacterial genus and species *Chroocloeocystis siderophila*, an unicellular cyanobacterium with significant EPS sheath harboring colloidal Fe(3+) from iron enriched media. Our preliminary data suggest that some filamentous species of iron-tolerant cyanobacteria are capable of exocytosis of iron precipitated in cytoplasm. Prior to 2.4 Ga global oceans were likely significantly enriched in soluble iron [Lindsay et al, 2003], conditions which are not conducive to growth of most contemporary oxygenic cyanobacteria. Thus, iron-tolerant CB may have played important physiological and evolutionary roles in Earth's history.

Author

*Bacteria; Iron; Physiology; Ecology; Microbiology; Molecular Biology; Marine Biology*

**20080026047** NASA Johnson Space Center, Houston, TX, USA

**Lab-Scale Study of the Calcium Carbonate Dissolution and Deposition by Marine Cyanobacterium *Phormidium subcapitatum***

Karakis, S. G.; Dragoeva, E. G.; Lavrenyuk, T. I.; Rogochiy, A.; Gerasimenko, L. M.; McKay, D. S.; Brown, I. I.; March 13, 2006; 2 pp.; In English; Copyright; Avail.: CASI: [A01](#), Hardcopy

Suggestions that calcification in marine organisms changes in response to global variations in seawater chemistry continue to be advanced (Wilkinson, 1979; Degens et al. 1985; Kazmierczak et al. 1986; R. Riding 1992). However, the effect of [Na+] on calcification in marine cyanobacteria has not been discussed in detail although [Na+] fluctuations reflect both temperature and sea-level fluctuations. The goal of these lab-scale studies therefore was to study the effect of environmental pH and [Na+] on CaCO<sub>3</sub> deposition and dissolution by marine cyanobacterium *Phormidium subcapitatum*. Marine cyanobacterium *P. subcapitatum* has been cultivated in ASN-III medium. [Ca<sup>2+</sup>] fluctuations were monitored with Ca(2+) probe. Na(+) concentrations were determined by the initial solution chemistry. It was found that the balance between CaCO<sub>3</sub> dissolution and precipitation induced by *P. subcapitatum* grown in neutral ASN III medium is very close to zero. No CaCO<sub>3</sub> precipitation induced by cyanobacterial growth occurred. Growth of *P. subcapitatum* in alkaline ASN III medium, however, was accompanied by significant oscillations in free Ca(2+) concentration within a Na(+) concentration range of 50-400 mM. Calcium carbonate precipitation occurred during the log phase of *P. subcapitatum* growth while carbonate dissolution was typical for the stationary phase of *P. subcapitatum* growth. The highest CaCO<sub>3</sub> deposition was observed in the range of Na(+) concentrations between 200-400 mM. Alkaline pH also induced the clamping of *P. subcapitatum* filaments, which appeared to have a strong affinity to envelop particles of chemically deposited CaCO<sub>3</sub> followed by enlargement of those particles size. EDS analysis revealed the presence of Mg-rich carbonate (or magnesium calcite) in the solution containing 10-100 mM Na(+);

calcite in the solution containing 200 mM Na(+); and aragonite in the solution containing with 400 mM Na(+). Typical present-day seawater contains xxmM Na(+). Early (Archean) seawater was likely less saline. The division of marine cyanobacterium *P. subcapitatum* is associated with periodic deposition and dissolution of CaCO<sub>3</sub>, the rhythms and intensity of which are dependent on concentrations of both OH(-) and Na(+). Thus, the role of present-day marine cyanobacteria in the global carbonate cycle might be reduced to aggregation and recrystallization of available CaCO<sub>3</sub> particles in marine water rather than long-term precipitation and accumulation of CaCO<sub>3</sub> deposits. For lower Na(+) concentrations, precipitation of carbonates by cyanobacteria would be even less significant. These results suggest that the lack of calcified cyanobacteria in stromatalite-bearing Precambrian sequences can be explained not only by high dissolved inorganic carbon concentrations but also by lower salinity, as well as possible lower pH compared to present-day oceans.

Author

*Calcium Carbonates; Dissolving; Marine Biology; Deposition; Bacteria*

**20080026048** NASA Johnson Space Center, Houston, TX, USA

**Novel Concept for LSS Based on Advanced Microalgal Biotechnologies**

Brown, I.; Jones, J. A.; Bayless, D.; Karakis, S.; Karpov, L.; McKay, D. S.; Habitation; February 05, 2006; Volume 30, Nos. 3/4, pp. 132; In English; Habitation 2006 Conference, 5-8 Feb. 2006, Orlando, FL, USA; Copyright; Avail.: CASI: A01, Hardcopy

One of the key issues for successful human space exploration is biomedical life support in hostile space and planetary environments that otherwise cannot sustain life. Bioregenerative life support systems (LSS) are one of the options for atmospheric regeneration. To date, no bioregenerative LSS has shown capability for 100% air regeneration. Nor have these LSS been robust enough to simultaneously provide a regenerable complete food source. In contrast to microalgae, traditional plant approaches, e.g. wheat and lettuce, are lacking essential amino acids, vitamins, and micronutrients. Moreover, the rate of photosynthesis by microalgae significantly exceeds that of high plants. Nevertheless, the employment of microalgae in LSS technology was restricted, until recently, due to high water demands. Also the per person requirement of a 40L volume of microalgae in a photobioreactor, to provide daily O<sub>2</sub> production, made an algae-based approach less attractive. By employing a vertically stacked membrane bioreactor, coupled with a solar tracker and photon-delivery system, a lightweight air revitalization system for space based applications, with minimal water requirements, can be developed. Our preliminary estimations suggest that a membrane bioreactor, 8m<sup>3</sup> in volume, comprised of 80m<sup>2</sup> (twenty 2m x 2m membranes, each spaced 10 cm apart), and a total of 70L of water could produce 2.7 kg of dried microalgal biomass that would supply the energy and essential amino acid requirements, as well as producing sufficient O<sub>2</sub> for the daily needs of a 15 member crew. Research on the biochemical content of edible blue-green alga *Spirulina* (*Arthrospira*) *platensis* shows a wide spectrum of stable *Spirulina* mutants with an enhanced content of amino acids, -carotene, and phycobilliprotein c-phycocyanin. Feeding animals suffering from radiation-induced lesions, c-phycocyanin, extracted from strain 27G, led to a correction in the decrement of dehydrogenase activity and energy-rich phosphate levels, as well as improved antioxidant defense and pyruvate levels, compared to untreated animals. Experimental anemia in rats was corrected by feeding *Spirulina platensis* strains 198B and 27G, (with an enhanced content of methionine, phycobiliproteins and carotenoids). *Spirulina* was recently shown by Ananyev et al, 2005, to be an oxygenic organism with the highest level of photosystem II activity (O<sub>2</sub> production). We propose therefore to develop a design for membrane-based photoreactors for Lunar and Mars exploration habitat LSS, for the cultivation of genetically modified strains of *Spirulina* to scrub CO<sub>2</sub> and supply astronauts with O<sub>2</sub>, protein, vitamins, and immunostimulators.

Author

*Algae; Biotechnology; Life Support Systems; Microbiology; Closed Ecological Systems; Biochemistry*

**20080026054** NASA Johnson Space Center, Houston, TX, USA

**Immune Response in Microgravity: Genetic Basis and Countermeasure Development Implications**

Risin, Diana; Ward, Nancy E.; Risin, Semyon A.; Pellis, Neal R.; October 02, 2006; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain

Contract(s)/Grant(s): NAG5-4072; NRA OLMSA-02; No Copyright; Avail.: Other Sources; Abstract Only

Impairment of the immunity in astronauts and cosmonauts even in shortterm flights is a recognized risk. Longterm orbital space missions and anticipated interplanetary flights increase the concern for more pronounced effects on the immune system with potential clinical consequences. Studies in true and modeled microgravity (MG) have demonstrated that MG directly affects numerous lymphocyte functions. The purpose of this study was to screen for genes involved in lymphocytes response to modeled microgravity (MMG) that could explain the functional and structural changes observed earlier. The microgravity-induced changes in gene expression were analyzed by microarray DNA chip technology. CD3and IL2activated Tcells were

cultured in 1g (static) and modeled microgravity (NASA Rotating Wall Vessel bioreactor) conditions for 24 hours. Total RNA was extracted using the RNeasy isolation kit (Qiagen, Valencia, CA). Microarray experiments were performed utilizing Affymetrix Gene Chips (U133A), allowing testing for 18,400 human genes. To decrease the biological variation and aid in detecting microgravity-associated changes, experiments were performed in triplicate using cells obtained from three different donors. Exposure to modeled microgravity resulted in alteration of 89 genes, 10 of which were upregulated and 79 down-regulated. Altered genes were categorized by their function, structural role and by association with metabolic and regulatory pathways. A large proportion was found to be involved in fundamental cellular processes: signal transduction, DNA repair, apoptosis, and multiple metabolic pathways. There was a group of genes directly related to immune and inflammatory responses (IL7R, granulysin, proteasome activator subunit 2, peroxiredoxin 4, HLADRA, lymphocyte antigen 75, IL18R and DOCK2 genes). Among these genes only one (IL7R) was upregulated, the rest were downregulated. The upregulation of the IL7 receptor gene was confirmed by RT PCR. Three genes with altered expression were identified in the apoptosis related group (Granzyme B, APO2 ligand and Beta3endoneixin). All of them were downregulated. Gene expression changes in MG might appear pivotal in identifying potential molecular targets for countermeasure development. (Supported by NRA OLMSA02 and NSCORT NAG54072 grants).

Author

*Immunity; Gravitational Effects; Gene Expression; Deoxyribonucleic Acid; Physiological Responses; Ribonucleic Acids; Metabolism*

**20080026089** NASA Johnson Space Center, Houston, TX, USA

#### **Fat-Soluble Vitamin Status in Self-Neglecting Elderly**

Kala, G.; Oliver, S. Mathews; Kelly, P. A.; Pickens, S.; Burnett, J.; Dyer, C. B.; Smith, S. M.; April 2006; 1 pp.; In English; Experimental Biology, 1-5 Apr. 2006, San Francisco, CA, USA

Contract(s)/Grant(s): NIH P20-RR020626-02; No Copyright; Avail.: Other Sources; Abstract Only

Elder self-neglect is a form of elder mistreatment. The systematic characterization of self-neglecting individuals is the goal of the CREST project. Reported here is the evaluation of fat-soluble vitamin status. Self-neglect (SN) subjects were recruited and consented following referral from Adult Protective Services. Control (CN) subjects were matched for age, gender, race, and socioeconomic status, as possible. We report here on 47 SN subjects (age 77 plus or minus 7, mean plus or minus SD; body weight 76 kg plus or minus 26) and 40 CN subjects (77 y plus or minus 7, 79 kg plus or minus 20). Blood samples were analyzed for indices of fat-soluble vitamin status. Plasma retinol (p less than 0.01) was lower in SN subjects. Plasma tocopherol tended (p less than 0.06) to be lower in SN subjects, while gamma-tocopherol was unchanged. SN subjects tended to have lower serum 25-OH vitamin D (p less than 0.11), and to be vitamin D deficient (26% below 23 mmol/L). Hypercalcemia occurred more often in SN subjects (23% had values above 2.56 mmol/L), as did elevated parathyroid hormone concentrations (p less than 0.05). These data demonstrate that many nutrients are affected in the self-neglecting elderly, and that long-term deficits are evident by the nature of changes in fat soluble vitamins.

Author

*Vitamins; Adults; Fats; Solubility*

**20080026091** NASA Johnson Space Center, Houston, TX, USA

#### **The Evaluation of Methicillin Resistance in Staphylococcus aboard the International Space Station**

Ott, C. M.; Bassinger, V. J.; Fontenot, S. L.; Castro, V. A.; Pierson, D. L.; May 22, 2005; 1 pp.; In English; 3rd International Workshop on Space Microbiology, 22-25 May 2005, Mol, Belgium; Copyright; Avail.: Other Sources; Abstract Only

The International Space Station (ISS) represents a semi-closed environment with a high level of crewmember interaction. As community-acquired methicillin-resistant Staphylococcus aureus (MRSA) has emerged as a health concern in environments with susceptible hosts in close proximity, an evaluation of isolates of clinical and environmental Staphylococcus aureus and coagulase negative Staphylococcus was performed to determine if this trend was also present in astronauts aboard ISS or the space station itself. Rep-PCR fingerprinting analysis of archived ISS isolates confirmed our earlier studies indicating a transfer of S. aureus between crewmembers. In addition, this fingerprinting also indicated a transfer between crewmembers and their environment. While a variety of S. aureus were identified from both the crewmembers and the environment, phenotypic evaluations indicated minimal methicillin resistance. However, positive results for the Penicillin Binding Protein, indicative of the presence of the mecA gene, were detected in multiple isolates of archived Staphylococcus epidermidis and Staphylococcus haemolyticus. Phenotypic analysis of these isolates confirmed their resistance to methicillin. While MRSA has not been isolated aboard ISS, the potential exists for the transfer of the gene, mecA, from coagulase negative environmental

Staphylococcus to *S. aureus* creating MRSA strains. This study suggests the need to expand environmental monitoring aboard long duration exploration spacecraft to include antibiotic resistance profiling.

Author

*Staphylococcus; Penicillin; International Space Station; Closed Ecological Systems; Aerospace Medicine*

**20080026097** NASA Johnson Space Center, Houston, TX, USA

**Hypovolemia Induced Orthostatic Hypotension in Presyncopal Astronauts and Normal Subjects Related to Hypoadrenergic Responsiveness**

Meck, Janice V.; Platts, Steven H.; Waters, Wendy W.; Shi, Shang-Jin; Hayashi, Yuho; Perez, Sondra A.; Ziegler, Michael G.; April 2006; 23 pp.; In English; Experimental Biology 2006, 1-5 Apr. 2006, San Francisco, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS98-HEDS-02-424; M01RR00827; NCRR M01-RR02558; Copyright; Avail.: CASI: [A03](#), Hardcopy

Circulating blood volume is reduced during spaceflight, making astronauts hemodynamically compromised. After landing, astronauts separate into two groups. One group compensates for the hypovolemia with a hyper-sympathetic response during upright tilt testing and can complete a tilt test with few symptoms. The other group is unable to mount a hyper-sympathetic response and experiences orthostatic hypotension and presyncope during upright tilt tests. We tested the hypothesis that hypovolemia alone, in the absence of spaceflight, also would cause subjects to separate into presyncopal and non-presyncopal groups according to their sympathetic responses during tilt. We studied 20 subjects, including 10 veteran astronauts, on three occasions. On Days 1 (normovolemia) and 3 (hypovolemia), plasma volume, tilt tolerance and supine and standing plasma norepinephrine levels were measured. Forty hours prior to Day 3, subjects were given intravenous furosemide, followed by 36 hours of a 10MEq Na diet. Statistical comparisons were made between normovolemia and hypovolemia responses. This protocol reproduced landing day tilt test outcomes with 100% fidelity in the astronauts. Similarly to patterns reported after flight, non-presyncopal subjects had greater norepinephrine responses to tilt during hypovolemia compared to normovolemia (580 plus or minus 79 vs. 298 plus or minus 37 pg/ml, P less than 0.05), but presyncopal subjects had no increase (180 plus or minus 44 vs. 145 plus or minus 32 pg/ml, P=NS). This model can be used to predict astronauts who will become presyncopal on landing day, so that prospective, individualized countermeasures can be developed. Within patient populations, it can be used to study the interaction of volemic state and the sympathetic nervous system.

Author

*Astronauts; Hypotension; Hypovolemia; Signs and Symptoms; Sympathetic Nervous System; Orthostatic Tolerance; Diuretics*

**20080026116** NASA Johnson Space Center, Houston, TX, USA

**In Vitro Experimental Model to Investigate the Biological Effects across the Bragg Curve of High-LET Radiation**

Desai, N.; Cucinotta, F. A.; Durante, M.; Lin, Z.; Meador, J.; Rusek, A.; Wu, H.; May 15, 2005; 1 pp.; In English; NASA Space Radiation Investigator's Workshop, 15-18 May 2005, Long Island, NY, USA; Copyright; Avail.: Other Sources;

Abstract Only

The space environment consists of a varying field of radiation particles including high energy ions, with a spacecrafts shielding material providing the only major protection to astronauts from harmful exposure. Unlike lowLET gamma or Xrays, the presence of shielding does not always reduce the radiation risks for energetic charged particle exposure since the dose delivered by the charged particle increases sharply as the particle approaches the end of its range, a position known as the Bragg peak and the correlating spatial dose distribution identified as the Bragg curve. The Bragg curve does not necessarily represent the biological damage along the particle traversal since biological effects are influenced by the track structure of both primary and secondary particles. Therefore, the biological Bragg curve is dependent of the energy and the type of the primary particle, and may vary for different biological endpoints. Here we describe a unique irradiation geometry and experimental system to measure the biological response across the Bragg curve in one consistent biological sample. Polyethylene shielding was used to achieve a Bragg curve distribution with the beam geometry parallel to a monolayer of fibroblast cells. We present data that highlights the differential formation of DNA double strand breaks (DSBs) and chromosomal deletions across the Bragg curve in human fibroblasts irradiated with 600 MeV/nucleon iron ion beams. Qualitative analyses of gammaH2AX fluorescence, a known marker of DSBs, indicated potentially increased clustering of DNA damage before the Bragg peak, enhanced homogenous distribution at the peak, and provided visual evidence of high linear energy transfer (LET) particle traversal of cells beyond the Bragg peak in agreement with one-dimensional transport approximations. A biological response curve generated for micronuclei induction across the Bragg curve for 600 MeV/n Fe ions did not reveal an increase in the yield of micronuclei at the Bragg peak location. Assessment of such biological parameters employing the described in vitro

experimental system may provide improved platforms to measure a number of biological consequences of shielding materials across the Bragg curve for high charge and energy (HZE) ions.

Author

*Aerospace Environments; Biological Effects; Bragg Curve; In Vitro Methods and Tests; Irradiation; Linear Energy Transfer (LET)*

**20080026117** NASA Johnson Space Center, Houston, TX, USA

**Studies of the Ability to Hold the Eye in Eccentric Gaze: Measurements in Normal Subjects with the Head Erect**

Reschke, Millard F.; Somers, Jeffrey T.; Feiveson, Alan H.; Leigh, R. John; Wood, Scott J.; Paloski, William H.; Kornilova, Ludmila; [2006]; 27 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC9-58; NSBRI NA00208; Copyright; Avail.: CASI: [A03](#), Hardcopy

We studied the ability to hold the eyes in eccentric horizontal or vertical gaze angles in 68 normal humans, age range 19-56. Subjects attempted to sustain visual fixation of a briefly flashed target located 30 in the horizontal plane and 15 in the vertical plane in a dark environment. Conventionally, the ability to hold eccentric gaze is estimated by fitting centripetal eye drifts by exponential curves and calculating the time constant ( $t_{(sub\ c)}$ ) of these slow phases of gaze-evoked nystagmus. Although the distribution of time-constant measurements ( $t_{(sub\ c)}$ ) in our normal subjects was extremely skewed due to occasional test runs that exhibited near-perfect stability (large  $t_{(sub\ c)}$  values), we found that  $\log_{10}(t_c)$  was approximately normally distributed within classes of target direction. Therefore, statistical estimation and inference on the effect of target direction was performed on values of  $z$  identical with  $\log_{10}t_{(sub\ c)}$ . Subjects showed considerable variation in their eyedrift performance over repeated trials; nonetheless, statistically significant differences emerged: values of  $t_c$  were significantly higher for gaze elicited to targets in the horizontal plane than for the vertical plane ( $P$  less than  $10(\exp -5)$ ), suggesting eccentric gazeholding is more stable in the horizontal than in the vertical plane. Furthermore, centrifugal eye drifts were observed in 13.3, 16.0 and 55.6% of cases for horizontal, upgaze and downgaze tests, respectively. Fifth percentile values of the time constant were estimated to be 10.2 sec, 3.3 sec and 3.8 sec for horizontal, upward and downward gaze, respectively. The difference between horizontal and vertical gazeholding may be ascribed to separate components of the velocity position neural integrator for eye movements, and to differences in orbital mechanics. Our statistical method for representing the range of normal eccentric gaze stability can be readily applied in a clinical setting to patients who were exposed to environments that may have modified their central integrators and thus require monitoring. Patients with gaze-evoked nystagmus can be flagged by comparing to the above established normative criteria.

Author

*Eye (Anatomy); Head (Anatomy); Eccentricity; Orbital Mechanics*

**20080026131** NASA Johnson Space Center, Houston, TX, USA

**Realtime Multichannel System for Beat to Beat QT Interval Variability**

Starc, Vito; Schlegel, Todd T.; 2006; 33 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): MOE-PO-510-381; Copyright; Avail.: CASI: [A03](#), Hardcopy

The measurement of beat-to-beat QT interval variability (QTV) shows clinical promise for identifying several types of cardiac pathology. However, until now, there has been no device capable of displaying, in real time on a beattobeat basis, changes in QTV in all 12 conventional leads in a continuously monitored patient. While several software programs have been designed to analyze QTV, heretofore, such programs have all involved only a few channels (at most) and/or have required laborious user interaction or offline calculations and postprocessing, limiting their clinical utility. This paper describes a PC-based ECG software program that in real time, acquires, analyzes and displays QTV and also PQ interval variability (PQV) in each of the eight independent channels that constitute the 12lead conventional ECG. The system also processes certain related signals that are derived from singular value decomposition and that help to reduce the overall effects of noise on the realtime QTV and PQV results.

Author

*Electrocardiography; Display Devices; Heart Diseases; Synchronism; Variability; Real Time Operation*

**20080026144** NASA Johnson Space Center, Houston, TX, USA

**'Nano' Morphology and Element Signatures of Early Life on Earth: A New Tool for Assessing Biogenicity**

Oehler, D. Z.; Mostefaoui, S.; Meibom, A.; Selo, M.; McKay, D. S.; Robert, F.; March 13, 2006; 2 pp.; In English; 37th Lunar

and Planetary Research Conference, 13-17 Mar. 2006, Houston, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The relatively young technology of NanoSIMS is unlocking an exciting new level of information from organic matter in ancient sediments. We are using this technique to characterize Proterozoic organic material that is clearly biogenic as a guide for interpreting controversial organic structures in either terrestrial or extraterrestrial samples. NanoSIMS is secondary ion mass spectrometry for trace element and isotope analysis at sub-micron resolution. In 2005, Robert et al. [1] combined NanoSIMS element maps with optical microscopic imagery in an effort to develop a new method for assessing biogenicity of Precambrian structures. The ability of NanoSIMS to map simultaneously the distribution of organic elements with a 50 nm spatial resolution provides new biologic markers that could help define the timing of life's development on Earth. The current study corroborates the work of Robert et al. and builds on their study by using NanoSIMS to map C, N (as CN), S, Si and O of both excellently preserved microfossils and less well preserved, non-descript organics in Proterozoic chert from the ca. 0.8 Ga Bitter Springs Formation of Australia.

Derived from text

*Signatures; Fossils; Life Sciences; Markers; Microorganisms; Morphology; Secondary Ion Mass Spectrometry; Quartz*

**20080026150** NASA Johnson Space Center, Houston, TX, USA

### **Response of Ambulatory Human Subjects to Artificial Gravity (Short Radius Centrifugation)**

Paloski, William H.; Arya, Maneesh; Newby, Nathaniel; Tucker, Jon-Michael; Jarchow, Thomas; Young, Laurence; June 07, 2006; 1 pp.; In English; 7th Symposium on the Role of the Vestibular Organs, 7-9 Jun. 2006, Noordwijk, Netherlands; Copyright; Avail.: CASI: [A01](#), Hardcopy

Prolonged exposure to microgravity results in significant adaptive changes, including cardiovascular deconditioning, muscle atrophy, bone loss, and sensorimotor reorganization, that place individuals at risk for performing physical activities after return to a gravitational environment. Planned missions to Mars include unprecedented hypogravity exposures that would likely result in unacceptable risks to crews. Artificial gravity (AG) paradigms may offer multisystem protection from the untoward effects of adaptation to the microgravity of space or the hypogravity of planetary surfaces. While the most effective AG designs would employ a rotating spacecraft, perceived issues may preclude their use. The questions of whether and how intermittent AG produced by a short radius centrifuge (SRC) could be employed have therefore sprung to the forefront of operational research. In preparing for a series of intermittent AG trials in subjects deconditioned by bed rest, we have examined the responses of several healthy, ambulatory subjects to SRC exposures.

Derived from text

*Aerospace Medicine; Artificial Gravity; Human Beings; Human Centrifuges*

**20080026151** NASA Johnson Space Center, Houston, TX, USA

### **Decrease in T Cell Activation and Calcium Flux during Clinorotation**

Sams, Clarence; Holtzclaw, J. David; May 12, 2006; 1 pp.; In English; Annual Meeting of the American Association of Immunologists, 12-16 May 2006, Boston, MA, USA; Copyright; Avail.: Other Sources; Abstract Only

We investigated the effect of altered gravitational environments on T cell activation. We isolated human, naive T cells (CD3+CD14-CD19-CD16-CD56-CD25-CD69-CD45RA-) following IRB approved protocols. These purified T cells were then incubated with 6 mm polystyrene beads coated with OKT3 (Ortho Biotech, Raritan, NJ) and antiCD28 (Becton Dickinson (BD), San Jose, CA) at 37 C for 24 hours. Antibodies were at a 1:1 ratio and the bead-to-cell ratio was 2:1. Four incubation conditions existed: 1) static or '1g'; 2) centrifugation at 10 relative centrifugal force (RCF) or '10g'; 3) clinorotation at 25 RPM (functional weightlessness or '0g'); and 4) clinorotation at 80 RPM ('1g' plus net shear force approx. 30 dynes/sq cm). Following incubation, T cells were stained for CD25 expression (BD) and intracellular calcium (ratio of Fluo4 to Fura Red, Molecular Probes, Eugene, OR) and analyzed by flow cytometry (Coulter EPICS XL, Miami, FL). Results: Static or '1g' T cells had the highest level of CD25 expression and intracellular calcium. T cells centrifuged at 10 RCF ('10g') had lower CD25 expression and calcium levels compared to the static control. However, cells centrifuged at 10 RCF had higher CD25 expression and calcium levels than those exposed to 24 RPM clinorotation ('0g'). T cells exposed to 24 RPM clinorotation had lower CD25 expression, but the approximately the same calcium levels than T cells exposed to 80 RPM clinorotation. These data suggest that stress-activated calcium channel exist in T cells and may play a role during T cell activation.

Author

*Antibodies; Centrifugal Force; Clinorotation; Cytometry; Weightlessness; Calcium*



**20080026154** NASA Johnson Space Center, Houston, TX, USA

**'Far' and 'Near' Visual Acuity While Walking and the Collective Contributions of Non-Ocular Mechanisms to Gaze Stabilization**

Peters, Brian T.; vanEmmerik, Richard E. A.; Bloomberg, Jacob J.; [January 2006]; 26 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Gaze stabilization was quantified in subjects (n=11) as they walked on a motorized treadmill (1.8 m/s) and viewed visual targets at two viewing distances. A 'far' target was positioned at 4 m (FAR) in front of the subject and the 'near' target was placed at a distance of 0.5 m (NEAR). A direct measure of visual acuity was used to assess the overall effectiveness of the gaze stabilization system. The contributions of nonocular mechanisms to the gaze goal were also quantified using a measure of the distance between the subject and point in space where fixation of the visual target would require the least eye movement amplitude (i.e. the head fixation distance (HFD)). Kinematic variables mirrored those of previous investigations with the vertical trunk translation and head pitch signals, and the lateral translation and head yaw signals maintaining what appear as antiphase relationships. However, an investigation of the temporal relationships between the maxima and minima of the vertical translation and head pitch signals show that while the maximum in vertical translation occurs at the point of the minimum head pitch signal, the inverse is not true. The maximum in the head pitch signal lags the vertical translation minimum by an average of greater than 12 percent of the step cycle time. Three HFD measures, one each for data in the sagittal and transverse planes, and one that combined the movements from both planes, all revealed changes between the FAR and NEAR target viewing conditions. This reorganization of the nonocular degrees of freedom while walking was consistent with a strategy to reduce the magnitude of the eye movements required when viewing the NEAR target. Despite this reorganization, acuity measures show that image stabilization is not occurring while walking and viewing the NEAR target. Group means indicate that visual acuity is not affected while walking in the FAR condition, but a decrement of 0.15 logMAR (i.e. 1.5 eye chart lines) exists between the standing and walking acuity measures when viewing the NEAR target.

Author

*Visual Acuity; Eye Movements; Degrees of Freedom; Kinematics; Eye (Anatomy); Distance*

**20080026180** NASA Johnson Space Center, Houston, TX, USA

**Vitamin D in Real and Simulated Weightlessness: Implications for Earth**

Rice, Barbara L.; Zwart, Sara R.; Smith, Scott M.; October 19, 2006; 1 pp.; In English; American Dietetic Association Meeting, 19-20 Oct. 2006, Honolulu, HI, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

Vitamin D deficiency has reemerged as a public health concern in the USA. It is also a concern for astronauts because spacecraft are shielded from ultraviolet light, leaving diet as the sole source of vitamin D. We report here the findings from four studies: one evaluation of astronauts before and after 4- to 6-month missions to the International Space Station, and the other three from a ground-based analog for space flight, long-term bed rest. For the space flight study, blood samples were collected before the flight and within hours of landing after it. Crewmembers (n = 11) were provided vitamin D supplements (as cholecalciferol (10 g/d) throughout the mission. The average number of vitamin D supplements reported to be consumed per week was 5.7 plus or minus 4.0. The vitamin D status indicator serum 25-hydroxycholecalciferol was 25% less after landing (48 plus or minus 20) than before flight (63 plus or minus 16) (P less than 0.01). A series of three studies was undertaken to evaluate nutritional changes during and after 60 or 90 days of -6 deg. head-down-tilt bed rest. A total of 11 subjects (8 M, 3 F; age 26-55 y) participated in the studies. Blood and urine were collected twice before bed rest and once per month during bed rest. During bed rest the average dietary intake of vitamin D for the three studies was 4.84 plus or minus 0.16 (study 1), 6.24 plus or minus 0.81 (study 2), and 7.16 plus or minus 1.40 (study 3) micrograms/day. In study 1 only, subjects were given a daily supplement of 10 g vitamin D (as ergocalciferol). Data were analyzed using repeated-measures ANOVA. In the first study, 7 days after the end of the bed rest, serum 25-hydroxycholecalciferol was 30% less than it was before bed rest (p less than 0.05). In the second and third studies, during or after bed rest the serum 25-hydroxycholecalciferol concentration was not significantly different from its concentration before bed rest. These data demonstrate that vitamin D intake is critical for individuals not exposed to the sun. Although we studied astronauts and healthy subjects in bed rest, the implications of our results also apply to people living in northern latitudes and others who receive little exposure to sunlight, such as elderly people who seldom go outdoors. The inability of supplements to maintain vitamin D status is also an important finding, and highlights the need for careful food selection to ensure adequate vitamin D intake.

Author

*Calciferol; Weightlessness Simulation; Earth (Planet)*

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*.

**20080025329** Defence Research and Development Canada, Toronto, Ontario Canada

**Effect of Various Environmental Stressors on Target Detection, Identification, and Marksmanship**

Tikuisis, Peter; Keefe, Allan A; Mar 2007; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478986; DRDC-TORONTO-TR-2006-258; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478986>

The advent of high resolution interactive simulation has made it possible to bring greater realism into the laboratory where experimental rigour is more easily controlled than in a field setting. Using a small arms trainer (SAT), the detection, identification, and engagement of targets were tested under a variety of environmentally stressful conditions including heat and cold exposure, noise, fatiguing exercise, and sleep deprivation, with caffeine intervention applied in the latter two trials. Additional investigations on the efficacy of a monetary incentive on individual performance, and on differences between individual and team performances were also conducted during the noise study. Target presentations were randomized and varied from standing pop-ups to moving figures of both foe and friendly types appearing seldom or frequently. Performance was judged according to the number of targets detected, correct target identifications, and marksmanship. Surprisingly, none of the physiological strains caused any serious degradation in performance except fatigue, which adversely affected target detection but not when caffeine was ingested to alleviate the fatigue. Generally, once a target had been detected (with or without fatigue), its engagement, which required intense but short-term focus (i.e., 6 s or less), was competently managed under significant levels of physiological strain, as if the act of detecting a target obviated the strain. The monetary incentive during the noise study failed to improve performance, which validated the use of the SAT in so far as extracting a best effort is concerned.

DTIC

*Detection; Target Acquisition*

**20080025520** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Living for Six Days at 2200 M Improves Time-Trial Performance of Sea-Level Residents Exposed to 4300 M**

Fulco, Charles S; Muza, Stephen R; Beidleman, Beth; Jones, Juli; Lammi, Eric; Staab, Janet; Rock, Paul B; Kambis, Kenneth; Glickman, Ellen; Doan, Brandon K; Brothers, Michael D; Zupan, Michael F; Cymerman, Allen; Feb 2008; 30 pp.; In English Report No.(s): AD-A479376; USARIEM-TR-T08-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall objective of the current project was to determine in previously unacclimatized SLR the effectiveness of staging in minimizing impairments in physical and cognitive performances and reducing acute mountain sickness incidence and severity during subsequent high altitude exposure. The data presented here will be focused on the effects of staging at moderate altitude on prolonged endurance performance of SLR during exposure to 4300 m. The results from the current study also will be compared to those of our previous two Pikes Peak studies to determine the relative effectiveness of short-term staging to no prior altitude acclimatization and to full moderate altitude acclimatization respectively.

DTIC

*Altitude Acclimatization; Sea Level*

**20080026090** NASA Johnson Space Center, Houston, TX, USA

**Nutritional Status in Humans during Long-Duration Bed Rest**

Smith, Scott M.; MatthewsOliver, Susan A.; Dillon, E. Lichar; Fesperman, Vernell; April 2006; 1 pp.; In English; Experimental Biology, 1-5 Apr. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

Bed rest is a valuable ground-based model for many of the physiological changes associated with space flight. A series of studies was undertaken to evaluate nutritional changes during and after 60 or 90 days of -6 head-down-tilt bed rest. A total of 11 subjects (8 M, 3 F; age 26-55 y) participated in the studies. Blood and urine were collected twice before bed rest and once per month during bed rest. Samples were analyzed in batch at the end of each study. Data were analyzed using repeated-measures ANOVA. Markers of bone resorption (such as n-telopeptide excretion,  $p < 0.05$ ) increased during bed rest, and 25-OH vitamin D status tended to decline ( $p=0.06$ ). During bed rest oxidative damage markers, such as superoxide dismutase increased ( $p < 0.01$ ) and 8-(OH)-2'-deoxyguanosine tended to increase ( $p=0.07$ ); whereas total

antioxidant capacity decreased (p less than 0.02). Iron status indices showed patterns of increased iron stores, with decreased transferrin receptors (p less than 0.001). Biochemical markers revealed a tendency toward a loss of muscle mass, by lower excretion of creatinine and 3-methyl-histidine during bed rest. All of these changes are very similar to those observed during space flight, and further document the utility of bed rest as a model of space flight.

Author

*Bed Rest; Long Duration Space Flight; Nutrition; Physiology; Human Beings; Biochemistry*

**20080026122** NASA Johnson Space Center, Houston, TX, USA

**Current ISS Exercise Countermeasures: Where are we now?**

Hayes, J. C.; Loerch, L.; Davis-Street, J.; Haralson, Cortni; Sams, C.; May 14, 2006; 1 pp.; In English; 77th Annual Scientific Meeting of the Aerospace, 14-18 May 2008, Orlando, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

Current International Space Station (ISS) crew schedules include 1.5 h/d for completion of resistive exercise and 1 h/d of aerobic exercise, 6 d/wk. While ISS post flight decrements in muscle strength, bone mineral density, and aerobic capacity improved in some crewmembers, deconditioning was still evident even with this volume of exercise. Results from early ISS expeditions show maximum loss in bone mineral density of the lumbar spine and pelvis in excess of 1.5% per month, with all crewmembers demonstrating significant bone loss in one or more regions. Similarly, post flight muscle strength losses in the hamstring and quadriceps muscle groups exceeded 30% in the immediate post mission period in some crewmembers. Measures of aerobic capacity early in the mission show average decrements of 15%, but with onboard aerobic exercise capability, the crew has been able to 'train up' over the course of the mission. These findings are highly variable among crewmembers and appear to be correlated with availability and reliability of the inflight resistive exercise device (RED), cycle ergometer, and treadmill. This suite of hardware was installed on ISS with limited operational evaluation in groundbased test beds. As a result, onorbit hardware constraints have resulted in inadequate physical stimulus, deconditioning, and increased risk for compromised performance during intra and extravehicular activities. These issues indicate that the current ISS Countermeasures System reliability or validity are not adequate for extendedduration exploration missions. Learning Objective: A better understanding of the status of ISS exercise countermeasures, their ability to protect physiologic systems, and recommendations for exploration exercise countermeasures.

Author

*Bone Demineralization; International Space Station; Muscles; Physical Exercise; Physical Fitness; Countermeasures; Weightlessness; Muscular Strength; Gravitational Effects; Physiological Effects*

**20080026140** Wyle Labs., Inc., Houston, TX, USA

**Stroboscopic Vision as a Treatment for Space Motion Sickness**

Reschke, Millard F.; Somers, J.T.; Ford, G.; Krnavek, J.M.; Hwang, E.Y.; June 07, 2006; 1 pp.; In English; Seventh Symposium on the Role of the Vestibular, 6-9 Jun. 2006, Noordwijk, Netherlands, Netherlands; Copyright; Avail.: Other Sources; Abstract Only

Stroboscopic illumination reduces the severity of motion sickness symptoms, and shutter glasses with a flash frequency of 4 Hz are as effective as a strobe light. Stroboscopic illumination appears to be an effective countermeasure where retinal slip is a significant factor in eliciting motion sickness. Additional research is currently underway to evaluate the stroboscopic glasses efficacy in a variety of different motion environments. Specifically, carsickness, sickness during the microgravity periods of parabolic flight and sea sickness. Possible mechanisms underlying the effectiveness of the glasses are also being investigated. There is evidence from pilot studies showing that the glasses, when strobed at the 4 Hz frequency, reduce saccade velocity to visually presented targets is reduced by approximately half of the normal values. It is interesting to note that adaptation to space flight may also slow saccade velocity.

Author

*Motion Sickness; Microgravity; Parabolic Flight; Aerospace Medicine; Adaptation*

**20080026141** Universities Space Research Association, Houston, TX, USA; Brookhaven National Lab., Upton, NY, USA

**Induction of Micronuclei in Human Fibroblasts across the Bragg Curve of Energetic Si and Fe Ions**

Wu, H.; Rusek, A.; Hada, M.; July 16, 2006; 1 pp.; In English; Committee on Space Research (COSPAR), 16-23 Jul. 2006, Beijing, China, China; Copyright; Avail.: Other Sources; Abstract Only

The space environment consists of a varying field of radiation particles including high-energy ions, with spacecraft shielding material providing the major protection to astronauts from harmful exposure. Unlike low-LET gamma or X-rays, the presence of shielding does not always reduce the radiation risks for energetic charged particle exposure. Since the dose

delivered by the charged particle increases sharply as the particle approaches the end of its range, a position known as the Bragg peak, the Bragg curve does not necessarily represent the biological damage along the particle traversal since biological effects are influenced by the track structure of both primary and secondary particles. Therefore, the biological Bragg curve is dependent on the energy and the type of the primary particle, and may vary for different biological endpoints. We studied micronuclei (MN) induction across the Bragg curve of Si and Fe ions at incident energies of 300 MeV/nucleon and 1 GeV/nucleon. A quantitative biological response curve did not reveal an increased yield of MN at the location of the Bragg peak. However, the ratio of mono- to bi-nucleated cells, which indicates inhibition in cell progression, increased at the Bragg peak location. These results confirm the hypothesis that severely damaged cells at the Bragg peak are likely to go through reproduction death.

Author

*Bragg Curve; Fibroblasts; Silicon; Iron; Ions; Energetic Particles; Extraterrestrial Radiation; Spacecraft Shielding; Radiation Shielding; Radiation Damage; Extraterrestrial Environments; Biological Effects*

**20080026153** NASA Johnson Space Center, Houston, TX, USA

### **Tilt and Translation Motion Perception during Off Vertical Axis Rotation**

Wood, Scott J.; Reschke, Millard F.; Clement, Gilles; January 2006; 22 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): DSO 499; Copyright; Avail.: CASI: [A03](#), Hardcopy

The effect of stimulus frequency on tilt and translation motion perception was studied during constant velocity off-vertical axis rotation (OVAR), and compared to the effect of stimulus frequency on eye movements. Fourteen healthy subjects were rotated in darkness about their longitudinal axis 10deg and 20deg off-vertical at 0.125 Hz, and 20deg offvertical at 0.5 Hz. Oculomotor responses were recorded using videography, and perceived motion was evaluated using verbal reports and a joystick with four degrees of freedom (pitch and roll tilt, mediallylateral and anteriorposterior translation). During the lower frequency OVAR, subjects reported the perception of progressing along the edge of a cone. During higher frequency OVAR, subjects reported the perception of progressing along the edge of an upright cylinder. The modulation of both tilt recorded from the joystick and ocular torsion significantly increased as the tilt angle increased from 10deg to 20deg at 0.125 Hz, and then decreased at 0.5 Hz. Both tilt perception and torsion slightly lagged head orientation at 0.125 Hz. The phase lag of torsion increased at 0.5 Hz, while the phase of tilt perception did not change as a function of frequency. The amplitude of both translation perception recorded from the joystick and horizontal eye movements was negligible at 0.125 Hz and increased as a function of stimulus frequency. While the phase lead of horizontal eye movements decreased at 0.5 Hz, the phase of translation perception did not vary with stimulus frequency and was similar to the phase of tilt perception during all conditions. During dynamic linear acceleration in the absence of other sensory input (canal, vision) a change in stimulus frequency alone elicits similar changes in the amplitude of both self motion perception and eye movements. However, in contrast to the eye movements, the phase of both perceived tilt and translation motion is not altered by stimulus frequency. We conclude that the neural processing to distinguish tilt and translation linear acceleration stimuli differs between eye movements and motion perception.

Author

*Attitude (Inclination); Motion Perception; Eye Movements; Degrees of Freedom; Rotation; VHF Omnidirectional Navigation*

**20080026161** Texas Univ., Galveston, TX, USA

### **The Effects of Modeled Microgravity on Nucleocytoplasmic Localization of Human Apurinic/Apyrimidinic**

Gonda, Steve; Jackson, E.B.; February 23, 2004; 1 pp.; In English; 2005 NASA Cell Science Conference, 23-25 Feb. 2004, Moody Gardens, Galveston, Texas, USA

Contract(s)/Grant(s): NASA101-31-GN-DA; No Copyright; Avail.: Other Sources; Abstract Only

Exposure to space radiation and microgravity occurs to humans during space flight. In order to have accurate risk estimations, answering questions to whether increased DNA damage seen during space flight is modified by microgravity are important. Several studies have examined whether intercellular repair of radiation-induced DNA lesions are modified by microgravity. Results from these studies show no modification of the repair processes due to microgravity. However, it is known that in studies not involving radiation that microgravity interferes with normal development. Interestingly, there is no data that attempts to analyze the possible effects of microgravity on the trafficking of DNA repair proteins. In this study, we analyze the effects of modeled microgravity on nucleocytoplasmic shuttling of the human DNA repair enzyme apurinic/apyrimidinic endonuclease 1 (APE1/Ref1) which is involved in base excision repair. We examined nuclear translocation of APE1 using enhanced green fluorescent protein (EGFP) fused to APE1 as a reporter. While APE1 under normal gravity showed normal nuclear localization, APE1 nuclear localization under modeled microgravity was decreased. These results

suggest that nucleocytoplasmic translocation of APE1 is modified under modeled microgravity.

Author

*Microgravity; Extraterrestrial Radiation; Mutations; Radiation Effects; Enzymes; Deoxyribonucleic Acid; Damage; Biological Effects*

**20080026194** NASA Johnson Space Center, Houston, TX, USA

**Incorporating Research Findings into Standards and Requirements for Space Medicine**

Duncan, J. Michael; May 14, 2006; 1 pp.; In English; Aerospace Medical Association Conference, 14-18 May 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Vision for Exploration has been the catalyst for NASA to refocus its life sciences research. In the future, life sciences research funded by NASA will be focused on answering questions that directly impact setting physiological standards and developing effective countermeasures to the undesirable physiological and psychological effects of spaceflight for maintaining the health of the human system. This, in turn, will contribute to the success of exploration class missions. We will show how research will impact setting physiologic standards, such as exposure limits, outcome limits, and accepted performance ranges. We will give examples of how a physiologic standard can eventually be translated into an operational requirement, then a functional requirement, and eventually spaceflight hardware or procedures. This knowledge will be important to the space medicine community as well as to vehicle contractors who, for the first time, must now consider the human system in developing and constructing a vehicle that can achieve the goal of success.

Author

*Aerospace Medicine; Research; Manned Space Flight; Space Missions*

**20080026195** NASA Johnson Space Center, Houston, TX, USA

**Physiologic Responses to Motorized and Non-Motorized Locomotion Utilizing the International Space Station Treadmill**

Smith, Cassie; Lee, Stuart MC; Laughlin, Mitzi; Loehr, James; Norcross, Jason; DeWitt, John; Hagan, R. D.; May 31, 2006; 1 pp.; In English; American College of Sports Medicine Meeting, 31 May - 3 Jun. 2006, Denver, Co, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

Treadmill locomotion is used onboard the International Space Station (ISS) as a countermeasure to the effects of prolonged weightlessness. The treadmill operates in two modes: motorized (T-M) and non-motorized (T-NM). Little is known about the potential physiologic differences between modes which may affect countermeasure exercise prescription. PURPOSE: To quantify heart rate (HR), oxygen consumption (VO<sub>2</sub>), perceived exertion (RPE), and blood lactate (BLa) during T-M and T-NM locomotion at 2 and 4 mph in normal ambulatory subjects. METHODS: Twenty subjects (10 men, 10 women; 31+/-5 yr, 172+/-10 cm, 68+/-13 kg, mean SD) with a treadmill peakVO<sub>2</sub> of 45.5+/-5.4 ml/kg/min (mean+/-SD) exercised on the ground-based ISS treadmill. Following a familiarization session in each mode, subjects completed two data collection sessions, T-M and T-NM in random order, at 2 and 4 mph. Subjects attempted to complete 5 min of exercise at each speed; if they could not maintain the speed, the trial was discontinued. At least 5 minutes of rest separated each speed trial, and at least 48 hrs separated each session. VO<sub>2</sub> was measured continuously (metabolic gas analysis), while HR (HR monitor) and RPE (Borg Chart, 6-20 scale) were recorded each min. Not all subjects completed 5 min during each condition, therefore the mean of the min 3 and 4 was taken as representative of steady-state. BLa was measured (finger stick) within 2 min post-exercise. Paired t-tests were used to test for differences (p<0.05) between treadmill modes within the same speed. RESULTS: All twenty subjects completed at least 4 min of exercise during all conditions, except T-NM 4 mph when only 11 subjects completed the minimum exercise duration. VO<sub>2</sub>, HR, RPE and BLa were significantly higher during T-NM locomotion at both speeds.

Author

*Treadmills; Locomotion; International Space Station; Countermeasures; Weightlessness; Physiological Responses; Oxygen Consumption; Heart Rate; Data Acquisition*

**20080026196** NASA Johnson Space Center, Houston, TX, USA

**ISS Utilization for Exploration-Class Missions**

Fincke, R.; Davis-Street, J.; Korth, D.; May 14, 2006; 1 pp.; In English; 77th Annual Scientific Meeting of the Aerospace, 14-18 May 2008, Orlando, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

Exercise countermeasures are the most commonly utilized approach for maintaining the health and performance of astronauts during spaceflight missions. However, International Space Station (ISS) exercise countermeasure hardware

reliability and prescriptions are not at a point of departure to support exploration-class missions. The JSC Exercise Countermeasures Project (ECP) plans to use ISS as a research and hardware evaluation platform to define and validate improved exercise hardware, prescriptions, and monitoring strategies to support crewmember operations on the Moon and Mars. The ECP will partner with JSC's Space Medicine Division to standardize elements of ISS exercise prescriptions to better understand their efficacy and to propose modified prescriptions for implementation that may be used in the crew exploration vehicle and/or lunar habitat. In addition, evaluations of the ISS treadmill harness will be conducted to define and improve fit and function, and assess the next generation medical monitoring devices such as the portable unit for metabolic analysis and the muscle atrophy research and exercise system for completion of periodic fitness evaluations during lunar and Mars travel. Finally, biomechanical data from ISS crew exercise sessions will be obtained to better understand loading and restraint systems, and identify the physiologic requirements during ISS extravehicular activities that may be analogous to extended excursions from the lunar habitat. It is essential to optimize exercise prescriptions, hardware, and monitoring strategies for exploration initiatives using ISS as a platform before the planned retirement of the Shuttle in 2010 and the declining NASA emphasis on ISS to maximize knowledge before embarking on travel to the Moon and Mars.

Author

*International Space Station; Physical Exercise; Health; Space Missions; Biodynamics; Countermeasures*

**20080026202** Wyle Labs., Inc., Houston, TX, USA; Naples II Univ., Naples, Italy

**Loss of Telomeres in the Progeny of Human Lymphocytes Exposed to Energetic Heavy Ions**

Cucinotta, F.A.; George, K.; Durante, M.; [2006]; 13 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We have used cross-species multi-color banding (RxFISH) combined with telomere FISH probes, to measure chromosomal aberrations in the progeny of human peripheral blood lymphocytes exposed to ionizing radiation. Accelerated iron particles (energy 1 GeV/nucleon) induced many more terminal deletions than the same dose of gamma-rays. We found that truncated chromosomes without telomeres could be transmitted for at least three cell cycles following exposure, and represented about 10% of all aberrations observed in the progeny of cells exposed to iron ions. High energy heavy ions generate the most significant health risk for human space exploration and the results suggest that telomere loss may be the leading mechanism for their high efficiency in the induction of late effects.

Author

*Telomeres; Lymphocytes; Heavy Ions; Energetic Particles; Chromosome Aberrations; Ionizing Radiation; Radiation Effects; Biological Effects; Bioastronautics*

**20080026203** Wyle Labs., Inc., Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA

**Estimation of Effective Doses for Radiation Cancer Risks on ISS, Lunar, and Mars Missions with Space Radiation Measurement**

Kim, M.Y.; Cucinotta, F.A.; September 07, 2005; 1 pp.; In English; 10th Workshop on Radiation Monitoring for the ISS, 7-9 Sep. 2005, Chiba, Japan, Japan; Copyright; Avail.: Other Sources; Abstract Only

Radiation protection practices define the effective dose as a weighted sum of equivalent dose over major sites for radiation cancer risks. Since a crew personnel dosimeter does not make direct measurement of effective dose, it has been estimated with skin-dose measurements and radiation transport codes for ISS and STS missions. The Phantom Torso Experiment (PTE) of NASA's Operational Radiation Protection Program has provided the actual flight measurements of active and passive dosimeters which were placed throughout the phantom on STS-91 mission for 10 days and on ISS Increment 2 mission. For the PTE, the variation in organ doses, which is resulted by the absorption and the changes in radiation quality with tissue shielding, was considered by measuring doses at many tissue sites and at several critical body organs including brain, colon, heart, stomach, thyroid, and skins. These measurements have been compared with the organ dose calculations obtained from the transport models. Active TEPC measurements of lineal energy spectra at the surface of the PTE also provided the direct comparison of galactic cosmic ray (GCR) or trapped proton dose and dose equivalent. It is shown that orienting the phantom body as actual in ISS is needed for the direct comparison of the transport models to the ISS data. One of the most important observations for organ dose equivalent of effective dose estimates on ISS is the fractional contribution from trapped protons and GCR. We show that for most organs over 80% is from GCR. The improved estimation of effective doses for radiation cancer risks will be made with the resultant tissue weighting factors and the modified codes.

Author

*Radiation Protection; Radiation Dosage; Cancer; Extraterrestrial Radiation; Radiation Measurement; Radiation Transport; Space Missions; Bioastronautics; Risk Assessment*

**20080026214** NASA Johnson Space Center, Houston, TX, USA

**Microgravity and Immunity: Changes in Lymphocyte Gene Expression**

Risin, D.; Pellis, N. R.; Ward, N. E.; Risin, S. A.; July 16, 2006; 1 pp.; In English; 36th Committee on Space Research (COSPAR) conference, 16-23 Jul. 2006, Beijing, China

Contract(s)/Grant(s): NAG5-4072; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026214>

Earlier studies had shown that modeled and true microgravity (MG) cause multiple direct effects on human lymphocytes. MG inhibits lymphocyte locomotion, suppresses polyclonal and antigen-specific activation, affects signal transduction mechanisms, as well as activation-induced apoptosis. In this study we assessed changes in gene expression associated with lymphocyte exposure to microgravity in an attempt to identify microgravity-sensitive genes (MGSG) in general and specifically those genes that might be responsible for the functional and structural changes observed earlier. Two sets of experiments targeting different goals were conducted. In the first set, T-lymphocytes from normal donors were activated with antiCD3 and IL2 and then cultured in 1g (static) and modeled MG (MMG) conditions (Rotating Wall Vessel bioreactor) for 24 hours. This setting allowed searching for MGSG by comparison of gene expression patterns in zero and 1 g gravity. In the second set - activated T-cells after culturing for 24 hours in 1g and MMG were exposed three hours before harvesting to a secondary activation stimulus (PHA) thus triggering the apoptotic pathway. Total RNA was extracted using the RNeasy isolation kit (Qiagen, Valencia, CA). Affymetrix Gene Chips (U133A), allowing testing for 18,400 human genes, were used for microarray analysis. In the first set of experiments MMG exposure resulted in altered expression of 89 genes, 10 of them were up-regulated and 79 down-regulated. In the second set, changes in expression were revealed in 85 genes, 20 were up-regulated and 65 were down-regulated. The analysis revealed that significant numbers of MGS genes are associated with signal transduction and apoptotic pathways. Interestingly, the majority of genes that responded by up- or down-regulation in the alternative sets of experiments were not the same, possibly reflecting different functional states of the examined T-lymphocyte populations. The responder genes (MGSG) might play an essential role in adaptation to MG and/or be responsible for pathologic changes encountered in Space and thus represent potential targets for molecular-based countermeasures

Author (revised)

*Microgravity; Immunity; Lymphocytes; Gene Expression; Physiological Responses; Gravitational Physiology; Bioastronautics*

**20080026215** Universities Space Research Association, Houston, TX, USA

**Evaluation of Late Effects of Heavy-Ion Radiation on Mesenchymal Stem Cells**

Gonda, S.R.; Behraves, E.; Huff, J.L.; Johnson, F.; January 10, 2005; 1 pp.; In English; Bioastronautics Investigators' Workshop, 10-12 Jan. 2005, Moody Gardens, Texas, USA

Contract(s)/Grant(s): 03-OBPR-07-0038-0009; No Copyright; Avail.: Other Sources; Abstract Only

The overall objective of this recently funded study is to utilize well-characterized model test systems to assess the impact of pluripotent stem cell differentiation on biological effects associated with high-energy charged particle radiation. These stem cells, specifically mesenchymal stem cells (MSCs), have the potential for differentiation into bone, cartilage, fat, tendons, and other tissue types. The characterization of the regulation mechanisms of MSC differentiation to the osteoblastic lineage by transcription factors, such as Runx2/Cbfa1 and Osterix, and osteoinductive proteins such as members of the bone morphogenic protein family are well established. More importantly, for late biological effects, MSCs have been shown to contribute to tissue restructuring and repair after tissue injury. The complex regulation of and interactions between inflammation and repair determine the eventual outcome of the responses to tissue injury, for which MSCs play a crucial role. Additionally, MSCs have been shown to respond to reactive oxygen species, a secondary effector of radiation, by differentiating. With this, we hypothesized that differentiation of MSCs can alter or exacerbate the damage initiated by radiation, which can ultimately lead to late biological effects of misrepair/fibrosis which may ultimately lead to carcinogenesis. Currently, studies are underway to examine high-energy X-ray radiation at low and high doses, approximately 20 and 200 Rad, respectively, on cytogenetic damage and gene modulation of isolated MSCs. These cells, positive for MSC surface markers, were obtained from three persons. In vitro cell samples were harvested during cellular proliferation and after both cellular recovery and differentiation. Future work will use established in vitro models of increasing complexity to examine the value of traditional 2D tissue-culture techniques, and utilize 3D in vitro tissue culture techniques that can better assess late effects associated with radiation.

Author

*Heavy Ions; Radiation Effects; Stem Cells; Biological Effects; Differentiation (Biology); Cells (Biology); Cell Culturing*

**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*.

**20080025106** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Maximizing Anthropometric Accommodation and Protection**

Robinette, Kathleen M; Aug 2007; 34 pp.; In English

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

Report No.(s): AD-A478783; AFRL-RH-WP-TR-2008-0022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document summarizes in-house anthropometric research done over a 5-year period with three primary objectives: 1) worldwide anthropometry resource development; 2) understanding the impact of anthropometry on fit and performance; and 3) transitioning fit, accommodation, and anthropometric technologies to the engineering and safety communities. It is a companion to a contractual effort entitled 'Adaptive Anthropometric Accommodation.'

DTIC

*Anthropometry; Human Factors Engineering; Information Systems; Protection; Protective Clothing*

**20080025288** World Technology Evaluation Center, Baltimore, MD USA

**International Assessment of Research and Development in Brain-Computer Interfaces. WTEC Panel Report**

Berger, Theodore W; Chapin, John K; Gerhardt, Greg A; McFarland, Dennis J; Principe, Jose C; Soussou, Walid V; Taylor, Dawn M; Tresco, Patrick A; Oct 2007; 235 pp.; In English

Report No.(s): AD-A478887; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478887>

Brain-computer interface (BCI) research deals with establishing communication pathways between the brain and external devices. BCI systems can be broadly classified depending on the placement of the electrodes used to detect and measure neurons firing in the brain: in invasive systems, electrodes are inserted directly into the cortex; in noninvasive systems, they are placed on the scalp and use electroencephalography or electrocorticography to detect neuron activity. This WTEC study was designed to gather information on worldwide status and trends in BCI research and to disseminate it to government decision makers and the research community. The study reviewed and assessed the state of the art in sensor technology, the biotic/abiotic interface and biocompatibility, data analysis and modeling, hardware implementation, systems engineering, functional electrical stimulation, noninvasive communication systems, and cognitive and emotional neuroprostheses in academic research and industry.

DTIC

*Brain; Human-Computer Interface*

**20080025325** Defence Research and Development Canada, Toronto, Ontario Canada

**Assessment of the Pulmanex Hi-Ox for Aeromedical Evacuation at 8000 Feet**

Bouak, F; Michas, B; Eaton, D J; Mar 2007; 46 pp.; In English

Report No.(s): AD-A478980; DRDC-TORONTO-TM-2006-200; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478980>

DRDC Toronto was tasked by the Canadian Forces Health Services Group Headquarters (CF H Svc Gp HQ) to verify that the Pulmanex Hi-Ox mask system (HiOx) is suitable, safe and efficient for use in aircraft at cabin altitudes up to 8000 feet (ft). The objective is to use the HiOx mask to provide oxygen (O<sub>2</sub>) to patients during aeromedical evacuation. Performance and safety were compared at ground level and 8000 ft and at four different O<sub>2</sub> flow rates (0, 2, 4 and 6 litres per minute (L/min)). An experiment was conducted by eight male volunteers inside the hypobaric chamber of DRDC Toronto. Subjects were at rest in a seated position. The data showed that it is possible to use the HiOx safely for aeromedical evacuation at 8000 ft with relatively low O<sub>2</sub> flows. The HiOx at altitude, like at ground level, significantly increased the blood O<sub>2</sub> saturation at as little as 2 L/min. The oxygen partial pressure of the inhaled mixture showed that the HiOx would require an increase to the O<sub>2</sub> supply flow rate at altitude to provide equivalent oxygen treatment as that at ground level. However, as demonstrated



in previous studies, the O<sub>2</sub> requirement at any altitude would be substantially less than with traditional oxygen masks, thereby extending the duration of supplemental oxygen and enabling the use of miniature O<sub>2</sub> concentrators.

DTIC

*Air Transportation; Evacuating (Transportation); Medical Services; Oxygen Masks*

**20080025376** Massachusetts Inst. of Tech., Cambridge, MA USA

**Design of a Quasi-Passive Parallel Leg Exoskeleton to Augment Load Carrying for Walking**

Valiente, Andrew; Aug 2005; 116 pp.; In English

Contract(s)/Grant(s): NBCHC040122

Report No.(s): AD-A479211; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479211>

Biomechanical experiments suggest that it may be possible to build a leg exoskeleton to reduce the metabolic cost of walking while carrying a load. A quasi-passive, leg exoskeleton is presented that is designed to assist the human in carrying a 75 lb. payload. The exoskeleton structure runs parallel to the legs, transferring payload forces to the ground. In an attempt to make the exoskeleton more efficient, passive hip and ankle springs are employed to store and release energy throughout the gait cycle. To reduce knee muscular effort, a variable damper is implemented at the knee to support body weight throughout early stance. In this thesis, the author hypothesizes that a quasi-passive leg exoskeleton of this design will improve metabolic walking economy for carrying a 75 lb. backpack compared with a leg exoskeleton without any elastic energy storage or variable-damping capability. He further anticipates that the quasi-passive leg exoskeleton will improve walking economy for carrying a 75 lb. backpack compared with unassisted loaded walking. To test these hypotheses, the rate of oxygen consumption is measured on one human test participant walking on a level surface at a self-selected speed. Pilot experimental data show that the quasi-passive exoskeleton increases the metabolic cost of carrying a 75 lb. backpack by 39% compared to carrying 75 lbs. without an exoskeleton. When the variable-damper knees are replaced by simple pin joints, the metabolic cost relative to unassisted load carrying decreases to 34%, suggesting that the dampening advantages of the damper knees did not compensate for their added mass. When the springs are removed from the aforementioned pin knee exoskeleton, the metabolic cost relative to unassisted load carrying increased to 83%. These results indicate that the implementation of springs is beneficial in exoskeleton design.

DTIC

*Biodynamics; Costs; Exoskeletons; Loads (Forces); Metabolism; Payloads; Walking*

**20080025377** Massachusetts Inst. of Tech., Cambridge, MA USA

**Biomimetic Design of an Under-Actuated Leg Exoskeleton for Load-Carrying Augmentation**

Walsh, Conor J; Feb 2006; 97 pp.; In English

Contract(s)/Grant(s): NBCHC040122

Report No.(s): AD-A479212; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479212>

Metabolic studies have shown that there is a metabolic cost associated with carrying a load. Previous work on exoskeleton design has not considered the passive dynamics of walking and has focused on fully actuated systems that are inefficient and heavy. In this thesis, an underactuated exoskeleton is presented that runs parallel to the human leg. The exoskeleton component design is based on the kinematics and kinetics of human walking. The joint components of the exoskeleton in the sagittal plane consist of a force-controllable actuator at the hip, a variable-damper mechanism at the knee, and a passive spring at the ankle. A state-machine control strategy is written based on joint angle and ground-exoskeleton force sensing. Positive non-conservative power is added at the hip during the walking cycle to help propel the mass of the human and payload forward. At the knee, the damper mechanism is turned on at heel strike as the exoskeleton leg is loaded and turned off during terminal stance to allow knee flexion. The spring at the ankle engages in controlled dorsiflexion to store energy that is later released to assist in powered plantarflexion. Kinetic and metabolic data are recorded from human subjects wearing the exoskeleton with a 75 lb. payload. These data are compared to data recorded from subjects walking without the exoskeleton. It is demonstrated that the exoskeleton transfers loads to the ground with a 90% and higher load transfer depending on the phase of gait. Further exoskeleton wearers report that the exoskeleton greatly reduces the stress on the shoulders and back. However, although a significant fraction of the payload is transferred through the exoskeleton structure, the exoskeleton is found to increase metabolic economy by 74%. By comparing distinct exoskeleton configurations, the relative effect of each exoskeleton component is determined.

DTIC

*Augmentation; Biodynamics; Biomimetics; Costs; Exoskeletons; Loads (Forces); Metabolism; Payloads; Walking*

**20080025560** Center for Technology Commercialization, Inc., Westborough, MA USA

**Law Enforcement Advanced Protection (LEAP) Duty Uniforms, Integrated Head Protection, Chemical/Biological Protection and Human Systems Integration Law Enforcement User Focus Group Report**

Creighton, II, Thomas E; Doherty, Stephen; Cook, Melinda A; Mar 2008; 93 pp.; In English  
Contract(s)/Grant(s): W911QY-07-C-0035

Report No.(s): AD-A479636; NATICK/TR-08/010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This focus group report documents the findings of a Law Enforcement Advanced Protection (LEAP) User Requirements Focus Group held on 15-16 May 2007 in Scottsdale, Arizona. This focus group is one in a series of personal protective equipment (PPE) related user focus groups for members of the law enforcement community. Its purpose was to collect data/criteria for operational requirements, personal protective equipment (PPE) trends and concepts of operations (CONOPS) from representatives in law enforcement. Program participants represented a cross section of the country's law enforcement community, serving in different agencies, departments, and job functions. The focus group topics were as follows: Duty Uniforms, Integrated Head Protection, Chemical/Biological Protection, and Human Systems Integration. Data collected through this focus group will be used with on-going research and analysis to support a number of LEAP-related activities, including developing performance criteria for law enforcement specific PPE standards.

DTIC

*Biochemistry; Law (Jurisprudence); Protection; Protective Clothing; Protectors; Systems Integration*

**20080025674** BeiHang Univ., Beijing, China

**Synthetic Evaluation Method of Mental Workload on Visual Display Interface in Airplane Cockpit**

Kang, Wei-yong; Yuan, Xiu-gan; Liu, Zhong-qi; Liu, Wei; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 103-107; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

To establish a system to evaluate the mental workload on visual display interface in airplane cockpits after synthesizing three kinds of mental workload assessment techniques: main task, physiological, and subjective evaluation. The evaluation indices of each kind of assessment techniques were defined, the experimental and subjective inquiry data and weighted averages were calculated and a quantification evaluation value for each method was obtained. With the weighted calculations the evaluation value of mental workload on visual display interface in airplane cockpits was obtained. In M kinds of different designs of visual display interface in airplane cockpit, the synthetic evaluation value of one design was the smallest and the mental workload of this design was the smallest. The design yielding the smallest mental workload was chosen as the final scheme of visual display interface in airplane cockpit. The evaluation system is combined with present main evaluation methods of mental workload to utilize their advantages. The evaluating result can be quantified more directly and clearly. With this evaluation system, mental workload can be evaluated during the design of visual display interface of airplane cockpit and the best scheme can be confirmed.

Author (revised)

*Cockpits; Display Devices; Mental Performance; Workloads (Psychophysiology); Human Factors Engineering; Human-Computer Interface; Physiology*

**20080025678** Institute of Space Medico-Engineering, Beijing, China

**Study on the Method of Recurrence Quantification Analysis (RQA) to Recognize the Amount of Human Bodies in Bioradar Echo Signals**

Xia, Lin-lin; Wang, Jian-qi; Lu, Guo-hua; Yue, yu; Jing, Xi-jing; Space Medicine and Medical Engineering, Vol. 21, No. 2; April 2008, pp. 126-129; In Chinese; See also [20080025664](#); Copyright; Avail.: Other Sources

To analyze the echo signals in bioradar and to recognize the amount of human bodies by using the method of recurrence quantification analysis (RQA). To detect the organism behind the brick wall, the echo signals were collected with ultra-wide-band (UWB) bioradar and analyzed with RQA. Through computing a series of quantification indices: percent recurrence, percent determinism and so on, it was shown that the percent recurrence was higher when people were detected than when they were not. The quantity of people detected by bioradar can be effectively recognized using RQA.

Author

*Situational Awareness; Echoes; Rescue Operations; Radar; Bioinstrumentation; Man Machine Systems*

**20080026009** NASA Johnson Space Center, Houston, TX, USA

**New Directions for NASA's Advanced Life Support Program**

Barta, Daniel J.; February 05, 2006; 2 pp.; In English; Habitation 2006 International ALS Working, 5010 Feb. 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Advanced Life Support (ALS), an element of Human Systems Research and Technology s (HSRT) Life Support and

Habitation Program (LSH), has been NASA's primary sponsor of life support research and technology development for the agency. Over its history, ALS sponsored tasks across a diverse set of institutions, including field centers, colleges and universities, industry, and governmental laboratories, resulting in numerous publications and scientific articles, patents and new technologies, as well as education and training for primary, secondary and graduate students, including minority serving institutions. Prior to the Vision for Space Exploration (VSE) announced on January 14th, 2004 by the President, ALS had been focused on research and technology development for long duration exploration missions, emphasizing closed-loop regenerative systems, including both biological and physicochemical. Taking a robust and flexible approach, ALS focused on capabilities to enable visits to multiple potential destinations beyond low Earth orbit. ALS developed requirements, reference missions, and assumptions upon which to structure and focus its development program. The VSE gave NASA a plan for steady human and robotic space exploration based on specific, achievable goals. Recently, the Exploration Systems Architecture Study (ESAS) was chartered by NASA's Administrator to determine the best exploration architecture and strategy to implement the Vision. The study identified key technologies required to enable and significantly enhance the reference exploration missions and to prioritize near-term and far-term technology investments. This technology assessment resulted in a revised Exploration Systems Mission Directorate (ESMD) technology investment plan. A set of new technology development projects were initiated as part of the plan's implementation, replacing tasks previously initiated under HSRT and its sister program, Exploration Systems Research and Technology (ESRT). The Exploration Life Support (ELS) Project, under the Exploration Technology Development Program, has recently been initiated to perform directed life support technology development in support of Constellation and the Crew Exploration Vehicle (CEV). ELS has replaced ALS, with several major differences. Thermal Control Systems have been separated into a new stand alone project (Thermal Systems for Exploration Missions). Tasks in Advanced Food Technology have been relocated to the Human Research Program. Tasks in a new discipline area, Habitation Engineering, have been added. Research and technology development for capabilities required for longer duration stays on the Moon and Mars, including bioregenerative system, have been deferred.

Author

*Life Support Systems; Feedback Control; Robotics; Temperature Control; Low Earth Orbits; Regeneration (Physiology); Space Exploration*

**20080026014** NASA Johnson Space Center, Houston, TX, USA

#### **Closure of Regenerative Life Support Systems: Results of the Lunar-Mars Life Support Test Project**

Barta, Daniel; Henninger, D.; Edeen, M.; Lewis, J.; Smth, F.; Verostko, C.; July 16, 2006; 2 pp.; In English; 36th COSPAR Scientific Assembly meeting, 16-23 Jul. 2006, Beijing, China; No Copyright; Avail.: Other Sources; Abstract Only

Future long duration human exploration missions away from Earth will require closed-loop regenerative life support systems to reduce launch mass, reduce dependency on resupply and increase the level of mission self sufficiency. Such systems may be based on the integration of biological and physicochemical processes to produce potable water, breathable atmosphere and nutritious food from metabolic and other mission wastes. Over the period 1995 to 1998 a series of ground-based tests were conducted at the National Aeronautics and Space Administration, Johnson Space Center, to evaluate the performance of advanced closed-loop life support technologies with real human metabolic and hygiene loads. Named the Lunar-Mars Life Support Test Project (LMLSTP), four integrated human tests were conducted with increasing duration, complexity and closure. The first test, LMLSTP Phase I, was designed to demonstrate the ability of higher plants to revitalize cabin atmosphere. A single crew member spent 15 days within an atmospherically closed chamber containing 11.2 square meters of actively growing wheat. Atmospheric carbon dioxide and oxygen levels were maintained by control of the rate of photosynthesis through manipulation of light intensity or the availability of carbon dioxide and included integrated physicochemical systems. During the second and third tests, LMLSTP Phases II & IIa, four crew members spent 30 days and 60 days, respectively, in a larger sealed chamber. Advanced physicochemical life support hardware was used to regenerate the atmosphere and produce potable water from wastewater. Air revitalization was accomplished by using a molecular sieve and a Sabatier processor for carbon dioxide absorption and reduction, respectively, with oxygen generation performed by water hydrolysis. Production of potable water from wastewater included urine treatment (vapor compression distillation), primary treatment (ultrafiltration/reverse osmosis and multi-filtration) and post processing. For the Phase II test the water recovery rate ranged from 95 to 98%, depending on the processor. LMLSTP Phase III, the fourth test of the series, had a duration of 91 days and included four crew members. The test demonstrated an integration of physicochemical and biological technologies for air revitalization, water recovery and waste processing. Wheat supplemented the physicochemical air revitalization systems by providing approximately 25% of the oxygen required for the 4-person crew. The water recovery system included immobilized cell and trickling filter bioreactors for primary water treatment, reverse osmosis and air evaporation systems for secondary water treatment, followed by post processing. The 8 day initial supply of water was recycled through the chamber and crew 10 times over the course of the test. Grain from the wheat together with fresh lettuce from a small growth chamber within the

crew chamber provided supplementation to the stored food system, but at a level less than 5% of the crew's caloric requirement. An incinerator was used to demonstrate mineralization of the crew's solid waste, with the combustion products (mainly carbon dioxide) returned to the wheat for conversion to oxygen.

Author

*Life Support Systems; NASA Programs; Long Duration Space Flight; Manned Mars Missions; Lunar Surface*

**20080026023** NASA Johnson Space Center, Houston, TX, USA

**NASA Johnson Space Center Usability Testing and Analysis facility (UTAF) Overview**

Whitmore, Mihriban; Holden, Kritina L.; April 2005; 1 pp.; In English; San Antonio Chapter of the Human Factors and Ergonomics Society (HFES), 1 Apr. 2005, San Antonio, TX, USA

Contract(s)/Grant(s): NAS9-02078; Copyright; Avail.: Other Sources; Abstract Only

The Usability Testing and Analysis Facility (UTAF) is part of the Space Human Factors Laboratory at the NASA Johnson Space Center in Houston, Texas. The facility performs research for NASA's HumanSystems Integration Program, under the HumanSystems Research and Technology Division. Specifically, the UTAF provides human factors support for space vehicles, including the International Space Station, the Space Shuttle, and the forthcoming Crew Exploration Vehicle. In addition, there are ongoing collaborative research efforts with external corporations and universities. The UTAF provides human factors analysis, evaluation, and usability testing of crew interfaces for space applications. This includes computer displays and controls, workstation systems, and work environments. The UTAF has a unique mix of capabilities, with a staff experienced in both cognitive human factors and ergonomics. The current areas of focus are: human factors applications in emergency medical care and informatics; control and display technologies for electronic procedures and instructions; voice recognition in noisy environments; crew restraint design for unique microgravity workstations; and refinement of human factors processes and requirements. This presentation will provide an overview of ongoing activities, and will address how the UTAF projects will evolve to meet new space initiatives.

Author

*Human Factors Engineering; Test Facilities; General Overviews; Aerospace Vehicles*

**20080026024** NASA Johnson Space Center, Houston, TX, USA

**Human Factors Assessment of Respiratory Support Pack (RSP) Cue Card**

Whitmore, Mihriban; Hudy, Cynthia; Smith, Danielle; Byrne, Vicky; May 08, 2005; 1 pp.; In English; Aerospace Medical Association (ASMA) Annual Meeting, 8-12 May 2005, Kansas City, MO, USA

Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: Other Sources; Abstract Only

The Respiratory Support Pack (RSP) is a medical pack onboard the International Space Station (ISS) that contains much of the necessary equipment for providing aid to a conscious or unconscious crewmember in respiratory distress. Inside the RSP lid pocket is a 5.5 by 11 inch paper cue card, which is used by a Crew Medical Officer as the procedure to set up the equipment and deliver oxygen to a crewmember. In training, crewmembers expressed concerns about the readability and usability of the cue card; consequently, updating the cue card was prioritized as an activity to be completed prior to Space Shuttle return-to-flight. The Usability Testing and Analysis Facility at the Johnson Space Center evaluated the current layout of the cue card, and proposed several new cue card designs based on human factors principals. A series of three studies were performed in order to experimentally compare performance with each of the cue card designs. Nonmedically trained personnel used either a redesigned RSP cue card, or the original card to simulate resuscitation (using a mannequin along with the hardware). Time to completion, errors and subjective ratings were recorded. The addition of pictures, colors, borders, and simplification of the flow of information (making minimal changes to the actual procedure content) elicited great benefits during testing. Time to complete RSP procedures was reduced by as much as three minutes with the final cue card design. Detailed results from these studies, as well as general guidelines for cue card design will be discussed.

Author

*Human Factors Engineering; Technology Assessment; International Space Station; Breathing Apparatus; Test Facilities*

**20080026032** NASA Johnson Space Center, Houston, TX, USA

**Human Factors and ISS Medical Systems: Highlights of Procedures and Equipment Findings**

Byrne, V. E.; Hudy, C.; Smith, D.; Whitmore, M.; January 10, 2005; 1 pp.; In English; Bioastronautics Investigators' Workshop, 10-12 Jan. 2005, Galveston, TX, USA

Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026032>

As part of the Space Human Factors Engineering Critical Questions Roadmap, a three year Technology Development

Project (TDP) was funded by NASA Headquarters to examine emergency medical procedures on ISS. The overall aim of the emergency medical procedures project was to determine the human factors issues in the procedures, training, communications and equipment, and to recommend solutions that will improve the survival rate of crewmembers in the event of a medical emergency. Currently, each ISS crew remains on orbit for six month intervals. As there is not standing requirement for a physician crewmember, during such time, the maintenance of crew health is dependant on individual crewmembers. Further, in the event of an emergency, crew will need to provide prolonged maintenance care, as well as emergency treatment, to an injured crewmember while awaiting transport to Earth. In addition to the isolation of the crew, medical procedures must be carried out within the further limitations imposed by the physical environment of the space station. For example, in order to administer care on ISS without the benefit of gravity, the Crew Medical Officers (CMOs) must restrain the equipment required to perform the task, restrain the injured crewmember, and finally, restrain themselves. Both the physical environment and the physical space available further limit the technology that can be used onboard. Equipment must be compact, yet able to withstand high levels of radiation and function without gravity. The focus here is to highlight the human factors impacts from our three year project involving the procedures and equipment areas that have been investigated and provided valuable to ISS and provide groundwork for human factors requirements for medical applications for exploration missions.

Author

*Human Factors Engineering; International Space Station; Aerospace Medicine; Emergencies*

**20080026037** NASA Johnson Space Center, Houston, TX, USA

**Tools to Support Human Factors and Systems Engineering Interactions During Early Analysis**

Thronesbery, Carroll; Malin, Jane T.; Holden, Kritina; Smith, Danielle Paige; March 04, 2006; 10 pp.; In English; 2006 IEEE Aerospace Conference, 4-11 Mar. 2006, Big Sky, MT, USA

Contract(s)/Grant(s): 72-131020-40-L2

Report No.(s): IEEEAC Paper 1496; Copyright; Avail.: Other Sources

We describe an approach and existing software tool support for effective interactions between human factors engineers and systems engineers in early analysis activities during system acquisition. We examine the tasks performed during this stage, emphasizing those tasks where system engineers and human engineers interact. The Concept of Operations (ConOps) document is an important product during this phase, and particular attention is paid to its influences on subsequent acquisition activities. Understanding this influence helps ConOps authors describe a complete system concept that guides subsequent acquisition activities. We identify commonly used system engineering and human engineering tools and examine how they can support the specific tasks associated with system definition. We identify possible gaps in the support of these tasks, the largest of which appears to be creating the ConOps document itself. Finally, we outline the goals of our future empirical investigations of tools to support system concept definition.

Author

*Human Factors Engineering; Systems Engineering; Human-Computer Interface; Systems Analysis; Support Systems*

**20080026152** NASA Johnson Space Center, Houston, TX, USA

**Utilization of Porous Media for Condensing Heat Exchangers**

Tuan, George C.; February 05, 2006; 1 pp.; In English; Habitation 2006, 5-8 Feb. 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

The use of porous media as a mean of separating liquid condensate from the air stream in condensing heat exchangers has been explored in the past inside small plant growth chambers and in the Apollo Command Module. Both applications used a cooled porous media made of sintered stainless steel to cool and separate condensation from the air stream. However, the main issues with the utilization of porous media in the past have been the deterioration of the porous media over long duration, such as clogging and changes in surface wetting characteristics. In addition, for long duration usage, biofilm growth from microorganisms on the porous media would also be an issue. In developing Porous Media Condensing Heat Exchangers (PMCHX) for future space applications, different porous materials and microbial growth control methods will need to be explored. This paper explores the work performed at JSC and GRC to evaluate different porous materials and microbial control methods to support the development of a Porous Media Condensing Heat Exchanger. It outlines the basic principles for designing a PMCHX and issues that were encountered and ways to resolve those issues. The PMCHX has potential of mass, volume, and power savings over current CHX and water separator technology and would be beneficial for long duration space missions.

Author

*Heat Exchangers; Condensing; Porous Materials; Air Flow; Stainless Steels; Porosity*

**20080026163** TDA Research, Inc., Wheat Ridge, CO, USA

**Space Suit Radiator Performance in Lunar and Mars Environments**

Paul, Heather; Trevino, Luis; Nability, James; Mason, Georgia; Copeland, Robert; Libberton, Kerry; Stephan, Ryan; July 09, 2007; 1 pp.; In English; 37th International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA  
Contract(s)/Grant(s): W.B.S. 731384.06.04.01.05.10; No Copyright; Avail.: Other Sources; Abstract Only

During an Extravehicular Activity (EVA), both the heat generated by the astronaut's metabolism and that produced by the Portable Life Support System (PLSS) must be rejected to space. The heat sources include the heat of adsorption of metabolic CO<sub>2</sub>, the heat of condensation of water, the heat removed from the body by the liquid cooling garment and the load from the electrical components. Although the sublimator hardware to reject this load weighs only 3.48 lbs, an additional eight pounds of water are loaded into the unit of which about six to eight are sublimated and lost; this is the single largest expendable during an eight-hour EVA. Using a radiator to reject heat from the Astronaut during an EVA, we can significantly reduce the amount of expendable water consumed by the sublimator. Last year we reported on the design and initial operational assessment tests of our novel radiator designated the Radiator And Freeze Tolerant heat eXchanger (RAFT-X). Herein, we report on tests conducted in the NASA Johnson Space Center Chamber E Thermal Vacuum Test Facility. Up to 800 Btu/h of heat were rejected in lunar and Mars environments with temperatures as cold as 150 F. Tilting the radiator did not cause an observable loss in performance. The RAFT-X endured freeze/thaw cycles and in fact, the heat exchanger was completely frozen three times without any apparent damage to the unit. We were also able to operate the heat exchanger in a partially frozen configuration to throttle the heat rejection rate from 530 Btu/h at low water flow rate down to 300 Btu/h. Finally, the deliberate loss of a single loop heat pipe only degraded the heat rejection performance by about 2 to 5%.

Author (revised)

*Space Suits; Heat Radiators; Heat Exchangers; Extravehicular Activity; Extraterrestrial Environments*

**20080026221** Jenkins (Matthew, R.), Esq., Dayton, OH, USA

**Processor Aided Firing of Small Arms**

Lenner, G. E., Inventor; Karcher, P. B., Inventor; 10 Sep 04; 25 pp.; In English

Contract(s)/Grant(s): DMB07-03-D-B009

Patent Info.: Filed Filed 10 Sep 04; US-Patent-Appl-SN-10-938-321

Report No.(s): PB2007-111556; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A digital processor aiming and firing system generates a trigger signal with electronic timing exactness, resulting in shooting accuracy unobtainable by humans. To achieve this, a view down the barrel sight is captured by a digital video camera and analyzed on a frame-by-frame basis by an electronic processor equipped with image identification software. Motion detectors attached to the weapon are used to interpolate the barrel position between frames. A motion history of the barrel position relative to the target is calculated and an extrapolation of the future position is made. When the anticipated barrel direction impinges on the target, corrected for motion and ballistic effects, the processor signals the launch of the projectile.  
NTIS

*Microprocessors; Guns (Ordnance); Accuracy; Gunfire*

**55**

**EXO BIOLOGY**

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

**20080026143** Centre National de la Recherche Scientifique, Paris, France

**NanoSIMS Reveals New Structural and Elemental Signatures of Early Life**

Oehler, Dorothy Z.; Mostefaoui, Smail; Meibom, Anders; Selo, Madeleine; Robert, Francois; McKay, David S.; March 26, 2006; 1 pp.; In English; Astrobiology Science Conference 2006, 26-30 Mar. 2006, Washington D.C., USA; Copyright; Avail.: Other Sources; Abstract Only

The young technology of NanoSIMS is unlocking new information from organic matter in ancient sediments. We have used this technique to characterize sub-micron scale element composition of Proterozoic organics that are clearly biogenic as a guide for interpreting problematic structures in terrestrial or extraterrestrial samples. We used the NanoSIMS 50 of the National Museum of Natural History in Paris to map carbon, nitrogen (as CN), and sulfur in organic structures from the approximately 0.8 Ga Bitter Springs Formation. We analyzed spheroidal and filamentous microfossils as well as organic

laminae that appeared amorphous by optical and scanning electron microscopy. In clear-cut microfossils, a coincidence between optical images and NanoSIMS element maps suggests a biological origin for the mapped carbon, sulfur, and nitrogen; this conclusion is supported by high resolution NanoSIMS maps showing identical spatial distributions of C, CN and S. High resolution images also demonstrate distinctive nano structure of the filaments and spheroids. In the amorphous laminae, NanoSIMS reveals morphologies reminiscent of compressed microfossils. Distinct CN/C ratios of the spheroids, filaments, and laminae may reflect their biological precursors (cell walls, cyanobacterial sheaths, and microbial communities/biofilms, respectively). Similar amorphous laminae comprise a preponderance of the organic matter in many Precambrian deposits. Thus it is possible that NanoSIMS will provide fresh insight into a large body of previously uninterpretable material. Additionally, NanoSIMS analysis may establish new biosignatures that will be helpful for assessing the origin and biogenicity of controversial Archean structures and any organic materials that may occur in Martian or other extraterrestrial samples.

Author

*Secondary Ion Mass Spectrometry; Nanostructure (Characteristics); Sediments; Organic Materials; Precambrian Period; Extraterrestrial Matter; Ion Probes; Nanotechnology; Exobiology*

## 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*.

**20080023733** Sandia National Labs., Albuquerque, NM USA

#### **Nonlinearly-Constrained Optimization Using Asynchronous Parallel Generating Set Search**

Griffin, J. D.; Kolda, T. G.; May 2007; 31 pp.; In English

Report No.(s): DE2007-909393; SAND2007-3257; No Copyright; Avail.: National Technical Information Service (NTIS)

Many optimization problems in computational science and engineering (CS&E) are characterized by expensive objective and/or constraint function evaluations paired with a lack of derivative information. Direct search methods such as generating set search (GSS) are well understood and efficient for derivative-free optimization of unconstrained and linearly-constrained problems. This paper addresses the more difficult problem of general nonlinear programming where derivatives for objective or constraint functions are unavailable, which is the case for many CS&E applications. We focus on penalty methods that use GSS to solve the linearly-constrained problems, comparing different penalty functions.

NTIS

*Nonlinearity; Parallel Processing (Computers); Synchronism*

**20080023913** NASA Langley Research Center, Hampton, VA, USA

#### **Hard Constraints in Optimization Under Uncertainty**

Crespo, Luis G.; Giesy, Daniel P.; Kenny, Sean P.; January 2008; 23 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 457280.02.07; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023913>

This paper proposes a methodology for the analysis and design of systems subject to parametric uncertainty where design requirements are specified via hard inequality constraints. Hard constraints are those that must be satisfied for all parameter realizations within a given uncertainty model. Uncertainty models given by norm-bounded perturbations from a nominal parameter value, i.e., hyper-spheres, and by sets of independently bounded uncertain variables, i.e., hyper-rectangles, are the focus of this paper. These models, which are also quite practical, allow for a rigorous mathematical treatment within the proposed framework. Hard constraint feasibility is determined by sizing the largest uncertainty set for which the design requirements are satisfied. Analytically verifiable assessments of robustness are attained by comparing this set with the actual uncertainty model. Strategies that enable the comparison of the robustness characteristics of competing design alternatives, the description and approximation of the robust design space, and the systematic search for designs with improved robustness are also proposed. Since the problem formulation is generic and the tools derived only require standard optimization algorithms for their implementation, this methodology is applicable to a broad range of engineering problems.

Author

*Robustness (Mathematics); Inequalities; Optimization; Perturbation; Algorithms*

**20080024181** NASA Langley Research Center, Hampton, VA, USA

**A Computational Procedure for Identifying Bilinear Representations of Nonlinear Systems Using Volterra Kernels**  
Kvaternik, Raymond G.; Silva, Walter A.; June 2008; 133 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.20.03

Report No.(s): NASA/TM-2008-215320; L-19461; No Copyright; Avail.: CASI: [A07](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080024181>

A computational procedure for identifying the state-space matrices corresponding to discrete bilinear representations of nonlinear systems is presented. A key feature of the method is the use of first- and second-order Volterra kernels (first- and second-order pulse responses) to characterize the system. The present method is based on an extension of a continuous-time bilinear system identification procedure given in a 1971 paper by Bruni, di Pillo, and Koch. The analytical and computational considerations that underlie the original procedure and its extension to the title problem are presented and described, pertinent numerical considerations associated with the process are discussed, and results obtained from the application of the method to a variety of nonlinear problems from the literature are presented. The results of these exploratory numerical studies are decidedly promising and provide sufficient credibility for further examination of the applicability of the method.

Author

*Nonlinear Systems; Volterra Equations; Kernel Functions; Numerical Analysis; Mathematical Models*

**20080024670** Institute for Information Industry, Taiwan, Province of China

**Effect of Heterogeneity on Static Load Balance Algorithm Performance in DHT Systems**

Tsai, Kun-Cheng; Chen, Chyohwa; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 301-311; In English; See also [20080024669](#); Copyright; Avail.: Other Sources

Application layer peer to peer (P2P) network technology is widely regarded as the most important development for next generation Internet infra-structure. For these systems to be effective, load balancing among the peers is critical. Early structured P2P systems rely on the randomness of object ID generated with a dynamic hash function to avoid the load imbalance issue. This has been known to result in an imbalance factor of  $O(\log N)$  in the number of items stored at a node. This paper makes two contributions. First, based on previous work, we propose a simple yet extremely effective extension. We demonstrate the superior performance of our proposal and also explore other important issues vital to the performance for the virtual server framework, such as the effect of the number of directories employed in the system, and the performance ramification of user registration strategies. Secondly, and more significantly, we characterize systematically the effect of heterogeneity on load balancing algorithm performance, and the conditions in which heterogeneity may be easy or hard to deal with. We show how previous results may be valid only in the simpler settings.

Author

*Heterogeneity; Loads (Forces); Static Loads; Algorithms; Internets*

**20080024676** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**Time-Domain Rotational Angle Identification of a Beam Structure Utilizing the Dynamic Transverse Deflection Signal**

Jenq, Shy-Tsang; Choa, Chih-Hang; Jeng, Yih-Nen; Liu, En-Cheng; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 279-290; In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 94-2212-E-006-103; Copyright; Avail.: Other Sources

The real time signal identification of rotation angle for a beam structure is studied in this work. A laser displacement sensor traced transverse displacement signal was used to identify the rotation angle of a beam. An orthogonal polynomial approach was used to expand the transverse displacement signal into orthogonal functions and their associated coefficients. These coefficients were used to identify the orthogonally expanded coefficients associated with the rotation angles of the beam structure. The rotation angle response of the beam can finally be synthesized and checked against the finite element code predicted result. We also conducted impact hammer tests on the root of a metallic cantilever beam. Both the loading history and the transverse displacement history at a specific location on the beam specimen were recorded. Similar to the numerical synthesis process, the test determined a displacement signal can also be used to identify the rotation angle of the beam. Through numerical and experimental verification, the currently proposed analysis seems to be able to identify the dynamic rotation angle response of the beam structure closely, when the prescribed transverse displacement input signal of the beam is given.

Author

*Beams (Supports); Real Time Operation; Time Signals; Polynomials; Finite Element Method; Cantilever Beams*



**20080024679** National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China  
**Performance Analysis of Service Differentiation in Wireless Local Area Networks with Poisson Frame Arrivals**  
Chung, Shun-Ping; Chen, Wei-Sin; Journal of the Chinese Institute of Engineers, Volume 31, No. 2; March 2008, pp. 329-333;  
In English; See also [20080024669](#)

Contract(s)/Grant(s): NSC 95-2221-E-011-030; Copyright; Avail.: Other Sources

We propose an analytical model for IEEE 802.11 wireless local area networks (WLAN), where both a multi-dimensional discrete-time Markov chain and an M/G/1/K are used to compute the performance measures of interest. Instead of assuming saturated traffic load, we consider the more realistic Poisson frame arrival traffic model. To support service differentiation, two parameters are set according to the user's priority: initial window size and window increasing factor. Last but not least, computer simulation programs written in C language are run to verify the accuracy of the analytical results.

Author

*Local Area Networks; Wireless Communication; Support Systems; Reliability Analysis; Markov Chains; Mathematical Models*

**20080025185** Lawrence Livermore National Lab., Livermore, CA USA

**COG - Publicly Available Now to Criticality Safety Practitioners**

Buck, R. M.; Cullen, D. E.; Heinrichs, D. P.; Lent, E. M.; Nielsen, D. E.; Sep. 25, 2006; 8 pp.; In English

Report No.(s): DE2007-909628; UCRL-CONF-224715; No Copyright; Avail.: Department of Energy Information Bridge

COG is a modern, general-purpose, high fidelity, multi-particle transport code with a long history of use in criticality safety studies at the Lawrence Livermore National Laboratory. This code was released to the Radiation Safety Information Computational Center (RSICC) for distribution to the public for the first time in January 2006. This paper provides an overview of the code development history, a description of features and capabilities of interest to the criticality safety practitioner, and our plans in support of the next public RSICC release.

NTIS

*Nuclear Reactors; Photons; Safety*

**20080025190** Lawrence Livermore National Lab., Livermore, CA USA

**Computer-Assist Material Tracking System as a Criticality Safety Aid to Operators**

Claybourn, R. V.; Huang, S. T.; Mar. 30, 2007; 6 pp.; In English

Report No.(s): DE2007-909634; UCRL/PROC-229561; No Copyright; Avail.: Department of Energy Information Bridge

In today's compliant-driven environment, fissionable material handlers are inundated with work control rules and procedures in carrying out nuclear operations. Historically, human errors are one of the key contributors of various criticality accidents. Since moving and handling fissionable materials are key components of their job functions, any means that can be provided to assist operators in facilitating fissionable material moves will help improve operational efficiency and enhance criticality safety implementation. From the criticality safety perspective, operational issues have been encountered in Lawrence Livermore National Laboratory (LLNL) plutonium operations. Those issues included lack of adequate historical record keeping for the fissionable material stored in containers, a need for a better way of accommodating operations in a research and development setting, and better means of helping material handlers in carrying out various criticality safety controls. Through the years, effective means were implemented including better work control process, standardized criticality control conditions (SCCC) and relocation of criticality safety engineers to the plutonium facility. Another important measure taken was to develop a computer data acquisition system for criticality safety assessment, which is the subject of this paper. The purpose of the Criticality Special Support System (CSSS) is to integrate many of the proven operational support protocols into a software system to assist operators with assessing compliance to procedures during the handling and movement of fissionable materials.

NTIS

*Safety; Safety Factors; Systems Engineering; Standardization; Protocol (Computers); Operations Research*

**20080025234** Comptroller of the Currency, Washington, DC, USA

**Internet Banking: Developments and Prospects**

Furst, K.; Lang, W. W.; Nolle, D. E.; Sep. 2000; 60 pp.; In English

Report No.(s): PB2007-112834; OCC/WP-2000-9; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This paper addresses significant gaps in existing knowledge about the Internet banking landscape. Using information drawn from a survey of national bank examiners, we find that while only 20 percent of national banks offered Internet banking in Q3 1999, these transactional Internet banks accounted for almost 90 percent of national banking system assets and 84

percent of the total number of small deposit accounts. All of the largest national banks offered Internet banking, but only about 7 percent of the smallest banks offered it. Among institutions offering Internet banking, large banks are more likely than small banks to offer a broad range of services on the Internet. Matching call report data to the examiner survey information, we also find that banks in all size categories offering Internet banking tend to rely less on interest-yielding activities and deposits than do non-Internet banks, and institutions with Internet banking outperformed non-Internet banks in terms of profitability. Excepted from the superior performance of Internet banks versus non-Internet banks are de novo Internet banks, which were less profitable and less efficient than non-Internet de novos. Projections based on banks plans as of Q3 1999 indicate that 45 percent of all national banks will be offering Internet banking by the beginning of 2001.

NTIS

*Internets; Deposits*

**20080025236** Comptroller of the Currency, Washington, DC, USA; Cornell Univ., Ithaca, NY, USA

### **Testing Simple Markov Structures for Credit Rating Transitions**

Kiefer, N. M.; Larson, C. E.; January 2004; 16 pp.; In English

Report No.(s): PB2007-112839; OCC/WP-2004-3; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Models abound that analyze changes in credit quality. These models are designed to determine the reserves and capital needed to support the risks of individual credits as well as portfolios of credit instruments. Historical information on the transition of credit exposures from one quality level, or rating, to another is often used to estimate models that describe the probabilistic evolution of credit quality. A popular specification is the simple, time-homogeneous Markov model. While the Markov specification cannot describe credit processes in the long run, it may be useful for describing short-run changes in portfolio risk. In this convenient specification, the entire stochastic process can be characterized in terms of estimated transition probabilities. However, the simple homogeneous Markovian transition framework is restrictive. We propose a simple test of the null hypotheses of time-homogeneity that can be performed on the sorts of data often reported. The test is applied to data sets on municipal bonds, commercial paper, and sovereign debt. We find that municipal bond ratings transitions are adequately described by the Markov model for up to five years, that commercial paper on a 30-day transition scale seems Markovian up six months (the extent of the available data), and that the transitions of sovereign debt ratings are adequately described by the Markov model (a result that may derive from the limited data of small sample sizes).

NTIS

*Ratings; Histories; Transition Probabilities; Null Hypothesis; Bonding*

**20080025243** Sandia National Labs., Albuquerque, NM USA

### **Effect of Delayed Link Failure on Probability of Loss of Assured Safety in Temperature-Dependent Systems with Multiple Weak and Strong Links**

Helton, J. C.; Johnson, J. D.; Oberkampf, W. L.; May 01, 2007; 59 pp.; In English

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

Report No.(s): DE2007-910200; SAND2007-1907; No Copyright; Avail.: Department of Energy Information Bridge

Weak link (WL)/strong link (SL) systems constitute important parts of the overall operational design of high consequence systems, with the SL system designed to permit operation of the system only under intended conditions and the WL system designed to prevent the unintended operation of the system under accident conditions. Degradation of the system under accident conditions into a state in which the WLs have not deactivated the system and the SLs have failed in the sense that they are in a configuration that could permit operation of the system is referred to as loss of assured safety. The probability of such degradation conditional on a specific set of accident conditions is referred to as probability of loss of assured safety (PLOAS). Previous work has developed computational procedures for the calculation of PLOAS under fire conditions for a system involving multiple WLs and SLs and with the assumption that a link fails instantly when it reaches its failure temperature. Extensions of these procedures are obtained for systems in which there is a temperature-dependent delay between the time at which a link reaches its failure temperature and the time at which that link actually fails.

NTIS

*Delay; Failure; Failure Analysis; Fires; Losses; Probability Theory; Safety; Temperature Dependence*

**20080025249** Lawrence Livermore National Lab., Livermore, CA USA

### **Distance-Two Interpolation for Parallel Algebraic Multigrid**

Sterck, H. D.; Falgout, R.; Nolting, J.; Yang, U. M.; Jun. 20, 2007; 7 pp.; In English

Report No.(s): DE2007-910210; UCRL-PROC-231994; No Copyright; Avail.: National Technical Information Service

(NTIS)

In this paper we study the use of long distance interpolation methods with the low complexity coarsening algorithm PMIS.

AMG performance and scalability is compared for classical as well as long distance interpolation methods on parallel computers. It is shown that the increased interpolation accuracy largely restores the scalability of AMG convergence factors for PMIS-coarsened grids, and in combination with complexity reducing methods, such as interpolation truncation, one obtains a class of parallel AMG methods that enjoy excellent scalability properties on large parallel computers.

NTIS

*Algebra; Interpolation; Matrices (Mathematics); Functions (Mathematics); Multigrid Methods*

**20080025814** Hoffman, Warnic, and D'Alessandro, LLC., Albany, NY, USA

**Inspection Method, System, and Program Product**

Mian, Z. F., Inventor; Mullaney, J. C., Inventor; Spoor, R. E., Inventor; 24 May 05; 19 pp.; In English

Contract(s)/Grant(s): DTRS57-04-C-10059; DTRS57-02-C-10059

Patent Info.: Filed Filed 24 May 05; US-Patent-Appl-SN-11-136-207

Report No.(s): PB2007-110510; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An improved solution for performing an inspection is provided, in which a user can use a handheld computing device to obtain and/or record the set of attributes required for the inspection. In particular, an inspection schedule can be initiated on the handheld computing device and the user can be prompted for the various attributes based on the inspection schedule. Various solutions can be incorporated for receiving the attributes on the handheld computing device, including manual entry, audible entry and/or one or more data sensing devices. Subsequently, the set of attributes can be communicated to a base station for further processing and/or more permanent storage.

NTIS

*Inspection; Patent Applications; Personal Computers*

**20080025825** Carnegie-Mellon Univ., Pittsburgh, PA, USA

**Active Sensing for Online Highway Bridge Monitoring**

Sohn, H.; May 2007; 52 pp.; In English

Report No.(s): PB2007-109637; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This project was aimed at developing and evaluating a sensor-based nondestructive testing (NDT) method for online monitoring of highway bridges without using any past baseline data. A theoretical framework of the proposed baseline-free NDT technique was developed along with a time reversal process (TRP), and a NDT methodology for detecting cracks in bridge steel girders was formulated. To prove the feasibility of the proposed concept, research addressed the following key questions: What is the practical sensing range of TRP for damage detection. Can different types of be selectively detected and quantified. Do sensor conditions affect damage detection. Do undesirable operational and environmental conditions affect damage detection. Is the proposed TRP applicable to more complex structural geometries. The sensing range of TRP was found to be significantly larger than that achieved by conventional NDT methods, and the active sensing device was able to propagate up to 40 m.

NTIS

*Detection; Highways; Nondestructive Tests*

**20080025851** Texas Univ., Austin, TX USA

**Navigation and Decision Making Efficiencies Under Conditions of Uncertainty**

Stankiewicz, Brian J; Mar 2008; 6 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0236

Report No.(s): AD-A479293; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Each and every day we make thousands of decisions in which our understanding of the situation is not completely known. Although we may have incomplete knowledge, we may possess knowledge that will be helpful in making a good' decision. For example, when purchasing an automobile, one does not know for certain how reliable this car will be. However, given the make and model's previous track record, one might be able to generate an initial estimate its reliability. However, given that the car is used, there is some uncertainty about how well the car was maintained and how it was used. One may consider purchasing an inspection by a mechanic. Following the inspection, one might be more confident that the car will be reliable-however, even with this additional information one is still in a state of uncertainty. One may consider purchasing an additional inspection to reduce one's uncertainty even more. As one can see, an individual can continue to gather

more-and-more information at a greater and greater accumulated cost. However, this additional information comes at a cost that may not exceed the expected gain in knowledge.

DTIC

*Decision Making; Efficiency; Navigation*

**20080025887** Defence Research and Development Canada, Valcartier, Quebec Canada

**Synthesis of Nonlinear Guidance Laws for Missiles with Uncertain Dynamics**

Rabbath, C A; Lechevin, N; Nov 2007; 48 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479365; DRDC-VALCARTIER-TM-2006-606; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This technical memorandum describes a nonlinear guidance law for a single-missile single-target engagement. The guidance relies on the concepts of Lyapunov stability and backstepping, which are constructive methods in nonlinear control theory. The design of the guidance law allows taking into account the nonlinear relative kinematics between the missile and the target, and ensuring ultimate boundedness of the missile-target system trajectories provided the estimation error of the target acceleration is bounded in magnitude. In other words, despite the nonlinear kinematics between the missile and the target, the guidance scheme is guaranteed to result in a relatively small miss distance between the missile and the target.

DTIC

*Laws; Missiles; Nonlinearity; Targets; Terminal Guidance*

**20080025932** Bureau of the Census, Washington, DC, USA

**Sensitivity of Economic Statistics to Coding Errors in Personal Identifiers**

Abowd, J. M.; Vilhuber, L.; Jan. 2003; 51 pp.; In English

Report No.(s): PB2007-113226; TP-2002-17; No Copyright; Avail.: CASI: [A04](#), Hardcopy

In this paper, we describe the sensitivity of small-cell flow statistics to coding errors in the identity of the underlying entities. Specifically, we present results based on a comparison of the U.S. Census Bureaus Quarterly Workforce Indicators (QWI) before and after correcting for such errors in SSN-based identifiers in the underlying individual wage records. The correction used involves a novel application of existing statistical matching techniques. It is found that even a very conservative correction procedure has a sizable impact on the statistics. The average bias ranges from 0.25 percent up to 15 percent for flow statistics, and up to 5 percent for payroll aggregates.

NTIS

*Coding; Economics; Errors; Sensitivity*

**20080025969** Rhodes (Craig S.), Silver Spring, MD, USA

**Hox Code Functions as a Growth Synchronizing Moving Reference Frame**

Rhodes, C. S., Inventor; Rhodes, C. A., Inventor; 6 Jul 04; 7 pp.; In English

Patent Info.: Filed Filed 6 Jul 04; US-Patent-Appl-SN-10-883-812

Report No.(s): PB2007-113877; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The determination of position during metazoan growth appears complex, in part, because we observe that growth does not occur at a constant rate, as temperatures fluctuate, so do the growth rates. One positioning method, a moving reference frame (MRF), is used in engineering, and navigation, to assign positions when velocity and changes in velocity are considerations. The use of a biological MRF employing Hox proteins to control position of cells along an axis is suggested, by the temporal-spatial expression patterns of the Hox proteins, the affects of Hox proteins on cell divisions. A MRF simultaneously controlling both gene transcription and cell divisions when coupled with asymmetric cell division seems sufficient to effectively determine exact cellular position along an axis of growth and account for many described homeotic morphological variations.

NTIS

*Coordinates; Hydrogen Compounds; Morphology; Oxides; Patent Applications; Proteins; Synchronism*

**20080026065** Helsinki Univ. of Technology, Helsinki, Finland

**Uniformly Quasiregular Mappings on Elliptic Riemannian Manifolds**

Kangaslampi, Riikka; Annales Academie Scientiarum Fennicae: Mathematica - Dissertationes; March 30, 2008; ISSN 1239-6303; Volume 151; 74 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other

Sources

In this thesis we study uniformly quasiregular (abbreviated uqr) mappings on compact riemannian manifolds. We prove

that the Julia set  $J(\text{sub } f)$  of a uqr-mapping  $f : M(\text{sup } n) \rightarrow M(\text{sup } n)$  on a compact riemannian manifold  $M(\text{sup } n)$  is non-empty. We extend the rescaling principle from euclidean spaces to families of quasiregular mappings between a euclidean space and a riemannian manifold. Thus we can use the rescaling principle to obtain from the family  $(f(\text{sup } j))$  of the iterates of the uqr-mapping  $f$  on the manifold  $M$  a quasiregular mapping  $g : R(\text{sup } n) \rightarrow M(\text{sup } n)$  defined in the whole space  $R(\text{sup } n)$ . Combining these results, we notice that if there exists a uqr-mapping on a compact riemannian manifold  $M(\text{sup } n)$ , there exists a quasiregular mapping  $g : R(\text{sup } n) \rightarrow M(\text{sup } n)$ . In other words, the manifold  $M(\text{sup } n)$  is quasiregularly elliptic. The converse result is proved in three dimensions: we construct a uqr-mapping on each oriented quasiregularly elliptic 3-dimensional compact riemannian manifold.

Author

*Euclidean Geometry; Riemann Manifold; Conformal Mapping; Elliptic Functions*

**20080026132** NASA Johnson Space Center, Houston, TX, USA

### **Fault Management Techniques in Human Spaceflight Operations**

O'Hagan, Brian; Crocker, Alan; [2006]; 20 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper discusses human spaceflight fault management operations. Fault detection and response capabilities available in current US human spaceflight programs Space Shuttle and International Space Station are described while emphasizing system design impacts on operational techniques and constraints. Preflight and inflight processes along with products used to anticipate, mitigate and respond to failures are introduced. Examples of operational products used to support failure responses are presented. Possible improvements in the state of the art, as well as prioritization and success criteria for their implementation are proposed. This paper describes how the architecture of a command and control system impacts operations in areas such as the required fault response times, automated vs. manual fault responses, use of workarounds, etc. The architecture includes the use of redundancy at the system and software function level, software capabilities, use of intelligent or autonomous systems, number and severity of software defects, etc. This in turn drives which Caution and Warning (C&W) events should be annunciated, C&W event classification, operator display designs, crew training, flight control team training, and procedure development. Other factors impacting operations are the complexity of a system, skills needed to understand and operate a system, and the use of commonality vs. optimized solutions for software and responses. Fault detection, annunciation, safing responses, and recovery capabilities are explored using real examples to uncover underlying philosophies and constraints. These factors directly impact operations in that the crew and flight control team need to understand what happened, why it happened, what the system is doing, and what, if any, corrective actions they need to perform. If a fault results in multiple C&W events, or if several faults occur simultaneously, the root cause(s) of the fault(s), as well as their vehicle-wide impacts, must be determined in order to maintain situational awareness. This allows both automated and manual recovery operations to focus on the real cause of the fault(s). An appropriate balance must be struck between correcting the root cause failure and addressing the impacts of that fault on other vehicle components. Lastly, this paper presents a strategy for using lessons learned to improve the software, displays, and procedures in addition to determining what is a candidate for automation. Enabling technologies and techniques are identified to promote system evolution from one that requires manual fault responses to one that uses automation and autonomy where they are most effective. These considerations include the value in correcting software defects in a timely manner, automation of repetitive tasks, making time critical responses autonomous, etc. The paper recommends the appropriate use of intelligent systems to determine the root causes of faults and correctly identify separate unrelated faults.

Author

*Fault Detection; Systems Engineering; Situational Awareness; Flight Control; Display Devices; Command and Control; Classifications; Autonomy; Correction*

**20080026222** Pietragallo, Botic and Gordon, Pittsburgh, PA, USA

### **Method for Determining Identity of Simultaneous Events and Applications to Image Sensing and A/D Conversion**

Brajovic, V., Inventor; 19 May 05; 23 pp.; In English

Contract(s)/Grant(s): NSF-0082364; NSF-0102272

Patent Info.: Filed 19 May 05; US-Patent-Appl-SN-11-133-091

Report No.(s): PB2007-110667; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of encoding identity of events comprises: receiving an event bit pattern having bits representative of events, and determining a code from the event bit pattern, said code containing the information for recovering identity of events when one or more events are simultaneously present in the event bit pattern.

NTIS

*Coding; Detection; Identities*

**20080026225** Second Sight Medical Products, Inc., Sylmar, CA, USA

**Video Processing Methods for Improving Visual Acuity and/or Perceived Resolution**

Greenberg, R. J., Inventor; Williamson, R. P., Inventor; Schulman, J. H., Inventor; Rassool, R. P., Inventor; Mandell, L. J., Inventor; 27 Apr 05; 34 pp.; In English

Contract(s)/Grant(s): NIH-R24EY12893-01

Patent Info.: Filed Filed 27 Apr 05; US-Patent-Appl-SN-11-115-620

Report No.(s): PB2007-110665; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and apparatus for improving visual acuity when providing a visual image from a 'high' resolution input device to a 'low' resolution output device. The described invention is of particular use when the output device is an array of electrodes as part of a retinal prosthesis used to restore vision to a visually-impaired patient. In that various limitations may, within the foreseeable future, limit the density of such an electrode array (and thus the resolution of the output image), the present invention teaches techniques to assign processed pixel subsets of a higher resolution image to a single electrode. By varying the pixel subsets, e.g., by jittering, and/or altering the processing criteria, the perceived visual acuity may be further improved. Alternatively and additionally, such processing may be further extended to drive neighboring electrodes in combination to thus stimulate virtual electrode sites and thus further enhance visual acuity.

NTIS

*Retina; Visual Acuity; Video Tapes*

**20080026227** Bureau of the Census, Washington, DC, USA

**Computing Person and Firm Effects Using Linked Longitudinal Employer-Employee Data**

Abowd, J. M.; Creecy, R. H.; Kramarz, F.; Apr. 2002; 18 pp.; In English

Report No.(s): PB2007-113232; TP-2002-06; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper we provide the exact formulas for the direct least squares estimation of statistical models that include both person and firm effects. We also provide an algorithm for determining the estimable functions of the person and firm effects (the identifiable effects). The computational techniques are also directly applicable to any linear two-factor analysis of covariance with two high-dimension non-orthogonal factors. We show that the application of the exact solution does not change the substantive conclusions about the relative importance of person and firm effects in the explanation of log real compensation; however, the correlation between person and firm effects is negative, not weakly positive, in the exact solution. We also provide guidance for using the methods developed in earlier work to obtain an accurate approximation.

NTIS

*Algorithms; Mathematical Models; Personnel*

## 60

### COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

**20080023825** Army Construction Engineering Research Lab., Champaign, IL USA

**IMCOM LONWORKS Building Automation Systems Implementation Strategy**

Schwenk, David M; Bush, Joseph; Hughes, Lucie M; Briggs, Stephen; White, Will; Jun 2007; 80 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478402; ERDC/CERL-TR-07-16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478402>

Army Installations often expand their use of digital control systems for heating, ventilating, and air conditioning and other mechanical and electrical building systems on a building-by-building basis. The control systems are installed under separate contracts by different contractors resulting in intra-system incompatibilities. The implementation of multi-vendor Open Building Automation Systems (BASs) is meant to overcome such incompatibilities; however BASs can present their own technical and administrative (including contractual) challenges. This interim report defines a methodology for the development and execution of a basewide Open BAS implementation plan based on LONWORKs technology and American National Standards Institute (ANSI) communications standard 709.1 where the BAS consists of a basewide Utility Monitoring and Control System (UMCS) that is interoperable with multi-vendor LONWORKs direct digital control (DDC) systems.

DTIC

*Automatic Control; Buildings; Control; Digital Systems*

**20080024061** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Comparison of Moir Interferometry and Digital Image Correlation**

Davidson, Ryan J; Mar 2008; 113 pp.; In English

Report No.(s): AD-A478781; AFIT/GAE/ENY/08-M06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research effort studied the effect of subset size and step size on the spatial resolution and accuracy of Digital Image Correlation (DIC). In addition, DIC was compared with moir interferometry in an attempt to give future researchers guidance on which method would be appropriate for their research. Strains fields were calculated from displacement fields measured by each method. The strain fields were then compared. The main findings of the research were that: increased subset sizes caused a smoothing of data; increased step sizes reduced the resolution of the data; DIC is an accurate displacement measurement technique; the spatial resolution of DIC is less than that of moir interferometry; DIC is a highly portable displacement measurement system; DIC is much faster than moir interferometry.

DTIC

*Data Correlation; Digital Techniques; Image Correlators; Interferometry*

**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.

**20080023813** Army Construction Engineering Research Lab., Champaign, IL USA

**Quick Prediction of Future Training/Testing Opportunities Using mLEAM**

Westervelt, James; MacAllister, Bruce; Sep 2006; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478355; ERDC/CERL-TR-06-27; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478355>

Urban development around many installations threatens the ability to provide realistic military training to the soldiers of the U.S. Army and adequate testing for future weapon systems. Regional planning can alter the patterns of future development around installations. The Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) has developed the military Landuse Evolution Assessment Model (mLEAM) suite of software tools to allow for the rapid and inexpensive testing of the impact of alternative regional plans on the future training and testing opportunities of nearby installations. This report describes the mLEAM approach and documents the application of mLEAM to the counties surrounding Fort Benning, GA to provide Fort Benning with options to proactively mitigate conflicts between the Army and the growing civilian community surrounding the installation.

DTIC

*Computer Programs; Computerized Simulation; Education; Land Use; Regional Planning*

**20080023827** Army War Coll., Carlisle Barracks, PA USA

**Consolidating Our Country's Biometric Resources and the Possible Implications**

Campos, Eloy; Mar 2, 2008; 29 pp.; In English

Report No.(s): AD-A478409; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478409>

The events of September II, 2001, set in motion a revolution in the field of security and security-related research. The use of biometrics for the purpose of ascertaining an individual's unique characteristics is not a new idea but the September II, 2001, terrorist attacks upon the USA helped to propel the industry into the front lines of the Global War on Terrorism. Due to the great potential for the exposure of private, individual information to would be criminals, the industry and the government are now facing a myriad of questions regarding societal and ethical implications associated with the widespread use of this technology.

DTIC

*Biometrics; Retina; Security*

**20080023831** Army Construction Engineering Research Lab., Champaign, IL USA

**Facility Composer Design Wizards: A Method for Extensible Codified Design Logic Based on Explicit Facility Criteria**  
Woods, Van J; Nachtigall, Susan D; Brucker, Beth A; Andrillion, Awilda; Nov 2004; 124 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478425; ERDC/CERL-TR-04-22; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478425>

Government design criteria are commonly captured in the form of design guides, regulations, technical manuals, and web pages, but not in a computable format. Current design systems provide no way to directly interact with a specific criterion, or to efficiently extend the functionality of an application to directly support criteria usage. Consequently, the only two choices are that designers must either manually ensure that all applicable criteria are identified and satisfied, or that a large customized application is developed. Custom systems are slow to develop and change, and difficult to update. Such systems do allow data modularization, but do not provide modular functionality--the ability to support customized methods or algorithms that perform useful operations on the data. The Facility Composer suite of tools supports the capturing and tracking of facility criteria and requirements, planning and design charrettes, and associated planning and design analyses. Facility Composer addresses many of the problems associated with the decentralized, non-computationally explicit, ad-hoc definition, distribution, and utilization of design criteria. This report describes work undertaken to provide a set of the most commonly used tools as part of the core features in Facility Composer, and also to provide a means for modularized extensibility of design logic.

DTIC

*Architecture (Computers); Design Analysis; Plant Design; Software Development Tools*

**20080023851** Army Construction Engineering Research Lab., Champaign, IL USA

**Planning Composer User's Guide: Through Beta Version 0.22**

Nachtigall, Susan D; Brucker, Beth A; Nov 2004; 44 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478528; ERDC/CERL-SR-04-31; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478528>

Over the past several years, the Architectural Engineering and Construction (AEC) industry has been making a substantial effort to create an standard facility modeling format known as the Industry Foundation Class (IFC), which has now made it possible to capture criteria and requirements during planning and design, and then to reuse this data during the life cycle of the facility. This research effort is par of the 'Fort Future' program, which is developing a capability to model, simulate, assess, and optimize installation capabilities to support the Objective Force. The Facility Acquisition component of Fort Future, Facility Composer, will shorten the time required to acquire facilities while ensuring that Objective Force and Future Combat Systems (FCS) criteria and requirements are met. Facility Composer tools support capturing and tracking of facility criteria and requirements, planning and design charrettes, and associated planning and design analyses. Planning Composer is one of the primary tools in the Facility Composer application suite, which helps users create an architectural program and to set values for project specific criteria. This work contains a User Guide for the Planning Composer software.

DTIC

*Architecture (Computers); Computer Programs; Manuals*

**20080023860** Army Construction Engineering Research Lab., Champaign, IL USA

**Planning Composer: Tutorial Through Beta Vision 0.22**

Nachtigall, Susan D; Brucker, Beth A; Nov 2004; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478571; ERDC/CERL SR-04-30; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478571>

While government design criteria commonly exist paper and web-page formats, few are expressed in a computable format. Current design systems provide no way to directly interact with these criteria. Facility Composer is a suite of tools designed for use by facility planners, designers, and engineers during the initial phases of facility planning and design. Facility Composer associates customer-specific, computable criteria with a growing facility model that continues throughout the life cycle of the facility. In Facility Composer, criteria can be associated with different project elements based on the appropriate level of detail, from the project to the site, the building story, function, and down to the individual space. Facility Composer's ability to maintain a linkage between criteria and project elements: (1) helps ensure that critical criteria are followed, (2) helps



organize criteria and makes them available at their point of use, and (3) simplifies creation, maintenance, and distribution of new criteria. This tutorial documents and illustrate the use of specific Planning Composer program features.

DTIC

*Computer Aided Design; Project Management*

**20080023944** Indasea, Inc., Kula, HI USA

**Data Shaping in the Cultural Simulation Modeler Integrated Behavioral Assessment Capability. Phase I**

Park, Jore; Fables, Wylci; Jul 2007; 176 pp.; In English

Contract(s)/Grant(s): FA9550-07-C-0047

Report No.(s): AD-A478609; IND-150707; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Data shaping in the Cultural Simulation Modeler was performed for the Integrated Behavioral Assessment Capability Phase I. The project leveraged IndaSea's Cultural Simulation Modeler(TM) application and the Rapid Human Assessment Information System browser-based interface developed by Oak Ridge National Laboratory, now known as the Universal Analyst Interface. IndaSea developed a Cultural Simulation Modeler Query Application Programming Interface, enabling connection to a database of 380,000 news articles on Indonesia. Essential Elements of Information relating to a selected scenario were structured in a template in the Universal Analyst Interface, and the template mirrored in the Cultural Simulation Modeler. Systems users logged in remotely, and sent selected template questions to the database. The Cultural Simulation Modeler indexes text and uses a Cultural Construct as a conceptual core to achieve culturally specific data shaping. Each question was expanded to form many queries in the Cultural Simulation Modeler, in order to adapt to cultural word usage as represented in the international news sources.

DTIC

*Data Bases; Simulation; Systems Integration*

**20080023954** Software and Engineering Associates, Inc., Carson City, NV USA

**Aluminum Agglomeration and Trajectory in Solid Rocket Motors**

Coats, Douglas; Hylin, E C; Babbitt, Deborah; Tullos, James A; Beckstead, Merrill; Webb, Michael; Davis, I L; Dang, Anthony; Aug 30, 2007; 89 pp.; In English

Contract(s)/Grant(s): FA9550-06-C-0069

Report No.(s): AD-A478629; SN285-FINAL-REPORT; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Report developed under STTR contract for Topic AF06-T012. The demand for higher performance rocket motors at a reduced cost requires continuous improvements in understanding and controlling propellant combustion. Numerous examples are available where seemingly minor modifications and improvements to existing solid rocket systems have caused previously well performing motors to exhibit unexpected and at times near catastrophic behavior. It is far cheaper to design out problems than fix them during the development or production phases. Various combustion issues have never been modeled in a complete motor prediction model. What is being proposed here has never been successfully done and would greatly increase the design tools available to the motor design community. The overall goal of this innovation is to provide a multi-physics based computer code which will accurately predict the entire flight of aluminum particles from the propellant surface through the nozzle exit plane together with a prediction of the effective properties of the binder, ammonium perchlorate, and aluminum particles which together constitute a solid propellant.

DTIC

*Agglomeration; Aluminum; Combustion; Computerized Simulation; Particle Trajectories; Solid Propellant Rocket Engines; Solid Rocket Propellants; Trajectories*

**20080023986** Naval Research Lab., Washington, DC USA

**Distributed Spatial Control, Global Monitoring and Steering of Mobile Agents (Preprint)**

Gordon, Diana F; Spears, William M; Sokolsky, Oleg; Lee, Insup; Nov 1999; 9 pp.; In English

Contract(s)/Grant(s): N00014-97-1-0505; N00014-99-WR20010

Report No.(s): AD-A478676; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, we combine two frameworks in the context of an important application. The first framework, called 'artificial physics,' is described in detail in a companion paper by Spears and Gordon. The purpose of artificial physics is the distributed spatial control of large collections of mobile physical agents. The agents can be composed into geometric patterns (e.g., to act as a sensing grid) by having them sense and respond to local artificial forces that are motivated by natural physics

laws. The purpose of the second framework is global monitoring of the agent formations developed with artificial physics. Using only limited global information, the monitor checks that the desired geometric pattern emerges over time as expected. If there is a problem, the global monitor steers the agents to self-repair. Our combined approach of local control through artificial physics, global monitoring, and ‘steering’ for self-repair is implemented and tested on a problem where multiple agents form a hexagonal lattice pattern.

DTIC

*Active Control; Artificial Intelligence; Control; Distributed Parameter Systems; Steering*

**20080023998** Office National d’Etudes et de Recherches Aerospatiales, Paris, France

**A Generic Architecture for Autonomous Uninhabited Vehicles**

Barbier, Magali; Gabard, Jean-Francois; Ayreault, Herve; Nov 1, 2007; 17 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478693; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Autonomous Navigation; Autonomy; Decision Making; Software Development Tools; Underwater Vehicles*

**20080024036** Yale Univ., New Haven, CT USA

**Modular Machine Code Verification**

Ni, Zhaozhong; May 2007; 183 pp.; In English

Contract(s)/Grant(s): F30602-99-1-0519

Report No.(s): AD-A478745; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Formally establishing safety properties of software presents a grand challenge to the computer science community. Producing proof-carrying code, i.e., machine code with machine-checkable specifications and proofs, is particularly difficult for system softwares written in low-level languages. One central problem is the lack of verification theories that can handle the expressive power of low-level code in a modular fashion. In particular, traditional type- and logic-based verification approaches have restrictions on either expressive power or modularity. This dissertation presents XCAP, a logic-based proof-carrying code framework for modular machine code verification. In XCAP, program specifications are written as general logic predicates, in which syntactic constructs are used to modularly specify some crucial higher-order programming concepts for system code, including embedded code pointers, impredicative polymorphisms, recursive invariants, and general references, all in a logical setting. Thus, XCAP achieves the expressive power of logic-based approaches and the modularity of type-based approaches. Its meta theory has been completely mechanized and proved. XCAP can be used to directly certify system kernel code. This dissertation contains a mini certified thread library written in x86 assembly. Every single instruction in the library, including those for context switching and thread scheduling, has a formal XCAP specification and a proof. XCAP is also connected to existing certifying compiler; a typepreserving translation from a typed assembly language to XCAP is included.

DTIC

*Coding; Construction*

**20080024046** GMV S.A., Madrid, Spain

**EOforge: Generic Open Framework for Earth Observation Data Processing Systems**

Gomez, Celestino; Gonzalez, Luis M; Prieto, Jose; Sep 2006; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478764; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Data Processing; Data Processing Equipment; Earth Observations (From Space); Interoperability; Observation*

**20080024227** NASA Langley Research Center, Hampton, VA, USA

**Tolerance and UQ4SIM: Nimble Uncertainty Documentation and Analysis Software**

Kleb, Bil; June 30, 2008; 2 pp.; In English; 5th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008), 30 Jun. - 5 Jul. 2008, Venice, Italy; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 526282.01070405; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080024227>

Ultimately, scientific numerical models need quantified output uncertainties so that modeling can evolve to better match reality. Documenting model input uncertainties and variabilities is a necessary first step toward that goal. Without known input parameter uncertainties, model sensitivities are all one can determine, and without code verification, output uncertainties are

simply not reliable. The basic premise of uncertainty markup is to craft a tolerance and tagging mini-language that offers a natural, unobtrusive presentation and does not depend on parsing each type of input file format. Each file is marked up with tolerances and optionally, associated tags that serve to label the parameters and their uncertainties. The evolution of such a language, often called a Domain Specific Language or DSL, is given in [1], but in final form it parallels tolerances specified on an engineering drawing, e.g., 1 +/- 0.5, 5 +/- 10%, 2 +/- 10 where % signifies percent and o signifies order of magnitude. Tags, necessary for error propagation, can be added by placing a quotation-mark-delimited tag after the tolerance, e.g., 0.7 +/- 20% 'T\_effective'. In addition, tolerances might have different underlying distributions, e.g., Uniform, Normal, or Triangular, or the tolerances may merely be intervals due to lack of knowledge (uncertainty). Finally, to address pragmatic considerations such as older models that require specific number-field formats, C-style format specifiers can be appended to the tolerance like so, 1.35 +/- 10U\_3.2f. As an example of use, consider figure 1, where a chemical reaction input file is has been marked up to include tolerances and tags per table 1. Not only does the technique provide a natural method of specifying tolerances, but it also servers as in situ documentation of model uncertainties. This tolerance language comes with a utility to strip the tolerances (and tags), to provide a path to the nominal model parameter file. And, as shown in [1], having the ability to quickly mark and identify model parameter uncertainties facilitates error propagation, which in turn yield output uncertainties.

Author

*Mathematical Models; Computer Programs; Error Analysis*

**20080025099** Navy Technology Center for Safety and Survivability, Washington, DC, DC USA

**User's Guide to STAT The SHADWELL Test Analysis Tool (Version 2.0)**

Hoover, John B; Feb 29, 2008; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478540; NRL/MR/6180--08-9109; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The SHADWELL Test Analysis Tool, originally developed to aid in the analysis of large-scale fire test data, has been updated. The new version removes the dependency on proprietary, third-party software and adds support for several new data input formats, including SHADWELL LabVIEW test data and the Fire and Smoke Simulator (FSSIM) fire model output. Methods are provided for definition of data channels, selection of data based on instrument type and location, filtering of data using various criteria and processing of the remaining data.

DTIC

*Computer Programs; Data Processing; Models; Programming Languages*

**20080025127** State Univ. of New York, Binghamton, NY USA

**Data Compression Trade-Offs for TDOA/FDOA Geo-Location Systems**

Fowler, Mark L; Feb 2008; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-2-0231; Proj-1038

Report No.(s): AD-A478488; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478488>

The research results focus on new data compression insights and methods that can enable the sharing of data for enhanced geolocation of RF emitters. The work was focused in four areas: (1) Data compression ideas were applied to the issue of how to select and configure a set of available sensors for location processing. This proved to be a challenging task. (2) The short-time Fourier transform (STFT) was integrated into the data compression algorithm and was shown to properly operate. (3) Matlab routines for data compression were developed and integrated into a single Matlab application. (4) It was shown that there are issues in using previous results that were developed explicitly for sonar signal cases when the signal was modeled as wide-sense stationary Gaussian process. Results are provided for signal models suitable for the communication signal case.

DTIC

*Data Compression; Detectors; Frequencies; Position (Location); Time Response; Tradeoffs*

**20080025343** Defence Directorate for Test and Evaluation, Bourges, France

**Unattended Acoustic Sensor Simulation of TG25 Trials using CHORALE Workshop**

Gozard, Patrick; Le Goff, Alain; Naz, Pierre; Cathala, Thierry; Latger, Jean; Dupuy, Yann; Oct 2006; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479059; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479059>

No abstract available

*Acoustic Properties; Acoustic Simulation; Acoustics; Signal Detectors; Simulation; Targets; Test Facilities*

**20080025350** Defence Research and Development Canada, Toronto, Ontario Canada

**IPME and External Clients: Enhancing Performance by Offloading Simulation Workload to External Clients; Explaining and Simplifying the Process**

Haar, ter, Phil; Cain, Brad; Dec 2007; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479120; DRDC-T-TM-2007-033; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479120>

The speed of simulation execution as performed by the Integrated Performance Modelling Environment (IPME) degrades significantly when computationally demanding functions, such as iterative mathematical calculations, are included in a model. Much of this degradation can be mitigated by transferring those functions that require significant computational resources (cpu processing) to an external client using the external client architecture that accompanies IPME. This client communicates with IPME using TCP/IP network protocol, exchanging values of common variables over the network. Using an external client allows more processing power to be dedicated to computationally expensive tasks and are generally more robust to increases in computational demand. A computationally demanding sample client is used to show the execution performance differences when the procedure resides within the IPME task network and when it is offloaded to an external client. This report also outlines how to use the sample client source code to build a client program, extending the developer's approach for client program development to create a more flexible interface. This will provide another option for client developers who may prefer a more intuitive template for developing their customized client than the sample client provided with IPME.

DTIC

*Computer Programming; Computerized Simulation; Performance Prediction; Simplification; Software Engineering; Workloads (Psychophysiology)*

**20080025478** Naval Research Lab., Bay Saint Louis, MS USA

**Performance of Mixed Layer Models in Simulating SST in the Equatorial Pacific Ocean**

Kara, Birol; Wallcraft, Alan J; Martin, Paul J; Chassignet, Eric P; Feb 23, 2008; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479261; NRL/JA/7320--05-5166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper examines the ability of three ocean mixed layer submodels to depict inter-annual variations of sea surface temperature (SST) in a global configuration of the HYbrid Coordinate Ocean Model (HYCOM). The mixed layer submodels are (1) the K-Profile Parameterization (KPP), (2) the NASA Goddard Institute for Space Studies (GISS) turbulence closure, and (3) the Mellor-Yamada Level 2.5 (MY) turbulence closure. Accuracy of SSTs from the submodels is investigated during 1996-2001, which includes the onset of the strong 1998 La Nina event, when a record cold SST anomaly in the eastern equatorial Pacific occurred. The model simulations (with no ocean data assimilation or relaxation to SST climatology) reveal that all three submodels generally capture the westward extent of the SST cooling within the eastern equatorial Pacific during the transition period from the 1997 El Nino to the 1998 La Nina, one of the largest short term events ever observed (7 deg C change in SST from May to June 1998). During the six-month period after the transition, the daily SST from the submodels is approx. 2 deg C warmer than the buoy SSTs obtained from the Tropical Atmosphere Ocean (TAO) array. Some of these biases are due to deficiencies in the net shortwave radiation and near-surface air temperature used for the simulations. Finally, comparisons with 166 yearlong daily SST time series from many buoys over various regions of the global ocean, including mostly equatorial Pacific, give median RMS differences of 0.65 deg, 0.70 deg, and 0.78 deg C for KPP, GISS, & MY, respectively, during 1996-2001.

DTIC

*Evaluation; Ocean Models; Pacific Ocean; Sea Surface Temperature; Simulation; Surface Temperature; System Effectiveness*

**20080025482** Brown Univ., Providence, RI USA

**Scalable Inference and Learning in Very Large Graphical Models Patterned after the Primate Visual Cortex**

Dean, Thomas; Apr 7, 2008; 11 pp.; In English

Contract(s)/Grant(s): N00014-06-0781; Proj-06PR07580-00

Report No.(s): AD-A479285; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Human-level visual performance has remained largely beyond the reach of engineered systems despite decades of research and significant advances in problem formulation, algorithms and computing power. We posit that significant progress can be made by combining existing technologies from machine vision, insights from theoretical neuroscience and large-scale distributed computing. Such claims have been made before and so it is quite reasonable to ask what are the new ideas we bring to the table that might make a difference this time around. From a theoretical standpoint, our primary point of departure from current practice is our reliance on exploiting time in order to turn an otherwise intractable unsupervised problem into a locally

semi-supervised, and plausibly tractable, learning problem. From a pragmatic perspective, our system architecture follows what we know of conical neuroanatomy and provides a solid foundation for scalable hierarchical inference. This combination of features provides the framework for implementing a wide range of robust object-recognition capabilities.

DTIC

*Cerebral Cortex; Computer Vision; Distributed Processing; Inference; Neurology; Primates; Visual Stimuli*

**20080025490** Defence Research and Development Canada, Valcartier, Quebec Canada

**Long-Term Operating System Maintenance. A Linux Case Study**

Carbone, Richard; Jan 2008; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479294; DRDC-VALCARTIER-TN-2007-150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In Operating system hardware reconfiguration: A case study for Linux, it was determined through experimentation that a Linux-based C2 operating system can successfully undergo a hardware migration and operating system hardware reconfiguration. The direct benefit of this is the ability to forgo any new operating system reinstallation in order to support newer hardware by using mechanisms internal to the operating system that support changes in hardware; this results in a decreased waiting time for system reaccreditation and redeployment. Since an operating system can evolve over time, it can accommodate changes in the system's hardware, thus presenting a tangible advantage for the Navy as this allows the operating system to be maintained over the long-term. However, there are complexities involved when maintaining an operating system for long periods. Therefore, this report serves as an introduction and a simple methodology for performing system maintenance-related tasks that include upgrading, updating, as well as data backups and restoration. This report is neither all-inclusive nor a replacement for qualified system administrators with years of experience. Instead, it can be used as a useful source of information to provide recommended practices, procedures, and information to help in planning for long-term system maintenance.

DTIC

*Maintenance; Unix (Operating System)*

**20080025495** Stanford Univ., Stanford, CA USA

**Practical Animation of Liquids**

Foster, Nick; Fedkiw, Ronald; Aug 2001; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-97-1-0027

Report No.(s): AD-A479314; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a general method for modeling and animating liquids. The system is specifically designed for computer animation and handles viscous liquids as they move in a 3D environment and interact with graphics primitives such as parametric curves and moving polygons. We combine an appropriately modified semi-Lagrangian method with a new approach to calculating fluid flow around objects. This allows us to efficiently solve the equations of motion for a liquid while retaining enough detail to obtain realistic looking behavior. The object interaction mechanism is extended to provide control over the liquid's 3D motion. A high quality surface is obtained from the resulting velocity field using a novel adaptive technique for evolving an implicit surface.

DTIC

*Computer Graphics; Fluid Flow; Liquids*

**20080025509** Defence Research and Development Canada, Valcartier, Quebec Canada

**Practical Verification & Safeguard Tools for C/C++**

Michaud, F; Carbone, R; Nov 2007; 76 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479348; DRDC-V-TR-2006-735; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document is the final report of an activity that took place in 2005-2006. The goal of this project was first to identify common software defects related to the use of the C and C++ programming languages. Errors and vulnerabilities created by these defects were also investigated, so that meaningful test cases could be created for the evaluation of best-of-breed automatic verification tools. Finally, when relevant, best practices were inferred from our experiments with these tools.

DTIC

*C (Programming Language); C++ (Programming Language); Defects; Program Verification (Computers); Software Development Tools; Vulnerability*

**20080025512** Defence Research and Development Canada, Valcartier, Quebec Canada

**Evaluation of the Accuracy of the Dark Frame Subtraction Method in CCD Image Processing**

Levesque, Martin P; Lelievre, Mario; Dec 2007; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479357; DRDC-V-TN-2007-343; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document evaluates the reliability of the dark-frame subtraction method for the detection of very dim targets in astronomical images. This method is frequently used for removing the image background gradient (a thermal artefact) in CCD images. This report demonstrates that this method may not be suitable for the detection of objects with very low signal-to-noise ratio. The analysis of two series of 500 dark frames, acquired at two different CCD temperatures, showed that dark frames are not reproducible with enough accuracy. The subtraction of two dark frames, assumed to be acquired at the same temperature, always leaves a residual background comparable or superior to the noise level. It is suspected that the temperature recorded into the image header is the cryo-cooler temperature and not directly the CCD temperature. The temperature oscillates and there is always a small temperature difference between the CCD chip and the cryo-cooler. However, it was found that the image mean intensity is tightly linked to the background gradient amplitude in each dark frame. The subtraction of dark frames with equal mean intensity, instead of equal recorded temperature, gives good results. Unfortunately, it is not obvious to evaluate the mean background intensity when the image contains signals, while the CCD temperature is always available in the image header. In the case where very faint objects have to be detected, the simple dark frame subtraction method should be replaced by more reliable algorithms (but generally longer to compute) able to separate the signal from the image background.

DTIC

*Accuracy; Background Noise; Charge Coupled Devices; Image Processing*

**20080025538** ENSCO, Inc., Melbourne, FL USA

**Computer Program Development Specification for the Surface Wave Analysis System (SWANS)**

Hutchenson, K D; Cunfer, R S; Sutton, A F; Aug 1986; 133 pp.; In English

Report No.(s): AD-A479447; DCS-SFS-86-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is a computer program development specification for the Surface Wave Analysis System (SWANS). Included in the Appendix are sections on the generation of synthetic seismograms, and linear inversion theory in geophysics, and frequency variable filters.

DTIC

*Computer Programming; Computer Programs; Surface Waves*

**20080025867** Air Force Research Lab., Rome, NY USA

**A Coordination Model for Improving Software System Attack-Tolerance and Survivability in Open Hostile Environments (Postprint)**

Ren, Shangping; Yu, Yue; Kwiat, Kevin A; Tsai, Jeffrey; Feb 2008; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4519

Report No.(s): AD-A479054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479054>

This paper presents a coordination model that contains three active entities: actors, roles and coordinators. Actors abstract the system's functionalities while roles and coordinators statically encapsulate coordination constraints and dynamically propagate these constraints among themselves and onto the actors. A software system's attack-tolerance and survivability in open hostile environments are enhanced through appropriate constraint propagations and constraint enforcements. This setting implies that both the coordination constraints and coordination activities are decentralized and distributed among the coordinators and the roles. The decentralization not only shields the system from single point of failures, but also provides a foundation that survivable feedback loops can be built upon. The survivable feedback loops presented in the model resist the contamination of the system by faulty elements and thereby protect the whole system from being broken down by single failures.

DTIC

*Coordination; Fault Tolerance; Models*

**20080025897** Naval Postgraduate School, Monterey, CA USA; Marine Hydrophysical Inst., Sevastopol, Russian Federation; Academy of Sciences of the Ukraine, Sevastopol, Ukraine

**Analysis of Sparse and Noisy Ocean Current Data Using Flow Decomposition. Part 1: Theory**

Chu, Peter C; Ivanov, Leonid M; Korzhova, Tatiana P; Margolina, Tatiana M; Melnichenko, Oleg V; Apr 2003; 15 pp.; In English

Contract(s)/Grant(s): N00014-02-1-4058

Report No.(s): AD-A479483; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new approach is developed to reconstruct a three-dimensional incompressible flow from noisy data in an open domain using a two-scalar (toroidal and poloidal) spectral representation. The results are presented in two parts: Theory (first part) and Application (second part). In Part I, this approach includes the following: (a) a boundary extension method to determine normal and tangential velocities at an open boundary, (b) establishment of homogeneous open boundary conditions for the two potentials with a spatially varying coefficient  $\kappa$ , (c) spectral expansion of  $\kappa$ , (d) calculation of basis functions for each of the scalar potentials, and (e) determination of coefficients in the spectral decomposition of both velocity and  $\kappa$  using linear or nonlinear regressions. The basis functions are the eigenfunctions of the Laplacian operator with homogeneous mixed boundary conditions and they depend upon the spatially varying parameter  $\kappa$  at the open boundary. A cost function used for poor data statistics is introduced to determine the optimal number of basis functions. An optimization scheme with iteration and regularization is proposed to obtain unique and stable solutions. In Part II, the capability of the method is demonstrated through the reconstruction of a 2D wind-driven circulation in a rotating channel, a baroclinic circulation in the eastern Black Sea, and a large-scale surface circulation in the Southern Ocean.

DTIC

*Decomposition; Differential Equations; Incompressible Flow; Lagrangian Function; Ocean Currents; Three Dimensional Flow; Velocity Distribution*

**20080025899** State Univ. of New York, Binghamton, NY USA

**Fault Tolerant Airborne Sensor Networks for Air Operations**

Wu, Eva; Feb 2008; 74 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-07-1-0172; Proj-230S

Report No.(s): AD-A478953; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478953>

This report summarizes the main results of research conducted during the summer of 2007 on tasking a finite number of cooperative agents to randomly emerging targets for their removal. Faults occur when some agents engaged in a mission are expired. Agents are subject to threat at a level determined by the number of targets present. On the other hand, the rate at which a target is removed depends on the number of cooperative agents assigned to it. Faults effectively change the network architecture and, therefore, degrade the network performance. Designs of control policies that determine the number of agents assigned are based on the network life when expired agents cannot be replenished, and on the network availability when expired agents are replenished at a certain rate. Tasking process is described by a discrete event system in the form of a queuing network, where agents are servers and targets are customers. Optimal policies are determined by solving a Markov decision problem.

DTIC

*Airborne Equipment; Fault Tolerance*

**20080025919** Naval Postgraduate School, Monterey, CA USA; Marine Hydrophysical Inst., Sevastopol, Russian Federation

**Analysis of Sparse and Noisy Ocean Current Data Using Flow Decomposition. Part II: Applications to Eulerian and Lagrangian Data**

Chu, Peter C; Ivanov, Leonid M; Korzhova, Tatiana P; Margolina, Tatiana M; Melnichenko, Oleg V; Apr 2003; 22 pp.; In English

Contract(s)/Grant(s): N00014-02-1-4058

Report No.(s): AD-A479484; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The capability of the reconstruction scheme developed in Part I is demonstrated here through three practical applications. First, the nonlinear regression model is used to reproduce the upper-layer, three-dimensional circulation of the eastern Black Sea from model data distorted by white and red noises. Second, the quasigeostrophic approximation is used to reconstruct the shallow water circulation pattern in an open domain with various sampling strategies. Third, the large-scale circulation in the Southern Ocean is reproduced from the First Global Atmospheric Research Program (GARP) Global Experiment (FGGE) drifter data with uncontrollable noise statistics. All three cases confirm that the theoretical approach is robust to various

noise-to-signal ratios, number of observations, and station disposition. Using the simplified open boundary condition for analyzing long-term observational data is recommended because the nonlinear regression procedure requires considerable computer resources.

DTIC

*Decomposition; Differential Equations; Incompressible Flow; Lagrangian Function; Ocean Currents; Three Dimensional Flow; Velocity Distribution*

**20080025926** Defence Research and Development Canada, Ottawa, Ontario Canada

**Localization in Self-Healing Autonomous Sensor Networks (SASNet): Studies on Cooperative Localization of Sensor Nodes using Distributed Maps**

Li, Li; Jan 2008; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479356; DRDC-O-TR-2008-020; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Self-healing Autonomous Sensing Network (SASNet) presents an advanced Wireless Sensor Network (WSN) that aims to enhance the effectiveness of mission operation in the contemporary military environment, by providing relevant and accurate situational awareness information. In order to achieve this objective, precise location information is required in SASNet. We present the studies on cooperative localization algorithms for wireless sensor nodes. We have taken the cooperative localization approach which can often produce accurate results using a very small number of anchor nodes or even no anchor nodes. The cooperative localization scheme adopted in this study computes a local map for each sensor node using all the available link metric constraints, and then merges the local maps into a global map where each node acquires its location coordinates. We examined advanced techniques of non-linear data mapping for computing local maps from the large data set of link constraints. We selected the Curvilinear Component Analysis (CCA) from a class of highly efficient neural networks and applied it to WSN localization, proposing a cooperative localization scheme based on CCA. We studied CCA localization in comparison with the MDS (Multi-Dimensional Scaling) map method. We first review related work on WSN localization and re-examine the pros and cons of the selected cooperative approach vs. other approaches. We then describe the CCA algorithm for data non-linear mapping, and extend it to solve the problem of sensor node position estimation. The performance simulations of CCA-MAP are conducted using SASNet scenarios and their results compared with the MDS-MAP algorithm. Advantages and shortcomings of the CCA-MAP algorithm are analyzed. Further, we discuss the design considerations of the discussed cooperative localization algorithms to compare and examine their implementation feasibility. Finally, conclusions and recommendations from this study are presented.

DTIC

*Autonomy; Healing; Local Area Networks; Mapping; Position (Location); Topology*

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### 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.

**20080023808** Army War Coll., Carlisle Barracks, PA USA

**DoD Computer Network Operations: Time to Hit the Send Button**

Glebocki, Jr, Joseph; Mar 10, 2008; 49 pp.; In English

Report No.(s): AD-A478337; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478337>

The Department of Defense (DoD) is rapidly moving forward into the cyber domain of warfare, but the USA Government is not ready to exploit this evolution in Civil-Military affairs. With the USA facing new threats to its national security at home and abroad like never before, U.S. policy and law must change to enable DoD to fully defend and fight in cyberspace. Due to the highly automated and interconnected nature of U.S. critical infrastructure, it is not practical to erect a barrier between military and civilian operations that can serve U.S. national interests. Within the interagency framework, DoD should serve as the lead, including the response phase whenever defense critical infrastructure is involved or when a cyber attack has seriously affected other national critical infrastructure. To enable this transformation, the Posse Comitatus Act (PCA) should be amended or rescinded so DoD can conduct full defensive and offensive cyberspace operations against all required targets.

DTIC

*Computer Networks; Defense Program; Public Relations; Security*



**20080023816** Army War Coll., Carlisle Barracks, PA USA

**Providing an Enterprise Service Architecture to the Net-Centric Warfighter**

Acevedo, David P; Mar 10, 2008; 35 pp.; In English

Report No.(s): AD-A478361; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478361>

To meet the challenges of the future the Department of Defense (DoD) must have a strategy to ensure that the joint forces of tomorrow will be able to achieve full-spectrum dominance through the use of networks and access to enterprise data services that provide true interoperability, seamless integration, and available-on-demand collaboration. Joint procedures for the implementation of deployed collaboration capabilities on DoD networks within local enclaves or domain-wide must be synchronized to achieve the greatest efficiencies at home station and when deployed. The objective is to provide a capability for the near-term implementation of an Active Directory (AD) environment capable of support in Generating Force (GF) environments while maintaining the ability to seamlessly deploy and integrate into Deployed Force (DF) architectures. A Joint directory and enterprise service strategy provides the potential for significantly enhanced interoperability, seamless integration, and collaboration capabilities through which these objectives can be achieved. This paper will examine existing AD deployment policies and guidance and how a joint strategy using the concept of Theater Resource Forest (TRF) architecture will greatly enhance interoperability and collaboration across the force.

DTIC

*Communication Networks; Computer Networks; Forests; Interoperability; Military Operations; United States*

**20080023846** Library of Congress, Washington, DC USA

**Critical Infrastructures: Background, Policy, and Implementation**

Moteff, John D; Jul 18, 2002; 36 pp.; In English

Report No.(s): AD-A478501; CRS-RL30153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478501>

The nation's health, wealth, and security rely on the production and distribution of certain goods and services. The array of physical assets, processes and organizations across which these goods and services move are called critical infrastructures. Computers and communications, themselves critical infrastructures, are increasingly tying these infrastructures together. There has been growing concern that this reliance on computers and computer networks raises the vulnerability of the nation's critical infrastructures to 'cyber' attacks. In May 1998, President Clinton released Presidential Decision Directive No. 63. The Directive set up groups within the federal government to develop and implement plans that would protect government-operated infrastructures and called for a dialogue between government and the private sector to develop a National Infrastructure Assurance Plan that would protect all of the nation's critical infrastructures by the year 2003. While the Directive called for both physical and cyber protection from both man-made and natural events, implementation focused on cyber protection against man-made cyber events (i.e. computer hackers). PDD-63 was a Clinton Administration policy document. Following the events of September 11, the Bush Administration released two relevant Executive Orders (EOs). EO 13228, signed October 8, 2001 established the Office of Homeland Security. Among its duties, the Office shall coordinate efforts to protect the USA and its critical infrastructure from the consequences of terrorist attacks. EO 13231 (Critical Infrastructure Protection in the Information Age), signed October 16, stated the Bush Administration's policy and objectives for protecting the nation's information infrastructure. These are similar to those stated in PDD-63 and assumes continuation of many PDD-63 activities. E.O. 13231, however, focuses entirely on information systems.

DTIC

*Computer Information Security; Planning; Policies; Protection; United States*

**20080023849** Library of Congress, Washington, DC USA

**Critical Infrastructures: Background and Early Implementation of PDD-63**

Moteff, John D; Jun 19, 2001; 28 pp.; In English

Report No.(s): AD-A478523; CRS-RL30153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478523>

The nation's health, wealth, and security rely on the supply and distribution of certain goods and services. The array of physical assets, processes and organizations across which these goods and services move are called critical infrastructures. Computers and communications, themselves critical infrastructures, are increasingly tying these infrastructures together. There is concern that this reliance on computers and computer networks makes the nation's critical infrastructures vulnerable to 'cyber' attacks. In May 1998, President Clinton released Presidential Decision Directive No. 63. The Directive sets up groups within the federal government to develop and implement plans that would protect government-operated infrastructures and

calls for a dialogue between government and the private sector to develop a National Infrastructure Assurance Plan that would protect the nation's critical infrastructures by the year 2003. PDD-63 identified 12 areas critical to the functioning of the country: information and communications; banking and finance; water supply; transportation; emergency law enforcement; emergency fire service; emergency medicine; electric power, oil, and gas supply and distribution; law enforcement and internal security; intelligence; foreign affairs; and national defense. The Directive assigned a lead agency to each sector to coordinate efforts at protecting the infrastructure upon which each of these areas depend. In its FY2001 budget, the Clinton Administration estimated that they requested \$2.03 billion for activities related to critical infrastructure protection. While much of this funding is buried within ongoing operating and equipment accounts, making it difficult to track during the appropriations process, there were a few high visibility initiatives. PDD-63 and its implementation raise a number of issues. Among them is the ability and willingness of the private sector to cooperate with the federal government in sharing information.

DTIC

*Computer Information Security; Presidential Reports; Protection; United States*

**20080023852** Library of Congress, Washington, DC USA

**Critical Infrastructures: Background, Policy, and Implementation**

Moteff, John D; Feb 10, 2003; 37 pp.; In English

Report No.(s): AD-A478529; CRS-RL30153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478529>

The nation's health, wealth, and security rely on the production and distribution of certain goods and services. The array of physical assets, processes and organizations across which these goods and services move are called critical infrastructures (e.g. electricity, the power plants that generate it, and the electric grid upon which it is distributed). Computers and communications, themselves critical infrastructures, are increasingly tying these infrastructures together. In May 1998, President Clinton released Presidential Decision Directive No. 63. The Directive set up groups within the federal government to develop and implement plans that would protect government-operated infrastructures and called for a dialogue between government and the private sector to develop a National Infrastructure Assurance Plan that would protect all of the nation's critical infrastructures by the year 2003. Following the events of September 11, the Bush Administration released two relevant Executive Orders (EOs). EO 13228, signed October 8, 2001 established the Office of Homeland Security. EO 13231, signed October 16, stated the Bush Administration's policy and objectives for protecting the nation's information infrastructure. On November 22, 2002, Congress passed legislation creating a Department of Homeland Security. The Department consolidates into a single department a number of offices and agencies responsible for implementing various aspects of homeland security. One of the directorates created by the legislation is responsible for Information Analysis and Infrastructure Protection. Other issues include protections for information shared between the government and the private sector, privacy versus protection, costs and the need to set priorities, and whether or not the federal government will need to employ more direct incentives to achieve an adequate level of protection by the private sector. This report will be updated as warranted.

DTIC

*Policies; Protection; Security; United States*

**20080023853** Library of Congress, Washington, DC USA

**Critical Infrastructures: Background, Policy, and Implementation**

Moteff, John D; Apr 9, 2003; 38 pp.; In English

Report No.(s): AD-A478530; CRS-RL30153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478530>

The nation's health, wealth, and security rely on the production and distribution of certain goods and services. The array of physical assets, processes and organizations across which these goods and services move are called critical infrastructures. Computers and communications, themselves critical infrastructures, are increasingly tying these infrastructures together. In May 1998, President Clinton released Presidential Decision Directive No. 63. The Directive set up groups within the federal government to develop and implement plans that would protect government-operated infrastructures and called for a dialogue between government and the private sector to develop a National Infrastructure Assurance Plan that would protect all of the nation's critical infrastructures by the year 2003. Following the events of September 11, the Bush Administration released two relevant Executive Orders (EOs). EO 13228, signed October 8, 2001 established the Office of Homeland Security. Among its duties, the Office shall 'coordinate efforts to protect the USA and its critical infrastructure from the consequences of terrorist attacks.' EO 13231, signed October 16, stated the Bush Administration's policy and objectives for protecting the nation's information infrastructure. On November 22, 2002, Congress passed legislation creating a Department of Homeland Security.

The Department consolidates into a single department a number of offices and agencies responsible for implementing various aspects of homeland security. Issues include whether to segregate cyber protection from physical protection organizationally, mechanisms for sharing information shared between the government and the private sector, costs, the need to set priorities, and whether or not the federal government will need to employ more direct incentives to achieve an adequate level of protection by the private sector and states, and privacy versus protection. This report will be updated as warranted.

DTIC

*Policies; Protection; Security; United States*

**20080023854** Library of Congress, Washington, DC USA

**Critical Infrastructures: Background, Policy, and Implementation**

Moteff, John D; Dec 17, 2002; 35 pp.; In English

Report No.(s): AD-A478531; CRS-RL30153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478531>

The nation's health, wealth, and security rely on the production and distribution of certain goods and services. The array of physical assets, processes and organizations across which these goods and services move are called critical infrastructures. Computers and communications, themselves critical infrastructures, are increasingly tying these infrastructures together. In May 1998, President Clinton released Presidential Decision Directive No. 63. The Directive set up groups within the federal government to develop and implement plans that would protect government-operated infrastructures and called for a dialogue between government and the private sector to develop a National Infrastructure Assurance Plan that would protect all of the nation's critical infrastructures by the year 2003. Following the events of September 11, the Bush Administration released two relevant Executive Orders (EOs). EO 13228, signed October 8, 2001 established the Office of Homeland Security. Among its duties, the Office shall 'coordinate efforts to protect the USA and its critical infrastructure from the consequences of terrorist attacks.' EO 13231, signed October 16, stated the Bush Administration's policy and objectives for protecting the nation's information infrastructure. On November 22, 2002, Congress passed legislation creating a Department of Homeland Security. The Department consolidates into a single department a number of offices and agencies responsible for implementing various aspects of homeland security. One of the directorates created by the legislation is responsible for Information Analysis and Infrastructure Protection. Other issues include protections for information shared between the government and the private sector, privacy versus protection, costs and the need to set priorities, and whether or not the federal government will need to employ more direct incentives to achieve an adequate level of protection by the private sector.

DTIC

*Information; Information Systems; Policies; Protection; Security; United States*

**20080024182** NASA Langley Research Center, Hampton, VA, USA

**Design of Test Articles and Monitoring System 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.; July 2008; 59 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-2008-215322; L-19473; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080024182>

This report describes the design of the test articles and monitoring systems developed to characterize the response of a fault-tolerant computer communication system when stressed beyond the theoretical limits for guaranteed correct performance. A high-intensity radiated electromagnetic field (HIRF) environment was selected as the means of injecting faults, as such environments are known to have the potential to cause arbitrary and coincident common-mode fault manifestations that can overwhelm redundancy management mechanisms. The monitors generate stimuli for the systems-under-test (SUTs) and collect data in real-time on the internal state and the response at the external interfaces. A real-time health assessment capability was developed to support the automation of the test. A detailed description of the nature and structure of the collected data is included. The goal of the report is to provide insight into the design and operation of these systems, and to serve as a reference document for use in post-test analyses.

Author

*Field-Programmable Gate Arrays; Avionics; Fault Tolerance; Interprocessor Communication; Real Time Operation; Electromagnetic Fields*

**20080024262** Army Research Lab., Aberdeen Proving Ground, MD USA

**Reconfigurable Computing: Experiences and Methodologies**

Park, Song-Jun; Shires, Dale; Henz, Brian; Jan 2008; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-7UE-DCL

Report No.(s): AD-A478362; ARL-TR-4358; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478362>

Reconfigurable computing refers to computations done with flexible fabrics where the data path and control flow can be customized to the application. Unlike traditional computing using the fetch, execute, and store model that is highly sequential, reconfigurable computing allows developers to program their applications both spatially and temporally. This allows for potentially great speed-ups with applications that might be well-suited for such approaches. However, programming in this style requires specialized hardware and a somewhat complex design flow. This report discusses background on the topic and highlights our experiences using this technology on two target applications. It also discusses the state-of-the-art high-level language approaches that have been offered to streamline the development cycle using these technologies.

DTIC

*Architecture (Computers); Methodology*

**20080025333** Army War Coll., Carlisle Barracks, PA USA

**Partnering With Private Networks The DOD Needs a Reserve Cyber Corps**

Dias, Dennis P; Mar 19, 2008; 33 pp.; In English

Report No.(s): AD-A479001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479001>

With the increasing rate of change of Information Technology (IT), the Department of Defense (DoD) and other government entities must look in new areas to meet threats and remain competent in this age. The concept of reaching non-uniformed civilian professionals to assist DoD in inter-agency challenges such as reconstruction in failed states can be used to suggest the use of a similar outreach to meet technology challenges. The specific challenges facing the DoD in the future will include network attacks from skilled adversaries. Given the rapid changes occurring in technology, there must be new partnerships and networks with agencies outside the DoD which should include the creation of a cyber corps of skilled civilian professionals that can augment DoD resources in a crisis. It is in our nation's national interest to leverage the talents of all entities in our society and the development of human intellectual capital through is critical. This Strategic Research Project (SRP) will seek to expand the concept of networking between the DoD and the private sector to create a reserve cyber corps to meet new technological changes and potential threats.

DTIC

*Cybernetics; Networks*

**20080025372** Yale Univ., New Haven, CT USA

**Mechanism Design for Policy Routing**

Feigenbaum, Joan; Sami, Rahul; Shenker, Scott; Nov 2003; 16 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0795

Report No.(s): AD-A479188; YALEU/DCS/TR-1258; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479188>

The Border Gateway Protocol (BGP) for interdomain routing is designed to allow autonomous systems (ASes) to express policy preferences over alternative routes. We model these preferences as arising from an AS's underlying utility for each route and study the problem of finding a set of routes that maximizes the overall welfare (i.e., the sum of all ASes' utilities for their selected routes). We show that, if the utility functions are unrestricted, this problem is NP-hard even to approximate closely. We then study a natural class of restricted utilities, next-hop preferences. We present a strategyproof, polynomial-time computable mechanism for welfare-maximizing routing over this restricted work on lowest-cost routing mechanism design, this mechanism appears to be incompatible with BGP and hence difficult to implement in the context of the current internet. Our contributions include a new complexity measure for Internet algorithms, the dynamic stability, which may be useful in other problem domains.

DTIC

*Autonomy; Optimization; Policies; Protocol (Computers)*

**20080025545** Army Tank-Automotive Research and Development Command, Warren, MI USA

**System Life Cycle Support (SLCS)**

Gachupin, Sam; Aug 23, 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479469; TARDEC-17540; No Copyright; Avail.: Defense Technical Information Center (DTIC)

PDES, Inc. is an international industry (OEMs)/government consortium formed to accelerate the development and implementation of ISO 10303, STEP(STandard for Exchange of Product model data). This data transfer standard is designed to allow companies and customers effectively exchange information, enhancing product development strategies. The objective of the System Life Cycle Support System Life Cycle Support (SLCS) is to develop a STEP-based life cycle management and support system, integrating U.S. Army vehicular product data from engineering and logistics databases using FALCON (Federated Army Lifecycle COllaborative eNterprise). The briefing reviews data exchange pilot programs.

DTIC

*Data Transmission; Government Procurement; Life (Durability)*

**20080025861** Defence Research and Development Canada, Dartmouth, Nova Scotia Canada

**Thoughts on a Design Framework for System Integration**

Isenor, Anthony W; Lapinski, Anna-Liesa S; Nov 2007; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478990; DRDC-ATLANTIC-TM-2006-143; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478990>

The problem of integrating heterogeneous systems is discussed. Some keys to the success of multi-system integration are establishing a team environment among those performing the integration, ensuring data interoperability, and designing an integrated system that takes into account everything the new system must do. The interaction of personnel to build a collaborative and trusting environment for the integration process is discussed. The important issues related to data interoperability, such as data naming, structure and content, are described. The data and personnel elements are then considered within a design framework. The framework of Cormier is reposed as a series of questions that should be considered before the integration development. Regulative elements of system integration, such as the impact of the Canadian Privacy Act on personal information, are also considered.

DTIC

*Architecture (Computers); Systems Integration*

**20080025862** NRNS, Inc., Ottawa, Ontario Canada

**Securing Wireless Local Area Networks with GoC PKI**

Spagnolo, J; Cayer, D; Oct 2007; 58 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479303; DRDC-O-CR-2007-239; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Defence R&D Canada led a project in which a wireless virtual private networking (VPN) architecture was set up in a test bed in the Network Information Operation (NIO) lab for 802.11/a/b/g communications. The goal of this initial work was to aid in developing a security policy for use of wireless local area networks (WLAN) in government enterprise networks. This report presents the results of follow-on work that leverages the Government of Canada (GoC) Public Key Infrastructure (PKI) technology for strong authentication of wireless users as well VPN users. The solution presented herein relies on the latest wireless security protocols to secure the wireless link and includes an Internet Protocol Security (IPsec) based VPN to achieve a greater level of assurance for more sensitive GoC network environments. The work focuses on the establishment and protection of digital identities, mutual authentication, authorization, data privacy and integrity, as well as wireless network policy management and dissemination. We conclude that the Wi-Fi Protected Access 2 (WPA2) when operating in enterprise mode and combined with GoC PKI issued certificates and wireless network policy managed through Windows group policies, is an acceptable solution for providing authenticated/secure WLAN access to GoC protected environments. We also conclude that layering IPsec security on top of WPA2 adds complexity without providing additional assurance against unauthorized WLAN access. While testing the proposed solution, difficulties were encountered integrating the IPsec VPN component of the wireless VPN within an enterprise Microsoft Windows environment.

DTIC

*Local Area Networks; Wireless Communication*

**20080025865** Air Force Cyberspace Command, Barksdale AFB, LA USA

**Air Force Cyber Command Strategic Vision**

Lord, William T; Feb 2008; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479060; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479060>

Warfighters rely upon cyberspace to command and control forces in the 21st century. Revolutionary technology has presented cyber capabilities, which can provide decisive effects traditionally achieved only through kinetic means. Recognizing the domain's importance, Secretary of the Air Force Michael Wynne announced Air Force Cyberspace Command (Provisional) in September 2007 to bring together the myriad existing cyber capabilities under a single commander. This new command will provide combat-ready forces equipped to conduct sustained operations in and through the electromagnetic spectrum, fully integrated with global air and space operations. This Air Force Cyber Command Strategic Vision is a foundation for the tremendous work that lies ahead as the organization achieves initial operational capability in 2008 and postures for full operational capability in 2009. It explains the mission of Air Force Cyberspace Command in the context of the strategic realities faced by the USA and how our capabilities will enhance the Air Force's global vigilance, global reach, and global power, while expanding the options available to the Joint Force. Air Force Cyberspace Command will be a dynamic warfighting organization integrating capabilities, systems, and warriors to establish cross-domain dominance. The Strategic Vision describes how we will develop 21st century cyberspace warriors and how they will control cyberspace to deliver sovereign options for the defense of the USA.

DTIC

*Electronic Warfare; Military Operations*

**20080025947** Air Force Research Lab., Rome, NY USA

**Coalition Network Management System**

Fitzgerald, Peter J; Feb 2008; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4519

Report No.(s): AD-A478955; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478955>

Under the auspices of The Technical Cooperation Program, a Project Arrangement (PA), entitled Coalition Command Control and Communications Demonstration Environment (CC3DE), between the US, Australia and Canada was created and realized from 2000 to 2003. These three nations collaborated on a Coalition Network Management System (CNMS) under the CC3DE PA. A new PA, entitled Policy Enabled Coalition Communications (PECC), will incorporate the UK and will iterate the design and concept of CNMS. As of this interim report, the PA still has not been signed due to export control language differences between nations. It is expected the PA will be signed in early 2008. Despite the limitation of an unsigned PA, AFRL has moved forward with in-house work on policy-based solutions for the coalition environment, to include: designing a modern service oriented architecture (SOA) for the coalition enterprise; identifying requirements for secure, cross-domain exchange of SOA protocols; begin design of reasoning resource monitors using semantic technology; and creating a NM protocol generator to test NM tool scalability.

DTIC

*Management Systems*

**63**

**CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS**

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

**20080023793** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Remote Battle Damage Assessment Using Sensor Fusion and 3D Imaging**

Bankowski, E; Meitzler, T; Lane, K; Sohn, E J; Bryk, D; Feb 13, 2004; 7 pp.; In English

Report No.(s): AD-A478160; TARDEC-TR-16242; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478160>

It is extremely important to meet the rapid Battle Damage Assessment (BDA) requirement for current and future systems. The proposed technical approach provides the capability to conduct timely BDA utilizing indigenous surveillance systems. The surveillance system consisting of digital visual and infrared (IR) cameras combined with a real-time 3D display is

proposed. This system will be integrated and tested under field conditions. The system will support real-time remote BDA by providing images of combat vehicles and their IR signatures. This assessment will allow soldiers to identify combat vehicles that have been damaged or destroyed on the battlefield. The task will be accomplished using the sensor fusion technique for visual and IR imagery. The battle damage assessment with 3D depth perception will be accomplished by using multiple camera views. The 3D images will be displayed remotely using auto-stereoscopic 3D display. This technology was tested in the lab environment for threat recognition, camouflage assessment, and space shuttle tile damage assessment. The results of this testing show the benefits of IR imaging and fused imaging techniques for threat assessment. The stereoscopic cameras were used for camouflage evaluation in the field. The benefit of this technique for BDA is in depth perception of the battlefield.

DTIC

*Cameras; Combat; Damage Assessment; Digital Cameras; Display Devices; Imaging Techniques; Infrared Radiation; Multisensor Fusion*

**20080023819** Air Force Electronic Warfare Evaluation Simulator (AFEWES), Forth Worth, TX USA

**Air Force Electronic Warfare Evaluation Simulator (AFEWES) Infrared Test and Evaluation Capabilities**

Jackson, II, Hank D; Blair, Tommy L; Ensor, Bruce A; Apr 2007; 12 pp.; In English; Original contains color illustrations Report No.(s): AD-A478382; XC-AFEWES/412TW; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: <http://hdl.handle.net/100.2/ADA478382>

The Air Force Electronic Warfare Evaluation Simulator (AFEWES) infrared countermeasures (IRCM) test facility currently has the ability to simulate a complete IRCM test environment, including IR missiles in flight, aircraft in flight, and various IR countermeasures including maneuvers, point-source flares, and lamp- and LASER-based jammer systems. The simulations of IR missiles in flight include missile seeker hardware mounted on a six degree-of-freedom flight simulation table. This paper will focus on recent developments and upgrades to the AFEWES IR capability. In particular, current developments in IR scene generation/projection and efforts to optically combine the IR image produced by a resistive array with existing foreground lamp sources.

DTIC

*Electronic Warfare; Evaluation; Flight Simulation; Infrared Radiation; Optical Countermeasures; Research Facilities; Simulators; System Effectiveness*

**20080023925** Wyoming Univ., Laramie, WY USA

**An Overview of Physicomimetics**

Spears, William M; Spears, Diana F; Heil, Rodney; Kerr, Wesley; Hettiarachchi, Suranga; Jan 2004; 16 pp.; In English Contract(s)/Grant(s): DODARMY41700 Report No.(s): AD-A478575; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper provides an overview of our framework, called physicomimetics, for the distributed control of swarms of robots. We focus on robotic behaviors that are similar to those shown by solids, liquids, and gases. Solid formations are useful for distributed sensing tasks, while liquids are for obstacle avoidance tasks. Gases are handy for coverage tasks, such as surveillance and sweeping. Theoretical analyses are provided that allow us to reliably control these behaviors. Finally, our implementation on seven robots is summarized.

DTIC

*Drone Vehicles; Physics; Robots; Self Organizing Systems; Surveillance*

**20080023931** Minnesota Univ., Minneapolis, MN USA

**Multiscale Sparse Image Representation with Learned Dictionaries (PREPRINT)**

Mairal, Julien; Sapiro, Guillermo; Elad, Michael; Jan 2007; 6 pp.; In English Report No.(s): AD-A478585; IMA-PREPRINT-SER-2152; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper introduces a new framework for learning multiscale sparse representations of natural images with overcomplete dictionaries. Our work extends the K-SVD algorithm [1], which learns sparse single-scale dictionaries for natural images. Recent work has shown that the K-SVD can lead to state-of-the-art image restoration results [2, 3]. We show that these are further improved with a multiscale approach, based on a Quadtree decomposition. Our framework provides an alternative to multiscale pre-defined dictionaries such as wavelets, curvelets, and contourlets, with dictionaries optimized for the data and application instead of pre-modelled ones.

DTIC

*Dictionaries; Restoration*

**20080023932** Minnesota Univ., Minneapolis, MN USA

**Geodesic Matting: A Framework for Fast Interactive Image and Video Segmentation and Matting (PREPRINT)**

Bai, Xue; Sapiro, Guillermo; Jan 3, 2008; 28 pp.; In English

Report No.(s): AD-A478586; IMA-PREPRINT-SER-2185; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An interactive framework for soft segmentation and matting of natural images and videos is presented in this paper. The proposed technique is based on the optimal, linear time, computation of weighted geodesic distances to user-provided scribbles, from which the whole data is automatically segmented. The weights are based on spatial and/or temporal gradients, considering the statistics of the pixels scribbled by the user, without explicit optical flow or any advanced and often computationally expensive feature detectors. These could be naturally added to the proposed framework as well if desired, in the form of weights in the geodesic distances. An automatic localized refinement step follows this fast segmentation in order to further improve the results and accurately compute the corresponding matte function. Additional constraints into the distance definition permit to efficiently handle occlusions such as people or objects crossing each other in a video sequence. The presentation of the framework is complemented with numerous and diverse examples, including extraction of moving foreground from dynamic background in video, natural and 3D medical images, and comparisons with the recent literature.

DTIC  
*Geodesic Lines; Image Processing; Imaging Techniques*

**20080023938** Minnesota Univ., Minneapolis, MN USA

**A Geodesic Framework for Fast Interactive Image and Video Segmentation and Matting (PREPRINT)**

Bai, Xue; Sapiro, Guillermo; Aug 2007; 10 pp.; In English

Report No.(s): AD-A478596; IMA-PREPRINT-SER-2171; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An interactive framework for soft segmentation and matting of natural images and videos is presented in this paper. The proposed technique is based on the optimal, linear time, computation of weighted geodesic distances to the user-provided scribbles, from which the whole data is automatically segmented. The weights are based on spatial and/or temporal gradients, without explicit optical flow or any advanced and often computationally expensive feature detectors. These could be naturally added to the proposed framework as well if desired, in the form of weights in the geodesic distances. A localized refinement step follows this fast segmentation in order to accurately compute the corresponding matte function. Additional constraints into the distance definition permit to efficiently handle occlusions such as people or objects crossing each other in a video sequence. The presentation of the framework is complemented with numerous and diverse examples, including extraction of moving foreground from dynamic background, and comparisons with the recent literature.

DTIC  
*Image Processing; Imaging Techniques*

**20080023941** Minnesota Univ., Minneapolis, MN USA

**Sparse Representation for Color Image Restoration (PREPRINT)**

Mairal, Julien; Elad, Michael; Sapiro, Guillermo; Oct 2006; 32 pp.; In English

Report No.(s): AD-A478604; IMA-PREPRINT-SER-2139; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sparse representations of signals have drawn considerable interest in recent years. The assumption that natural signals, such as images, admit a sparse decomposition over a redundant dictionary leads to efficient algorithms for handling such sources of data. In particular, the design of well adapted dictionaries for images has been a major challenge. The K-SVD has been recently proposed for this task, and shown to perform very well for various gray-scale image processing tasks. In this paper we address the problem of learning dictionaries for color images and extend the K-SVD-based gray-scale image denoising algorithm that appears in [2]. This work puts forward ways for handling nonhomogeneous noise and missing information, paving the way to state-of-the-art results in applications such as color image denoising, demosaicing, and inpainting, as demonstrated in this paper.

DTIC  
*Algorithms; Color; Restoration*



**20080023948** Minnesota Univ., Minneapolis, MN USA

**Distancecut: Interactive Real-Time Segmentation and Matting of Images and Videos (PREPRINT)**

Bai, Xue; Sapiro, Guillermo; Jan 2007; 6 pp.; In English

Report No.(s): AD-A478613; IMA-PREPRINT-SER-2153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An interactive algorithm for soft segmentation and matting of natural images and videos is presented in this paper. The technique follows and extends [11], where the user first roughly scribbles/labels different regions of interest, and from them the whole data is automatically segmented. The segmentation and alpha matte are obtained from the fast, linear complexity, computation of weighted distances to the user-provided scribbles. These weighted distances assign probabilities to each labelled class for every pixel. The weights are derived from models of the image regions obtained from the user provided scribbles via kernel density estimation. The matting results follow from combining this density and the computed weighted distances. We present the underlying framework and examples showing the capability of the algorithm to segment and compute alpha mattes in interactive real time, for difficult natural data.

DTIC

*Image Processing; Real Time Operation; Segments*

**20080023959** Minnesota Univ., Minneapolis, MN USA

**Interactive Image Segmentation via Adaptive Weighted Distances (PREPRINT)**

Protiere, Alexis; Sapiro, Guillermo; Aug 2006; 10 pp.; In English

Report No.(s): AD-A478644; IMA-PREPRINT-SER-2132; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An interactive algorithm for soft segmentation of natural images is presented in this paper. The user first roughly scribbles different regions of interest, and from them the whole image is automatically segmented. This soft segmentation is obtained via fast, linear complexity, computation of weighted distances to the user-provided scribbles. The adaptive weights are obtained from a series of Gabor filters, and are automatically computed according to the ability of each single filter to discriminate between the selected regions of interest. We present the underlying framework and examples showing the capability of the algorithm to segment diverse images.

DTIC

*Distance; Image Processing; Imaging Techniques*

**20080023960** Minnesota Univ., Minneapolis, MN USA

**Spatially-Coherent Non-Linear Dimensionality Reduction and Segmentation of Hyper-Spectral Images (PREPRINT)**

Mohan, Anish; Sapiro, Guillermo; Bosch, Edward; Jun 2006; 7 pp.; In English

Report No.(s): AD-A478645; IMA-PREPRINT-SER-2123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Non-linear dimensionality reduction and vector segmentation of hyper-spectral images is investigated in this letter. The proposed framework takes into account the nonlinear nature of high dimensional hyper-spectral images, and projects onto a lower dimensional space via a spatially-coherent locally linear embedding technique. The spatial coherence is introduced by comparing individual pixels based on their local surrounding neighborhood structure. This neighborhood concept is also extended to the segmentation and classification stages using a modified vector angle distance. We present the underlying concepts of the proposed framework and experimental results showing the significant classification improvements.

DTIC

*Image Processing; Imagery; Nonlinearity; Segments; Spectra*

**20080023967** Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA

**Special Weapons Observation Remote recon Direct Action System (SWORDS)**

Jones, Kim; Nov 1, 2007; 9 pp.; In English

Report No.(s): AD-A478652; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Remote Control; Robots*

**20080024050** Army Night Vision Lab., Fort Belvoir, VA USA

**Reverberation Time, Feasibility for Weapons Fire Range Estimation**

Libbey, Brad; Oct 2006; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478767; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Feasibility; Fires; Reverberation; Sound Waves; Wave Reflection*

**20080024267** Minnesota Univ., Minneapolis, MN USA

**A Variational Framework for Simultaneous Motion Estimation and Restoration of Motion-Blurred Video (PRE-PRINT)**

Bar, Leah; Berkels, Benjamin; Rumpf, Martin; Sapiro, Guillermo; Aug 2007; 10 pp.; In English

Report No.(s): AD-A478584; IMA-PREPRINT-SER-2170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The problem of motion estimation and restoration of objects in a blurred video sequence is addressed in this paper. Fast movement of the objects, together with the aperture time of the camera, result in a motion-blurred image. The direct velocity estimation from this blurred video is inaccurate. On the other hand, an accurate estimation of the velocity of the moving objects is critical for restoration of motion-blurred video. Therefore, restoration needs accurate motion estimation and vice versa, and a joint process is called for. To address this problem we derive a novel model of the blurring process and propose a Mumford-Shah type of variational framework, acting on consecutive frames, for joint object deblurring and velocity estimation. The proposed procedure distinguishes between the moving object and the background and is accurate also close to the boundary of the moving object. Experimental results both on simulated and real data show the importance of this joint estimation and its superior performance when compared to the independent estimation of motion and restoration.

DTIC

*Restoration; Image Reconstruction; Blurring; Video Communication*

**20080024269** Minnesota Univ., Minneapolis, MN USA

**What Can Casual Walkers Tell Us About a 3D Scene? (PREPRINT)**

Rother, Diego; Patwardhan, Kedar A; Sapiro, Guillermo; Aug 2007; 10 pp.; In English

Report No.(s): AD-A478600; IMA-PREPRINT-SER-2173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An approach for incremental learning of a 3D scene from a single static video camera is presented in this paper. In particular, we exploit the presence of casual people walking in the scene to infer relative depth, learn shadows, and segment the critical ground structure. Considering that this type of video data is so ubiquitous, this work provides an important step towards 3D scene analysis from single cameras in readily available ordinary videos and movies. On-line 3D scene learning, as presented here, is very important for applications such as scene analysis, foreground refinement, tracking, biometrics, automated camera collaboration, activity analysis, identification, and real-time computer-graphics applications. The main contributions of this work are then two-fold. First, we use the people in the scene to continuously learn and update the 3D scene parameters using an incremental robust ( $L_{sub 1}$ ) error minimization. Secondly, models of shadows in the scene are learned using a statistical framework. A symbiotic relationship between the shadow model and the estimated scene geometry is exploited towards incremental mutual improvement. We illustrate the effectiveness of the proposed framework with applications in foreground refinement, automatic segmentation as well as relative depth mapping of the floor/ground, and estimation of 3D trajectories of people in the scene.

DTIC

*Image Processing; Walking; Three Dimensional Models; Video Communication*

**20080024270** Minnesota Univ., Minneapolis, MN USA

**Learning Multiscale Sparse Representations for Image and Video Restoration (PREPRINT)**

Mairal, Julien; Sapiro, Guillermo; Elad, Michael; Jul 2007; 28 pp.; In English

Report No.(s): AD-A478603; IMA-PREPRINT-SER-2168; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A framework for learning multiscale sparse representations of color images and video with over complete dictionaries is presented in this paper. Following the single-scale grayscale K-SVD algorithm introduced in [1], which formulates the sparse dictionary learning and image representation as an optimization problem efficiently solved via orthogonal matching pursuit

and SVD, this proposed multiscale learned representation is obtained based on an efficient quadtree decomposition of the learned dictionary and overlapping image patches. The proposed framework provides an alternative to pre-defined dictionaries such as wavelets, and leads to state-of-the-art results in a number of image and video enhancement and restoration applications. The presentation of the framework here proposed is accompanied by numerous examples demonstrating its practical power.

DTIC

*Restoration; Image Enhancement; Video Communication; Image Reconstruction*

**20080024271** Minnesota Univ., Minneapolis, MN USA

**A Graph-based Foreground Representation and Its Application in Example Based People Matching in Video (PREPRINT)**

Patwardhan, Kedar A; Sapiro, Guillermo; Morellas, Vassilios; Jan 2007; 6 pp.; In English

Report No.(s): AD-A478607; IMA-PREPRINT-SER-2154; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this work, we propose a framework for foreground representation in video and illustrate it with a multi-camera people matching application. We first decompose the video into foreground and background. A low-level coarse segmentation of the foreground is then used to generate a simple graph representation. A vertex in the graph represents the ‘appearance’ of a corresponding segment in the foreground, while the relationship between two segments is encoded by an edge between the corresponding vertices. This provides a simple yet powerful and general representation of the foreground, which can be very useful in problems such as people detection and tracking. We illustrate the effectiveness of this model using an ‘example based query’ type of application for people matching in videos. Matching results are provided in multiple-camera situations and also under occlusion.

DTIC

*Image Processing; Graphs (Charts); Video Communication*

**20080025069** Naval Research Lab., Washington, DC USA

**A Generalized Graph-Based Method for Engineering Swarm Solutions to Multiagent Problems (Preprint)**

Wiegand, R P; Potter, Mitchell A; Sofge, Donald A; Spears, William M; Sep 2006; 11 pp.; In English

Report No.(s): AD-A478680; XB-NRL/MR/5510; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present two key components of a principled method for constructing modular, heterogeneous swarms. First, we generalize a well-known technique for representing swarm behaviors to extend the power of multiagent systems by specializing agents and their interactions. Second, a novel graph-based method is introduced for designing swarm-based behaviors for multiagent teams. This method includes engineer-provided knowledge through explicit design decisions pertaining to specialization, heterogeneity, and modularity. We show the representational power of our generalized representation can be used to evolve a solution to a challenging multiagent resource protection problem. We also construct a modular design by hand, resulting in a scalable and intuitive heterogeneous solution for the resource protection problem.

DTIC

*Mathematical Models; Robotics*

**20080025070** Naval Research Lab., Washington, DC USA

**Using Artificial Physics to Control Agents**

Spears, William M; Gordon, Diana F; Nov 1999; 9 pp.; In English

Report No.(s): AD-A478708; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We introduce a novel framework called ‘artificial physics’, which provides distributed control of large collections of agents. The agents react to artificial forces that are motivated by natural physical laws. This framework provides an effective mechanism for achieving self-assembly, fault-tolerance, and self-repair. Examples are shown for various regular geometric configurations of agents. A further example demonstrates that self-assembly via distributed control can also perform distributed computation.

DTIC

*Artificial Intelligence; Active Control; Distributed Parameter Systems; Fault Tolerance*

**20080025077** Warpiv Technologies, Inc., San Diego, CA USA

**Real Time Estimation and Prediction using Optimistic Simulation and Control Theory Techniques**

Steinmen, Jeffrey; Lammers, Craig; Jan 2008; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0218; Proj-459S

Report No.(s): AD-A478334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478334>

This paper describes a revolutionary approach to information processing that will increase warfighter productivity by orders of magnitude for problems requiring analysis, planning, optimization, and dynamic situation assessment and prediction in live operational environments. This technology, known as HyperWarpSpeed, breaks the four-dimensional barrier of space and time by extending modeling, simulation, and analysis capabilities into the fifth dimension.

DTIC

*Control Theory; Data Processing; Real Time Operation; Simulation*

**20080025129** Clemson Univ., SC USA

**An Exponential Class of Model-Free Visual Servoing Controllers in the Presence of Uncertain Camera Calibration**

Fang, Y; Dixon, W E; Dawson, D M; Chen, J; Dec 2003; 7 pp.; In English

Contract(s)/Grant(s): Proj-DOE-EMSP-82794; Proj-DOE-EMSP-82797

Report No.(s): AD-A478508; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478508>

In recent papers, a new class of model-free (i.e., the 3-dimensional task-space model of the object is unknown) visual servoing methods was proposed that are based on the estimation of the relative camera orientation between two views of an object. By utilizing homography-based techniques, the control problem is decoupled by separating the rotation and translation components. A single controller is used to control the rotation component, and the class members consist of various translation controllers. Each of the current class members has been proven to yield asymptotic regulation in the presence of uncertainty in the intrinsic and extrinsic calibration parameters. New control development and stability analysis techniques are crafted in this paper to develop a new translation controller that yields exponential rotation and translation regulation in the presence of uncertainty in the intrinsic and extrinsic calibration parameters. Extensions to this research can be used to yield exponential regulation by the other translation controllers.

DTIC

*Calibrating; Cameras; Computer Vision; Controllers; Rangefinding; Servomechanisms*

**20080025130** Clemson Univ., SC USA

**Adaptive Visual Servoing in the Presence of Intrinsic Calibration Uncertainty**

Chen, J; Behal, A; Dawson, D M; Dixon, W E; Dec 2003; 7 pp.; In English

Report No.(s): AD-A478509; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478509>

In this paper, we design an adaptive kinematic controller that asymptotically regulates a robot end-effector to a desired position and orientation under visual feedback (of points located on a fixed reference frame) from a camera mounted on the end-effector. This task is accomplished despite lack of depth measurements as well as uncertainty in the camera intrinsic parameter matrix.

DTIC

*Calibrating; Computer Vision*

**20080025294** Idaho Univ., Moscow, ID USA

**Developing Fleets of Autonomous Underwater Vehicles**

Edwards, Dean B; Mar 31, 2008; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0674

Report No.(s): AD-A478903; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478903>

Autonomous underwater vehicles (AUVs) have a demonstrated capability to collect valuable data for scientific and military purposes. Historically, individual vehicles have been used. To reduce the overall time and cost of acquiring data over large areas, multiple vehicles must be used. A fleet of 5 AUVs, capable of underwater commutation, were fabricated. Languages and logics were developed to enable collaborative operations among the vehicles. Experiments with a formation

of 5 AUVs operating underwater simultaneously are described. The AUVs operated autonomously, in that they enabled their operations on their own, initiated and constrained by underwater acoustic communication and navigation against a general behavioral background provided by programmed logics. The operations were not choreographed in advance and programmed into the machines, nor were they the result of intervention by an operator on the surface. The vehicles performed deployment, formation-flying, vehicle replacement, divert-to-point of interest, and leader replacement behaviors. The experiments show that autonomous collaborative behavior by 5 AUVs is possible under the constraints of underwater acoustic navigation and acoustic communication.

DTIC

*Autonomy; Command and Control; Countermeasures; Fuzzy Systems; Machine Learning; Underwater Vehicles*

**20080025301** Idaho National Engineering and Environmental Lab., Idaho Falls, ID USA

**Collaborative Tools for Mixed Teams of Humans and Robots**

Bruemmer, David J; Walton, Miles C; Mar 2003; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478926; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478926>

This paper discusses efforts at the Idaho National Engineering and Environmental Laboratory 'INEEL' to develop a control architecture for mixed teams of ground and air vehicles. Our approach has been to consider the air vehicles, ground robots and humans as team members with different levels of authority, different communication, processing, power and mobility capabilities and also different perceptual capabilities. The paper examines the current control-architecture and interface with special attention to the role of a collaborative workspace in enabling mixed-initiative interaction between humans and heterogeneous teams of robotic vehicles.

DTIC

*Aircraft; Robots*

**20080025310** California Univ., Los Angeles, CA USA

**Detecting Humans via Their Pose**

Bissacco, Alessandro; Yang, Ming-Hsuan; Soatto, Stefano; Jan 2007; 9 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0095; N00014-03-1-0850

Report No.(s): AD-A478945; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478945>

We consider the problem of detecting humans and classifying their pose from a single image. Specifically, our goal is to devise a statistical model that simultaneously answers two questions: 1' is there a human in the image? and, if so, 2' what is a low-dimensional representation of her pose? We investigate models that can be learned in an unsupervised manner on unlabeled images of human poses, and provide information that can be used to match the pose of a new image to the ones present in the training set. Starting from a set of descriptors recently proposed for human detection, we apply the Latent Dirichlet Allocation framework to model the statistics of these features, and use the resulting model to answer the above questions. We show how our model can efficiently describe the space of images of humans with their pose, by providing an effective representation of poses for tasks such as classification and matching, while performing remarkably well in human/non human decision problems, thus enabling its use for human detection. We validate the model with extensive quantitative experiments and comparisons with other approaches on human detection and pose matching.

DTIC

*Detection; Image Processing; Machine Learning; Mathematical Models*

**20080025322** Naval Research Lab., Washington, DC USA

**Long-Term Symbolic Learning in Soar and ACT-R**

Kennedy, William G; Trafton, J G; Sep 2007; 7 pp.; In English

Report No.(s): AD-A478972; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478972>

The characteristics of long-term, symbolic learning were investigated using Soar and ACT-R models of a task to rearrange blocks into specific configurations. Long sequences of problems were run collecting data to answer fundamental questions about long-term, symbolic learning. The questions were whether symbolic learning continues indefinitely, how learned knowledge is used, and whether performance degrades over the long term. It was found that in both systems symbolic learning

eventually stopped, ACT-R produced three observable phases of learning, and both Soar and ACT-R suffer from the utility problem of degraded performance with continuous on-line learning.

DTIC

*Artificial Intelligence; Learning; On-Line Systems*

**20080025346** Army War Coll., Carlisle Barracks, PA USA

**21st Century Considerations for the Human Intelligence Strategist**

Stagg, L M; Feb 17, 2008; 29 pp.; In English

Report No.(s): AD-A479084; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479084>

The goal of this paper is to generate dialogue within the intelligence planning community regarding strategic Human Intelligence (HUMINT) design. HUMINT operations have the potential to be an operational, if not strategic center of gravity to defeat the USA most challenging opponent, the insurgency. There is no doubt that America provides numerous examples of superior field craft application and tactical success. Nearly every day successful HUMINT operations occur, but there is likely a reason the nation has not successfully capitalized on these opportunities to strategically defeat the enemy networks. One contributing factor may be weaknesses in HUMINT doctrine which in turn contributes to uncoordinated efforts. Another root may be a focus too far below the operational and strategic level of war. This document examines some historical theories that suggest new considerations for the 21st century human intelligence strategists to address these deficiencies. Additionally, it recommends a preemptive policy that allows the engagement of insurgencies prior to their maturation while simultaneously maintaining the high intensity upper hand.

DTIC

*Intelligence; Warfare*

**20080025369** Fleet Numerical Oceanography Center, Monterey, CA USA

**Inferring Bottom Acoustic Properties from AN/SQQ-32 Sonar Reverberation Data in Order to Reduce False Targets in Bottom/Buried Mine Detection**

Howell, Henry H; Bourke, Robert H; Wilson, James H; Null and, J M; Fabre, Josette; Apr 2002; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479177; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479177>

Bottom/sub bottom geoacoustic properties must be determined to high spatial resolution in order to reduce false targets for bottom/buried mine detection. Inversion techniques (ITs) are used to infer bottom geoacoustic properties using AN/SQQ-32 beam reverberation level (RL) time series data acquired in Rhode Island Sound in February 1993. A technique was developed wherein the deviation of the RL for an individual ping and beam from an area-wide average RL is used to generate geo-referenced maps illustrating the relative reflectivity of the seabed. These geo-plots not only agree with existing descriptions of the sediment distribution, but also provide a highly detailed spatial representation of the bottom geoacoustic distribution. The plots highlight the gross inadequacies, particularly in spatial resolution, of existing information on bottom geoacoustic properties and the difficulties of using such algorithms as Lambert's Law to characterize the RL. These plots, when produced using appropriately small sample intervals, have sufficient spatial resolution to reveal MCM clutter density information. Geo-referenced maps of relative reflectivity can be an invaluable aid to in developing 'realistic' mine hunting time lines especially in a route-survey mode or as a surveying tool to compare clutter densities. These clutter densities are used as a basis for change detection algorithms applied to bottom/buried mine detection. Additionally, they can also be used to identify appropriate geoacoustic parameter inputs for accurate sonar model performance predictions and to provide real time performance monitoring and assessment, (i.e. a capability to revise and modify the search strategy).

DTIC

*Acoustic Properties; Mine Detectors; Neural Nets; Ocean Bottom; Reverberation; Sonar; Targets*

**20080025454** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Robotic Vehicle Construction**

Mazhar, Mohammad S, Inventor; Mar 9, 2004; 7 pp.; In English

Report No.(s): AD-D020346; PATENT-6 702 050 B1; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020346>

A robotic vehicle is provided with an elliptical shaped housing, the housing having a circumferential track disposed about

its midsection. The circumferential track is driven by a prime mover to rotate the housing and move it over a variety of different terrains. The vehicle is adapted to carry weapons systems for military application.

DTIC

*Construction; Patents; Robotics*

**20080025526** Idaho National Engineering Lab., Idaho Falls, ID USA

**Modeling and Simulation for Exploring Human-Robot Team Interaction Requirements**

Dundenhoeffer, Donald D; Bruemmer, David J; Davis, Midge L; Dec 2001; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC07-99ID13727

Report No.(s): AD-A479401; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Small-sized and micro-robots will soon be available for deployment in large-scale forces. Consequently, the ability of a human operator to coordinate and interact with large-scale robotic forces is of great interest. This paper describes the ways in which modeling and simulation have been used to explore new possibilities for human-robot interaction. The paper also discusses how these explorations have fed implementation of a unified set of command and control concepts for robotic force deployment. Modeling and simulation can play a major role in fielding robot teams in actual missions. While live testing is preferred, limitations in terms of technology, cost, and time often prohibit extensive experimentation with physical multi-robot systems. Simulation provides insight, focuses efforts, eliminates large areas of the possible solution space, and increases the quality of actual testing.

DTIC

*Command and Control; Robotics; Robots; Simulation*

**20080025547** Idaho National Engineering and Environmental Lab., Idaho Falls, ID USA

**A Robotic Swarm for Spill Finding and Perimeter Formation**

Bruemmer, David J; Dudenhoeffer, Donald D; McKay, Mark D; Anderson, Matthew O; Aug 2002; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC07-99ID13727

Report No.(s): AD-A479478; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper addresses issues surrounding deployment and tasking of a real-world collective of cost-effective, small mobile robots. To escape the limitations of centralized control, this project distributes control using an innovative, multi-modal communication architecture including acoustical chirping, infrared, and radio frequency transmissions. This paper reports on the use of social potential fields - attractive and repulsive fields emitted by each robot -- as a means to coordinate group behavior and promote the emergence of swarm intelligence as seen in a colony of ants or swarm of bees. A suite of C2 tools, AgentTools, has been developed to enable an operator to inject high-level domain knowledge and guidance into the behavior of the otherwise autonomous robots. The resulting system permits the user to interact with functional groups, rather than issuing commands to each individual robot. Using the realworld robot collective and C2 system, the Idaho National Engineering and Environmental Laboratory has performed experiments to empirically analyze the benefits and limitations associated with the use of many small-scale robots. Experimental results point to fundamental advantages of distributed systems and indicate that our real-world implementation of social potential fields scales well to varying numbers of robots and improves performance in terms of time and reliability.

DTIC

*Group Dynamics; Robotics; Robots; Spilling*

**20080025554** Idaho National Engineering and Environmental Lab., Idaho Falls, ID USA

**Development and Implementation of Large-Scale Micro-Robotic Forces Using Formation Behaviors**

Dudenhoeffer, D D; Bruemmer, D J; Anderson, M O; McKay, M D; Apr 2000; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC07-99ID13727

Report No.(s): AD-A479548; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Micro-robots may soon be available for deployment by the thousands. Consequently, controlling and coordinating a force this large to accomplish a prescribed task is of great interest. This paper describes a flexible architecture for deploying thousands of autonomous robots simultaneously. The robots' behavior is based on a subsumption architecture in which individual behaviors are prioritized with respect to all others. The primary behavior explored in this paper is group formation

behavior drawn from the work in social potential fields applications conducted by Reif and Wang, and Dudenhoefter and Jones. While many papers have examined the application of social potential fields in a simulation environment, this paper describes the implementation of this behavior in a collective of small robots.

DTIC

*Potential Fields; Robotics; Robots*

**20080025879** Army Research Development and Engineering Command, Warren, MI USA

**Rough Set Based Splitting Criterion for Binary Decision Tree Classifiers**

Mikulski, Dariusz G; Sep 26, 2006; 182 pp.; In English

Report No.(s): AD-A479106; 16334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479106>

Pattern recognition applications often use inductive reasoning to find hidden relationships and concepts within a data set. Many computational models and heuristics exist to assist in induction [12, 14, 18, 22, 26, 37]. Even so, researchers continue to actively develop new inductive methods [8, 10, 45, 46]. The research in this thesis advances induction for pattern classification by presenting the derivation and application of a new measure of inlon%ation based on rough set theory - the rough product. The rough product helps us to understand the manner in which an attribute value partition affects the upper approximation for each decision class. The thesis also presents an application of the rough product in a splitting criterion for binary decision tree classifiers. Using a MATLAB(trade name) software tool that we developed for this research, we compare the performance of the Gini Index, Twoing Rule, Maximum Deviance Reduction, and Rough Product splitting criteria on various data sets using k-folds cross validation. We determine performance by measuring the following metrics: accuracy, error rate, precision, recall, F-measure, node count, depth count, and complexity. Our results suggest that, in the presence of noisy data, the Rough Product splitting criterion could construct binary decision trees that are simpler and shorter than those produced by the Gini Index, Twoing Rule, or Maximum Deviance Reduction splitting criteria.

DTIC

*Classifiers; Criteria; Decision Theory; Pattern Recognition*

**20080025888** Harvard Univ., Cambridge, MA USA

**High-Level Vision: Top-Down Processing in Neurally Inspired Architectures**

Kosslyn, Stephen M; Draper, Bruce; Ganis, Giorgio; Knobel, Mark; Feb 2008; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-2-0270; DARPA ORDER-V026/00; Proj-BICA

Report No.(s): AD-A478977; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478977>

An exhaustive literature review of computationally relevant studies of high-level vision and mental imagery was conducted, and a qualitative theory of the processing subsystems in the brain and their interactions during visual object identification are summarized herein. A computational model that embodies these ideas was built with the intention that it could be 'damaged' in various ways in order to observe its behavior while performing visual tasks that are analogous to those performed by the brain-damaged patients; this model is described in detail in this report. A second model of early/intermediate vision, which is intended to supplement and complement the work on late visual processing, has also been developed, and is described. Progress testing the models is reported. Additional deliverables include a binder with the abstracts of all the relevant literature (which can serve as a guide for further research) and an annotated copy of the software code for the IMPER model.

DTIC

*Architecture (Computers); Brain Damage; Cognition; Computerized Simulation; Imagery; Vision*

**20080025909** Defense Advanced Research Projects Agency, Arlington, VA USA

**Expanding Frontiers of Humanoid Robotics**

Swinson, Mark L; Bruemmer, David J; Aug 2000; 10 pp.; In English

Report No.(s): AD-A479359; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Mobile robots pose a unique set of challenges to artificial intelligence researchers. Such challenges include issues of autonomy, uncertainty (both sensing and control), and reliability, which are all constrained by the discipline that the real world imposes. Planning, sensing, and acting must occur in concert and in context. That is, information processing must satisfy not only the constraints of logical correctness but also some assortment of crosscutting, physical constraints. Particularly interesting among these robots are humanoids, which assume an anthropomorphic (human-like) form. A growing number of



roboticists believe that the human form provides an excellent platform on which to enable interactive, real-world machine learning. Robots that can learn from natural, human model interactions with the environment might be able to accomplish tasks by means their designers did not explicitly implement and to adapt to the unanticipated circumstances in an unstructured environment. Ultimately, humanoids might prove to be the ideal robot design to interact with people. After all, humans tend to naturally interact with other humanlike entities. Eventually, humans and humanoids might be able to cooperate in ways now imaginable only in science fiction. Humanoids might also provide a revolutionary way of studying cognitive science. As we review successes and failures in the field, we provide a contextual backdrop for understanding where humanoid research began, the dilemmas with which it currently struggles, and where it might take us in the future. We also discuss how these technological developments have and will continue to affect the ways in which we understand ourselves.

DTIC

*Artificial Intelligence; Robotics; Robots*

**20080025943** Air Force Research Lab., Eglin AFB, FL USA

**Dimensionality Reduction and Information-Theoretic Divergence Between Sets of Ladar Images**

Gray, David M; Principe, Jose C; Mar 2008; 13 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A478884; AFRL-RW-EG-TP-2008-7403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478884>

This paper presents a preliminary study of information-theoretic divergence between sets of LADAR image data. This study has been motivated by the hypothesis that despite the huge dimensionality of raw image space, related images actually lie on embedded manifolds within this set of all possible images and can be represented in much lower-dimensional sub-spaces. If these low-dimensional representations can be found, information theoretic properties of the images can be exploited while circumventing many of the problems associated with the so-called 'curse of dimensionality.' In this study, PCA techniques are used to find a low-dimensional sub-space representation of LADAR image sets. A real LADAR image data set was collected using the AFSTAR sensor and a synthetic image data set was created using the Irma LADAR image modeling program. One unique aspect of this study is the use of an entirely synthetic data set to find a sub-space representation that is reasonably valid for both the synthetic data set and the real data set. After the sub-space representation is found, an information-theoretic density divergence measure (Cauchy-Schwarz divergence) is computed using Parzen window estimation methods to find the divergence between and among the sets of synthetic and real target classes. These divergence measures can then be used to make target classification decisions for sets of images. In practice, this technique could be used to make classification decisions on multiple images collected from a moving sensor platform or from a geographically distributed set of cooperating sensor platforms operating in a target region.

DTIC

*Divergence; Images; Information Theory; Laser Range Finders; Lasers; Optical Radar; Radar*

**20080026077** NASA Johnson Space Center, Houston, TX, USA

**Improving Grasp Skills Using Schema Structured Learning**

Platt, Robert; Grupen, Roderic A.; Fagg, Andrew H.; May 31, 2006; 6 pp.; In English; 5th International Conference on Development and Learning, 31 May - 3 Jun. 2006, Bloomington, IN, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNJ05HB61A; NNJ04JF76H; DAAD19-03-R-0017; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026077>

Abstract In the control-based approach to robotics, complex behavior is created by sequencing and combining control primitives. While it is desirable for the robot to autonomously learn the correct control sequence, searching through the large number of potential solutions can be time consuming. This paper constrains this search to variations of a generalized solution encoded in a framework known as an action schema. A new algorithm, SCHEMA STRUCTURED LEARNING, is proposed that repeatedly executes variations of the generalized solution in search of instantiations that satisfy action schema objectives. This approach is tested in a grasping task where Dexter, the UMass humanoid robot, learns which reaching and grasping controllers maximize the probability of grasp success.

Author

*Controllers; Robotics; Sequential Control; Machine Learning; Robots; Sequencing*

**20080026205** NASA Johnson Space Center, Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA

**Intelligence for Human-Assistant Planetary Surface Robots**

Hirsh, Robert; Graham, Jeffrey; Tyree, Kimberly; Sierhuis, Maarten; Clancey, William J.; [2006]; 20 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026205>

The central premise in developing effective human-assistant planetary surface robots is that robotic intelligence is needed. The exact type, method, forms and/or quantity of intelligence is an open issue being explored on the ERA project, as well as others. In addition to field testing, theoretical research into this area can help provide answers on how to design future planetary robots. Many fundamental intelligence issues are discussed by Murphy [2], including (a) learning, (b) planning, (c) reasoning, (d) problem solving, (e) knowledge representation, and (f) computer vision (stereo tracking, gestures). The new 'social interaction/emotional' form of intelligence that some consider critical to Human Robot Interaction (HRI) can also be addressed by human assistant planetary surface robots, as human operators feel more comfortable working with a robot when the robot is verbally (or even physically) interacting with them. Arkin [3] and Murphy are both proponents of the hybrid deliberative-reasoning/reactive-execution architecture as the best general architecture for fully realizing robot potential, and the robots discussed herein implement a design continuously progressing toward this hybrid philosophy. The remainder of this chapter will describe the challenges associated with robotic assistance to astronauts, our general research approach, the intelligence incorporated into our robots, and the results and lessons learned from over six years of testing human-assistant mobile robots in field settings relevant to planetary exploration. The chapter concludes with some key considerations for future work in this area.

Derived from text

*Robotics; Planetary Surfaces; Robots; Space Exploration; Computer Vision; Lessons Learned; Problem Solving*

**64**

**NUMERICAL ANALYSIS**

Includes iteration, differential and difference equations, and numerical approximation.

**20080023807** Columbia Univ., New York, NY USA

**On Two-Stage Convex Chance Constrained Problems**

Erdogan, E; Iyengar, G; Nov 3, 2005; 26 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0514; NSF-CCR-00-09972

Report No.(s): AD-A478336; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478336>

In this paper we develop approximation algorithms for two-stage convex chance constrained problems. Nemirovski and Shapiro [18] formulated this class of problems and proposed an ellipsoid-like iterative algorithm for the special case where the impact function  $f(x, h)$  is bi-affine. We show that this algorithm extends to bi-convex  $f(x, h)$  in a fairly straightforward fashion. The complexity of the solution algorithm as well as the quality of its output are functions of the radius  $r$  of the largest Euclidean ball that can be inscribed in the polytope defined by a random set of linear inequalities generated by the algorithm [18]. Since the polytope determining  $r$  is random, computing  $r$  is difficult. Yet, the solution algorithm requires  $r$  as an input. In this paper we provide some guidance for selecting  $r$ . We show that the largest value of  $r$  is determined by the degree of robust feasibility of the two-stage chance constrained problem - the more robust the problem, the higher one can set the parameter  $r$ . Next, we formulate ambiguous two-stage chance constrained problems. In this formulation the random variables defining the chance constraint are known to have a fixed distribution; however, the decision maker is only able to estimate this distribution to within some error. We construct an algorithm that solves the ambiguous two-stage chance constrained problem when the impact function  $f(x, h)$  is bi-affine and the extreme points of a certain 'dual' polytope are known explicitly. DTIC

*Algorithms; Convexity*

**20080023814** Army Research Lab., Aberdeen Proving Ground, MD USA

**Small Parameter Analysis of the Modified Tate Equations**

Huguet, Jesse A; Reichwein, Sarah; Jones, Stanley E; Walter, William P; Feb 2008; 14 pp.; In English

Contract(s)/Grant(s): Proj-AH80

Report No.(s): AD-A478356; ARL-RP-199; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478356>

The Tate Theory of penetration of armor targets by long rod penetrators [1,2] has been the benchmark one-dimensional

model of this event for decades. The model is applied to metal-on-metal normal impact of cylindrical rod penetrators. The key physical parameters in the model are the penetrator and target strengths and densities (assumed constant), as well as the penetrator length. With these parameters and the impact speed, penetration depth for all combinations of the parameters can be evaluated. In a recent paper, Walters et al [3] showed that all of the important effects of the classic Tate Theory could be captured by a regular perturbation solution of the fundamental equations. The small parameter that they used was  $\epsilon = Y_p / \rho_p v_0^2$ , where  $Y_p$  is the penetrator yield strength,  $\rho_p$  is the penetrator density and  $v_0$  is the impact speed. In 1987, Jones et al [4] modified the equation of motion of the undeformed section to include mass loss and mushrooming at the interface with the target. The changes to the theory that result from these modifications bring the strengths of the target and penetrator into line with laboratory levels while achieving reasonable penetration depths. In this paper, we will show that the regular perturbation analysis used by Walters et al [3] can be extended to the modified system of equations from Jones et al [4] using the same small parameter mentioned in the previous paragraph. The perturbation process is carried out to terms of first order and an approximate analytical solution is found. This solution is then used to repeat the reduction of data given by Wilson et al [5] for Aluminum and Steel alloy penetrators normally impacting Aluminum and Steel targets. Another case involving heavy metal penetrators impacting Rolled Hard Armor (RHA) targets is also presented.

DTIC  
*Armor; Penetration; Perturbation Theory; Rods; Targets*

**20080023835** Columbia Univ., New York, NY USA

**Total Variation Based Image Cartoon-Texture Decomposition**

Yin, Wotao; Goldfarb, Donald; Osher, Stanley; Jan 2005; 26 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0514; N00014-03-0071

Report No.(s): AD-A478457; CU-CORC-TR-2005-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478457>

This paper studies algorithms for decomposing a real image into the sum of cartoon and texture based on total variation minimization and second-order cone programming (SOCP). The cartoon is represented as a function of bounded variation while texture (and noise) is represented by elements in the space of oscillating functions, as proposed by Yves Meyer. Our approach gives more accurate results than those obtained previously by Vese-Osher's approximation to Meyer's model, which we also formulate and solve as an SOCP. The model of minimizing total variation with an L1-norm fidelity term is also considered and empirically shown to achieve even better results when there is no noise. This model is analyzed and shown to be able to select features of an image according to their scales.

DTIC

*Decomposition; Image Dissector Tubes; Mathematical Programming; Textures*

**20080023928** Minnesota Univ., Minneapolis, MN USA

**On the Non-Uniform Complexity of Brain Connectivity (PREPRINT)**

Haro, Gloria; Lenglet, Christophe; Sapiro, Guillermo; Thompson, Paul; Dec 2007; 6 pp.; In English

Report No.(s): AD-A478579; IMA-PREPRINT-SER-2183; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A stratification and manifold learning approach for analyzing High Angular Resolution Diffusion Imaging 'HARDI' data is introduced in this paper. HARDI data provides high-dimensional signals measuring the complex microstructure of biological tissues, such as the cerebral white matter. We show that these high-dimensional spaces may be understood as unions of manifolds of varying dimensions/complexity and densities. With such analysis, we use clustering to characterize the structural complexity of the white matter. We briefly present the underlying framework and numerical experiments illustrating this original and promising approach.

DTIC

*Angular Resolution; Brain; Diffusion; High Resolution; Imaging Techniques; Microstructure; Nonuniformity; Signal Processing*

**20080023934** Minnesota Univ., Minneapolis, MN USA

**Extremal Positive Pluriharmonic Functions on Euclidean Balls (PREPRINT)**

Jafari, Farhad; Putinar, Mihai; Nov 2007; 13 pp.; In English

Report No.(s): AD-A478589; IMA-PREPRINT-SER-2180; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Contrary to the well understood structure of positive harmonic functions in the unit disk, most of the properties of positive

pluriharmonic functions in symmetric domains of  $C_n$ , in particular the unit ball, remain mysterious. In particular, in spite of efforts spread over quite a few decades, no characterization of the extremal rays in the cone of positive pluriharmonic functions in the unit ball of  $C_n$  is known. We investigate this question by a geometric tomography technique, and provide some new classes of examples of such extremal functions.

DTIC

*Euclidean Geometry*

**20080023940** California Inst. of Tech., Pasadena, CA USA

**Computational Electromagnetics**

Bruno, Oscar P; Feb 25, 2008; 10 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0006

Report No.(s): AD-A478599; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Objectives are as follows: 1) High-frequency integral equations: Multiple-scattering/ shadowing interactions; 2) Periodic and random surfaces and structures; 3) Canonical Integration: Edge scattering; 4) Canonical Integration: High Frequency; 5) Geometry representation and solution of challenging real-world problems.

DTIC

*Computational Electromagnetics; Electromagnetic Radiation; High Frequencies; Integral Equations; Shadows*

**20080023942** Minnesota Univ., Minneapolis, MN USA

**Multiscale Representation and Segmentation of Hyperspectral Imagery Using Geometric Partial Differential Equations and Algebraic Multigrid Methods (PREPRINT)**

Duarte-Carvajalino, Julio M; Sapiro, Guillermo; Velez-Reyes, Minguel; Castillo, Paul E; Jun 2007; 15 pp.; In English

Contract(s)/Grant(s): EEC-9986821

Report No.(s): AD-A478605; IMA-PREPRINT-SER-2167; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A fast algorithm for multiscale representation and segmentation of hyperspectral imagery is introduced in this paper. The multiscale/scale-space representation is obtained by solving a nonlinear diffusion Partial Differential Equation (PDE) for vector-valued images. We use Algebraic Multigrid (AMG) techniques to obtain a fast and scalable solution of the PDE and to segment the hyperspectral image following the intrinsic multigrid structure. We test our algorithm on four standard hyperspectral images that represent different environments commonly found in remote sensing applications: agricultural, urban, mining, and marine. The experimental results show that the segmented images lead to better classification than using the original data directly, in spite of the use of simple similarity metrics and piecewise constant approximations obtained from the segmentation maps.

DTIC

*Algebra; Image Processing; Imagery; Multigrid Methods; Partial Differential Equations; Segments*

**20080023969** Yale Univ., New Haven, CT USA

**Fast Random Projections Using Lean Walsh Transforms**

Liberty, Edo; Ailon, Nir; Singer, Amit; Dec 2007; 10 pp.; In English

Report No.(s): AD-A478655; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a  $\kappa * d$  random projection matrix that is applicable to vectors  $\chi \in \mathbb{R}^{(exp d)}$  in  $O(d)$  operations if  $d > \kappa * (exp 2 + \delta)$ . Here,  $\kappa$  is the minimal Johnson Lindenstrauss dimension and  $\delta$  is arbitrarily small. The projection succeeds, with probability  $1 - 1/n$ , in preserving vector lengths, up to distortion  $\epsilon$ , for all vectors such that  $\|\chi\|_\infty < \|\chi\|_2 \kappa^{(exp -1/2)d} (exp -\delta)$  (for arbitrary small  $\delta$ ). Sampling based approaches are either not applicable in linear time or require a bound on  $\|\chi\|_\infty$  that is strongly dependant on  $d$ . Our method overcomes these shortcomings by rapidly applying dense tensor power matrices to incoming vectors.

DTIC

*Transformations (Mathematics); Vector Analysis*

**20080023988** Texas Univ., Austin, TX USA

**Duality and Unified Analysis of Discrete Approximations in Structural Dynamics and Wave Propagation: Comparison of rho-method Finite Elements with kappa-method NURBS (Preprint)**

Hughes, T J; Reali, A; Sangalli, G; Oct 10, 2007; 53 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-0263

Report No.(s): AD-A478678; UTA-ICES-TR-29; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We study the discretization behavior of classical finite element and NURBS approximations on problems of structural vibrations and wave propagation. We find that, on the basis of equal numbers of degrees-of-freedom and bandwidth, NURBS have superior approximation properties. In fact, we observe that the high mode behavior of classical finite elements is divergent with the order of approximation, a surprisingly negative result. On the other hand, NURBS offer almost spectral approximation properties, and all modes converge with increasing order of approximation.

DTIC

*Dynamic Response; Dynamic Structural Analysis; Finite Element Method; Nonuniformity; Splines; Vibration; Wave Propagation*

**20080024020** Naval Observatory, Washington, DC USA

**Initial Results From the USNO Dispersed Fourier Transform Spectrograph**

Hajian, Arsen R; Behr, Bradford B; Cenko, Andrew T; Olling, Robert P; Mozurkewich, David; Armstrong, J T; Pohl, Brian; Petrossian, Sevan; Knuth, Kevin H; Hindsley, Robert B; Jan 25, 2007; 19 pp.; In English

Report No.(s): AD-A478725; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have designed and constructed a dispersed Fourier transform spectrometer (dFTS), consisting of a conventional FTS followed by a grating spectrometer. By combining these two devices, we negate a substantial fraction of the sensitivity disadvantage of a conventional FTS for high-resolution, broadband, optical spectroscopy, while preserving many of the advantages inherent to interferometric spectrometers. In addition, we have implemented a simple and inexpensive laser metrology system, which enables very precise calibration of the interferometer wavelength scale. The fusion of interferometric and dispersive technologies with a laser metrology system yields an instrument well suited to stellar spectroscopy, velocimetry, and extrasolar planet detection, which is competitive with existing high-resolution, high-accuracy stellar spectrometers. In this paper we describe the design of our prototype dFTS, explain the algorithm we use to efficiently reconstruct a broadband spectrum from a sequence of narrowband interferograms, and present initial observations and resulting velocimetry of stellar targets.

DTIC

*Fourier Transformation; Spectrographs; Spectrometers*

**20080024021** Calabria Univ., Arcavacata di Rende, Italy

**Adaptive Control Allocation for Fault Tolerant Overactuated Autonomous Vehicles**

Casavola, Alessandro; Garone, Emanuele; Nov 1, 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478726; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Adaptive Control; Autonomy; Fault Tolerance*

**20080024031** Minnesota Univ., Minneapolis, MN USA

**Constrained Localization in Static and Dynamic Sensor Networks (PREPRINT)**

Mahmoudi, Mona; Sapiro, Guillermo; Jan 2006; 6 pp.; In English

Report No.(s): AD-A478739; IMA-PREPRINT-SER-2091; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this note we propose to introduce physical constraints in the localization problem in sensor networks. This is based on extending the classical STRESS function from distance geometry and multidimensional scaling. We present the underlying framework and demonstrate its importance with three examples: penalizing the sensors for being in high elevation areas, removing sensors from forbidden areas, and forcing the sensors to be on pre-described curves. We also extend the work to dynamic environments.

DTIC

*Detectors; Position (Location); Position Sensing*

**20080024033** Minnesota Univ., Minneapolis, MN USA

**Approximate Dirichlet Boundary Conditions in the Generalized Finite Element Method (PREPRINT)**

Babuska, Ivo; Nistor, Victor; Tarfulea, Nicolae; Feb 2006; 23 pp.; In English

Contract(s)/Grant(s): N00014-94-C-0401; DMS-0341982

Report No.(s): AD-A478741; IMA-PREPRINT-SER-2096; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We propose a method for treating the Dirichlet boundary conditions in the framework of the Generalized Finite Element Method (GFEM). We use approximate Dirichlet boundary conditions and polynomial approximations of the boundary.  
DTIC

*Approximation; Boundary Conditions; Boundary Value Problems; Dirichlet Problem; Finite Element Method*

**20080024034** Minnesota Univ., Minneapolis, MN USA

**On Geometric Variational Models for inpainting Surface Holes (PREPRINT)**

Caselles, Vicent; Haro, Gloria; Sapiro, Guillermo; Verdera, Joan; Jan 2006; 46 pp.; In English

Report No.(s): AD-A478742; IMA-PREPRINT-SER-2089; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Geometric approaches for filling-in surface holes are introduced and studied in this paper. The basic idea is to represent the surface of interest in implicit form, and fill-in the holes with a scalar, or systems of, geometric partial differential equations often derived from optimization principles. These equations include a system for the joint interpolation of scalar and vector fields, a Laplacian-based minimization, a mean curvature diffusion flow, and an absolutely minimizing Lipschitz extension. The theoretical and computational framework, as well as examples with synthetic and real data, are presented in this paper.  
DTIC

*Image Processing; Partial Differential Equations*

**20080024069** Ecole Centrale de Lyon, Ecully, France

**Outdoor Sound Propagation Modelling in Complex Environments: Recent Developments in the Parabolic Equation Method**

Blanc-Benon, Philippe; Oct 1, 2006; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478796; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Equations; Parabolas; Parabolic Differential Equations; Sound Propagation; Sound Transmission; Sound Waves*

**20080024072** Royal Military Academy, Brussels, Belgium

**Characterization of Background Traffic in Hybrid Network Simulation**

Lauwens, Ben; Scheers, Bart; Van de Capelle, Antoine; Oct 1, 2006; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478802; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Communication Networks; Computerized Simulation; Traffic*

**20080025084** Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA

**Finite Element Analysis of M15 and M19 Mines Under Wheeled Vehicle Load**

Pavlovic, Brian; Ng, William; Mar 2008; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478437; ARAET-TR-08006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478437>

Unfuzed M15 and M19 mines are present in different proving grounds and test ranges, both as intended and unintended targets for testing of various munitions and weapon systems. There is a concern that these unfuzed mines may be accidentally driven over by various Army vehicles (HMMWV, Bobcats, etc.). Composition B is typically the explosive found in these mines and also in many gun launched projectiles (i.e., 155-mm artillery, 30-mm grenades, and 105-mm projectiles). The gun launched projectiles subjects the Composition B explosives to significantly higher shock and stress levels than loading from a vehicle wheel. The purpose of this study is to use Finite Element codes to determine the stress levels in the mine due to simplified vehicle loading scenarios and compare them to the stress seen in gun launched projectiles. This data and analyses

together with assessments from other Subject Matter Experts should provide sufficient evidence that accidentally driving a vehicle over either unfuzed M15 or M19 mines would not be a safety hazard.

DTIC

*Finite Element Method; Loads (Forces); Safety*

**20080025315** Monopole Research, Thousand Oaks, CA USA

**Material Identification Algorithm**

Bleszynski, Elizabeth; Bleszynski, Marek; Jaroszewicz, Thomas; Sep 2007; 14 pp.; In English

Contract(s)/Grant(s): FA9550-05-C-0037

Report No.(s): AD-A478950; MON-2007-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478950>

We developed numerical techniques for simulating radar returns from large realistic scenes composed of uneven ground, trees, and reflecting objects. The simulation includes effects of ionospheric dispersion on the radar pulses. We developed an integral-equation code and performed numerical simulation of radiation for small-loop large-current antennas, with loops radiating in open space or partly shielded by enclosures of various material properties. The code implements regularization methods for handling of subwavelength electromagnetic radiation problems in the presence of materials. We developed a fast integral-equation based solver for simulating propagation of thermo-acoustic waves induced by short microwave pulses in biological media, in particular in the human head. The code implements a matrix compression based on fast Fourier transforms (FFTs), as well as a rescaling technique which allows us to treat problems with large contrasts of material parameters. We analyzed propagation of infra-red (IR) radiation through dilute and dense media composed of discrete scatterers. In application to propagation of short IR pulses through atmospheric clouds we established conditions under which the waves may experience reduced attenuation. To allow simulation of propagation in dense media, we developed a fast integral-equation solver for a two-dimensionally periodic system modeling a laterally infinite slab of the medium.

DTIC

*Algorithms; Numerical Analysis; Simulation*

**20080025338** Towson Univ., Towson, MD USA

**Extension of P-adic Exact Scientific Computational Library (ESCL) to Compute the Exponential of Rational Matrix**

Lu, Chao; Feb 7, 2008; 27 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0099

Report No.(s): AD-A479031; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479031>

For the past three years, we have been developing an Exact Scientific Computational Library (ESCL) using p-adic arithmetic. New algorithms have been designed and implemented for matrix operations with rational numbers by representing numerator and denominator with arbitrary length integers, all integers and fractional numbers are represented by p-adic sequences, and all arithmetic calculations are carried out in p-adic domain. In this project, we have worked on: (1) investigating the relation of the length M of p-adic expansion for a rational matrix and the periodicity of a resulted p-adic sequence from arithmetic operation in p-adic field; and extension of the ESCL to compute: (2) the complex rational matrix; (3) the exponential of a rational matrix.

DTIC

*Arithmetic; Exponential Functions; Libraries; Matrices (Mathematics)*

**20080025366** Naval Postgraduate School, Monterey, CA USA

**A Terrain-Following Crystal Grid Finite Volume Ocean Circulation Model**

Chu, Peter C; Fan, Chenwu; Jan 2004; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479172; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479172>

A three-dimensional hydrostatic finite volume ocean model is developed solving the integral dynamical equations. Since the basic (integral) equations are solved for finite volumes rather than grid points, the flux conservation is easily enforced even on arbitrary meshes. Both upwind and high-order compact schemes can be incorporated into the model to increase computational stability and accuracy. For abrupt topography, a terrain-following grid discretization is designed to reduce computational errors such that the four lateral boundaries of each finite volume are perpendicular to x and y axes, and the two

vertical boundaries are not purely horizontal. This grid system reveals a superior feature to Cartesian and sigma coordinate systems. The accuracy of this model was tested in this study.

DTIC

*Crystals; Finite Volume Method; Integral Equations; Ocean Currents; Ocean Models; Partial Differential Equations; Terrain Following*

**20080025463** Massachusetts Inst. of Tech., Cambridge, MA USA

**The Fastest Fourier Transform in the West**

Frigo, Matteo; Johnson, Steven G; Sep 11, 1997; 21 pp.; In English

Contract(s)/Grant(s): N00014-94-1-0985

Report No.(s): AD-A479232; MIT-LCS-TR-728; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes FFTW, a portable C package for computing the one- and multidimensional complex discrete Fourier transform 'DFT'. FFTW is typically faster than all other publicly available DFT software, including the well-known FFTPACK and the code from Numerical Recipes. More interestingly, FFTW is competitive with or better than proprietary, highly-tuned codes such as Sun's PerformanceLibrary and IBM'sESSL library. FFTW implements the Cooley-Tukey fast Fourier transform, and is freely available on the Web at <http://theory.lcs.mit.edu/fftw>. Three main ideas are the keys to FFTW's performance. First, the computation of the transform is performed by an executor consisting of highly-optimized, composable blocks of C code called codelets. Second, at runtime, a planner finds an efficient way 'called a 'plan'' to compose the codelets. Through the planner, FFTW adapts itself to the architecture of the machine it is running on. Third, the codelets are automatically generated by a codelet generator written in the Caml Light dialect of ML. The codelet generator produces long, optimized, unreadable code, which is nevertheless easy to modify via simple changes to the generator.

DTIC

*Discrete Functions; Fourier Transformation*

**20080025469** California Univ., Los Angeles, CA USA

**Robust Treatment of Interfaces for Fluid Flows and Computer Graphics**

Enright, Doug; Fedkiw, Ron; Jan 2003; 13 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0620; N00014-03-1-0071

Report No.(s): AD-A479244; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Researchers have used numerical techniques to solve partial differential equations describing physical phenomena for many years. One challenging area, the numerical treatment of interfaces, motivated the creation of a topologically robust interface capturing algorithm, the level set method of Osher and Sethian [29]. The level set method has been used to track interfaces in a wide variety of applications. Utilizing geometrical information about the interface, which is naturally obtained from the level set function, an accurate treatment of material discontinuities across the interface can be obtained via the Ghost Fluid Method [15]. Discontinuities are implicitly enforced with the ghost fluid method, avoiding any numerical smoothing of discontinuous quantities across the interface. The ghost fluid method and related techniques have been used to model discontinuities in compressible and incompressible flows [15, 24, 22, 3], flames and detonations [27, 16], solid fluid coupling [14] and Stefan problems [19, 18, 4]. A newly proposed, fully conservative ghost fluid method has been used to track contact discontinuities, inert shocks and detonation waves [25]. Accurate modeling of the motion of a contact discontinuity itself for incompressible flows has been a challenge for level set methods. Recently a new method, the particle level set method [10], has been proposed to accurately track contact discontinuities for incompressible flows.

DTIC

*Algorithms; Computer Graphics; Fluid Flow*

**20080025474** Naval Postgraduate School, Monterey, CA USA

**Rotation Method for Reconstructing Process and Field From Imperfect Data**

Chu, Peter C; Ivanov, Leonid M; Margolina, Tatyana M; Aug 28, 2003; 8 pp.; In English

Contract(s)/Grant(s): N00014-99-1-4007

Report No.(s): AD-A479253; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reconstruction of processes and fields from noisy data is to solve a set of linear algebraic equations. Three factors affect the accuracy of reconstruction: (a) a large condition number of the coefficient matrix, (b) high noise-to-signal ratio in the source term, and (c) no a priori knowledge of noise statistics. To improve reconstruction accuracy, the set of linear algebraic equations is transformed into a new set with minimum condition number and noise-to-signal ratio using the rotation matrix.



The procedure does not require any knowledge of low-order statistics of noises. Several examples including highly distorted Lorenz attractor illustrate the benefit of using this procedure.

DTIC

*Algebra; Linear Equations; Matrix Theory; Rotation; Signal to Noise Ratios*

**20080025487** Florida Agricultural and Mechanical Univ., Tallahassee, FL USA

**Numerical Solutions for Optimal Control under SPDE Constraints**

Cao, Yanzhao; Jan 2008; 8 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0154

Report No.(s): AD-A479290; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The focus of this project is about numerical solutions of optimal control problems using the analysis of variance (ANOVA) analysis. The impact of random parameter dependent boundary conditions on the solutions of a class of nonlinear partial differential equations (PDEs) is considered. Because the boundary conditions are random field, the PDE becomes stochastic PDE. The concepts of effective dimensions are used to determine the accuracy of the ANOVA expansions. Demonstrations are given to show that whenever truncated ANOVA expansions of functionals provide accurate approximations, optimizers found through a simple surrogate optimization strategy are also relatively accurate.

DTIC

*Numerical Analysis; Optimal Control; Partial Differential Equations*

**20080025543** Stanford Univ., Stanford, CA USA

**A Fourth Order Accurate Discretization for the Laplace and Heat Equations on Arbitrary Domains, with Applications to the Stefan Problem**

Gibou, Frederic; Fedkiw, Ronald; Apr 27, 2004; 41 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0620; N00014-03-1-0071

Report No.(s): AD-A479464; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, the authors first describe a fourth order accurate finite difference discretization for both the Laplace equation and the heat equation with Dirichlet boundary conditions on irregular domains. In the case of the heat equation, they use an implicit time discretization to avoid the stringent time step restrictions associated with explicit schemes. They then turn their focus to the Stefan problem and construct a third order accurate method that also includes an implicit time discretization. Multidimensional computational results are presented to demonstrate the order accuracy of these numerical methods.

DTIC

*Boundary Conditions; Dirichlet Problem; Domains; Error Analysis; Extrapolation; Laplace Equation; Partial Differential Equations; Thermodynamics*

**20080025550** California Univ., Los Angeles, CA USA

**Integral Invariant Signatures**

Manay, Siddharth; Hong, Byuny-Woo; Yezzi, Anthony J; Soatto, Stefano; May 2004; 13 pp.; In English

Contract(s)/Grant(s): IIS-0208197; F49620-03-1-0095

Report No.(s): AD-A479522; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For shapes represented as closed planar contours, we introduce a class of functionals that are invariant with respect to the Euclidean and similarity group, obtained by performing integral operations. While such integral invariants enjoy some of the desirable properties of their differential cousins, such as locality of computation ‘which allows matching under occlusions’ and uniqueness of representation ‘in the limit’, they are not as sensitive to noise in the data. We exploit the integral invariants to define a unique signature, from which the original shape can be reconstructed uniquely up to the symmetry group, and a notion of scale-space that allows analysis at multiple levels of resolution. The invariant signature can be used as a basis to define various notions of distance between shapes, and we illustrate the potential of the integral invariant representation for shape matching on real and synthetic data.

DTIC

*Signatures*

**20080025555** Stanford Univ., Stanford, CA USA

**A Fast and Accurate Semi-Lagrangian Particle Level Set Method**

Enright, Douglas; Losasso, Frank; Fedkiw, Ronald; Apr 25, 2004; 25 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0620; N00014-03-1-0071

Report No.(s): AD-A479559; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, we present an efficient semi-Lagrangian based particle level set method for the accurate capturing of interfaces. This method retains the robust topological properties of the level set method without the adverse effects of numerical dissipation. Both the level set method and the particle level set method typically use high order accurate numerical discretizations in time and space, e.g. TVD Runge-Kutta and HJ-WENO schemes. We demonstrate that these computationally expensive schemes are not required. Instead, fast, low order accurate numerical schemes suffice. That is, the addition of particles to the level set method not only removes the difficulties associated with numerical diffusion, but also alleviates the need for computationally expensive high order accurate schemes. We use an efficient, first order accurate semi-Lagrangian advection scheme coupled with a first order accurate fast marching method to evolve the level set function. To accurately track the underlying flow characteristics, the particles are evolved with a second order accurate method. Since we avoid complex high order accurate numerical methods, extending the algorithm to arbitrary data structures becomes more feasible, and we show preliminary results obtained with an octree-based adaptive mesh.

DTIC

*Algorithms; Lagrangian Function*

**20080025886** Stanford Univ., Stanford, CA USA

**Spatially Adaptive Techniques for Level Set Methods and Incompressible Flow**

Losasso, Frank; Fedkiw, Ronald; Osher, Stanley; May 3, 2005; 42 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0620; N00014-97-1-0027

Report No.(s): AD-A479382; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the seminal work of [92] on coupling the level set method of [69] to the equations for two-phase incompressible flow, there has been a great deal of interest in this area. That work demonstrated the most powerful aspects of the level set method, i.e. automatic handling of topological changes such as merging and pinching, as well as robust geometric information such as normals and curvature. Interestingly, this work also demonstrated the largest weakness of the level set method, i.e. mass or information loss characteristic of most Eulerian capturing techniques. In fact, [92] introduced a partial differential equation for battling this weakness, without which their work would not have been possible. In this paper, we discuss both historical and most recent works focused on improving the computational accuracy of the level set method focusing in part on applications related to incompressible flow due to both its popularity and stringent accuracy requirements. Thus, we discuss higher order accurate numerical methods such as Hamilton-Jacobi WENO [46], methods for maintaining a signed distance function, hybrid methods such as the particle level set method [27] and the coupled level set volume of fluid method [91], and adaptive gridding techniques such as the octree approach to free surface flows proposed in [56].

DTIC

*Incompressible Flow; Computation*

**20080025898** Naval Postgraduate School, Monterey, CA USA

**Lagrangian Predictability of High-Resolution Regional Models: The Special Case of the Gulf of Mexico**

Chu, P C; Ivanov, L M; Kantha, L H; Margolina, T M; Melnichenko, O V; Poberezhny, Y A; Feb 25, 2004; 21 pp.; In English

Contract(s)/Grant(s): N00014-02-1-1043; N00014-03-1-0488

Report No.(s): AD-A479385; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Lagrangian prediction skill (model ability to reproduce Lagrangian drifter trajectories) of the nowcast/forecast system developed for the Gulf of Mexico at the University of Colorado at Boulder is examined through comparison with real drifter observations. Model prediction error (MPE), singular values (SVs) and irreversible-skill time (IT) are used as quantitative measures of the examination. Divergent (poloidal) and nondivergent (toroidal) components of the circulation attractor at 50 m depth are analyzed and compared with the Lagrangian drifter buoy data using the empirical orthogonal function (EOF) decomposition and the measures, respectively. Irregular (probably, chaotic) dynamics of the circulation attractor reproduced by the nowcast/forecast system is analyzed through Lyapunov dimension, global entropies, toroidal and poloidal kinetic energies. The results allow assuming exponential growth of prediction error on the attractor. On the other hand, the q-th moment of MPE grows by the power law with exponent of  $3q/4$ . The probability density function (PDF) of MPE has a symmetrical but non-Gaussian shape for both the short and long prediction times and for spatial scales ranging from 20 km to 300 km. The phenomenological model of MPE based on a diffusion-like equation is developed. The PDF of IT is

non-symmetric with a long tail stretched towards large ITs. The power decay of the tail was faster than 2 for long prediction times.

DTIC

*Gulf of Mexico; High Resolution; Lagrangian Function; Ocean Models; Predictions*

**20080026187** NASA Langley Research Center, Hampton, VA, USA

**Problems Associated with Grid Convergence of Functionals**

Salas, Manuel D.; Atkins, Harld L.; July 07, 2008; 6 pp.; In English; 5th International Conference on Computational Fluid Dynamics, 7-11 Jul. 2008, Seoul, Korea, Republic of; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.04; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026187>

The current use of functionals to evaluate order-of-convergence of a numerical scheme can lead to incorrect values. The problem comes about because of interplay between the errors from the evaluation of the functional, e.g., quadrature error, and from the numerical scheme discretization. Alternative procedures for deducing the order-property of a scheme are presented. The problem is studied within the context of the inviscid supersonic flow over a blunt body; however, the problem and solutions presented are not unique to this example.

Author

*Computational Grids; Convergence; Functionals; Blunt Bodies; Mathematical Models*

65

**STATISTICS AND PROBABILITY**

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

**20080023800** Columbia Univ., New York, NY USA

**Characterizing Optimal Adword Auctions**

Iyengar, Garud; Kumar, Anuj; Nov 14, 2006; 30 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0514

Report No.(s): AD-A478308; CORC-TR-2006-04-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478308>

We present a number of models for the adword auctions used for pricing advertising slots on search engines such as Google, Yahoo! etc. We begin with a general problem formulation which allows the privately known valuation per click to be a function of both the identity of the advertiser and the slot. We present a compact characterization of the set of all deterministic incentive compatible direct mechanisms for this model. This new characterization allows us to conclude that there are incentive compatible mechanisms for this auction with a multidimensional type-space that are not affine maximizers. Next, we discuss two interesting special cases: slot independent valuation and slot independent valuation up to a privately known slot and zero thereafter. For both of these special cases, we characterize revenue maximizing and efficiency maximizing mechanisms and show that these mechanisms can be computed with a worst case computational complexity  $O(n^2m^2)$  and  $O(n^2m^3)$  respectively, where  $n$  is number of bidders and  $m$  is number of slots. Next, we characterize optimal rank based allocation rules and propose a new mechanism that we call the customized rank based allocation. We report the results of a numerical study that compare the revenue and efficiency of the proposed mechanisms. The numerical results suggest that customized rank-based allocation rule is significantly superior to the rank-based allocation rules.

DTIC

*Income; Internets*

**20080023937** Minnesota Univ., Minneapolis, MN USA

**Translated Poisson Mixture Model for Stratification Learning (PREPRINT)**

Haro, Gloria; Randal, Gregory; Sapiro, Guillermo; Sep 2007; 19 pp.; In English

Report No.(s): AD-A478595; IMA-PREPRINT-SER-2174; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A framework for the regularized and robust estimation of non-uniform dimensionality and density in high dimensional noisy data is introduced in this work. This leads to learning stratifications, that is, mixture of manifolds representing different characteristics and complexities in the data set. The basic idea relies on modeling the high dimensional sample points as a process of Translated Poisson mixtures, with regularizing restrictions, leading to a model which includes the presence of noise.

The Translated Poisson distribution is useful to model a noisy counting process, and it is derived from the noise-induced translation of a regular Poisson distribution. By maximizing the log-likelihood of the process counting the points falling into a local ball, we estimate the local dimension and density. We show that the sequence of all possible local counting in a point cloud formed by samples of a stratification can be modeled by a mixture of different Translated Poisson distributions, thus allowing the presence of mixed dimensionality and densities in the same data set. With this statistical model, the parameters which best describe the data, estimated via expectation maximization, divide the points in different classes according to both dimensionality and density, together with an estimation of these quantities for each class. Theoretical asymptotic results for the model are presented as well. The presentation of the theoretical framework is complemented with artificial and real examples showing the importance of regularized stratification learning in high dimensional data analysis in general and computer vision and image analysis in particular.

DTIC

*Image Processing; Stratification*

**20080023949** Minnesota Univ., Minneapolis, MN USA

**Stratification Learning: Detecting Mixed Density and Dimensionality in High Dimensional Point Clouds (PREPRINT)**

Haro, Gloria; Randall, Gregory; Sapiro, Guillermo; Sep 2006; 12 pp.; In English

Report No.(s): AD-A478614; IMA-PREPRINT-SER-2135; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The study of point cloud data sampled from a stratification, a collection of manifolds with possible different dimensions, is pursued in this paper. We present a technique for simultaneously soft clustering and estimating the mixed dimensionality and density of such structures. The framework is based on a maximum likelihood estimation of a Poisson mixture model. The presentation of the approach is completed with artificial and real examples demonstrating the importance of extending manifold learning to stratification learning.

DTIC

*Detection; Image Processing; Stratification*

**20080023989** Washington Univ., Seattle, WA USA

**Online Prediction under Model Uncertainty Via Dynamic Model Averaging: Application to a Cold Rolling Mill**

Raferly, Adrian E; Karny, Miroslav; Andrysek, Josef; Ettler, Pavel; Dec 14, 2007; 26 pp.; In English

Contract(s)/Grant(s): N00014-01-10745

Report No.(s): AD-A478679; UW-STAT-TR-525; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We consider the problem of online prediction when it is uncertain what the best prediction model to use is. We develop a method called Dynamic Model Averaging (DMA) in which a state space model for the parameters of each model is combined with a Markov chain model for the correct model. This allows the (correct) model to vary over time. The state space and Markov chain models are both specified in terms of forgetting, leading to a highly parsimonious representation. The method is applied to the problem of predicting the output strip thickness for a cold rolling mill, where the output is measured with a time delay. We found that when only a small number of physically motivated models were considered and one was clearly best, the method quickly converged to the best model, and the cost of model uncertainty was small; indeed DMA performed slightly better than the best physical model. When model uncertainty and the number of models considered were large, our method ensured that the penalty for model uncertainty was small. At the beginning of the process, when control is most difficult, we found that DMA over a large model space led to better predictions than the single best performing physically motivated model.

DTIC

*Cold Rolling; Dynamic Models; Mathematical Models*

**20080024016** Utah Univ., Salt Lake City, UT USA

**Cramer-Rao Bounds for Nonparametric Surface Reconstruction from Range Data**

Tasdizen, Tolga; Whitaker, Ross; Apr 18, 2003; 24 pp.; In English

Contract(s)/Grant(s): N00014-01-10033; NSF-CCR-0092065

Report No.(s): AD-A478716; UUCS-03-006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Cramer-Rao error bound provides a fundamental limit on the expected performance of a statistical estimator. The error bound depends on the general properties of the system, but not on the specific properties of the estimator or the solution. The Cramer-Rao error bound has been applied to scalar- and vector-valued estimators and recently to parametric shape

estimators. However, nonparametric, low-level surface representations are an important important tool in 3D reconstruction, and are particularly useful for representing complex scenes with arbitrary shapes and topologies. This paper presents a generalization of the Cramer-Rao error bound to nonparametric shape estimators. Specifically, we derive the error bound for the full 3D reconstruction of scenes from multiple range images.

DTIC

*Cramer-Rao Bounds; Statistics*

**20080024265** Columbia Univ., New York, NY USA

**Robust Active Portfolio Management**

Erdogan, E; Goldfarb, D; Iyengar, G; Nov 27, 2006; 43 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0514

Report No.(s): AD-A478307; CORC-TR-2004-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478307>

In this paper we construct robust models for active portfolio management in a market with transaction costs. The goal of these robust models is to control the impact of estimation errors in the values of the market parameters on the performance of the portfolio strategy. Our models can handle a large class of piecewise convex transaction cost functions and allow one to impose additional side constraints such as bounds on the portfolio holdings, constraints on the portfolio beta, and limits on cash and industry exposure. We show that the optimal portfolios can be computed by solving second-order cone programs -- a class of optimization problems with a worst case complexity (i.e., cost) that is comparable to that for solving convex quadratic programs (e.g. the Markowitz portfolio selection problem). We tested our robust strategies on simulated data and on real market data from 2000-2003 imposing realistic transaction costs. In these tests, the proposed robust active portfolio management strategies significantly outperformed the S&P 500 index without a significant increase in volatility.

DTIC

*Economics; Mathematical Models; Optimization*

**20080025233** Comptroller of the Currency, Washington, DC, USA

**How Low Can You Go: An Optimal Sampling Strategy for Fair Lending Exams**

Dietrich, J.; Aug. 2001; 27 pp.; In English

Report No.(s): PB2007-112824; OCC/WP-2001-3; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This study uses Monte Carlo simulation to examine the impact of nine sampling strategies on the finite sample performance of the maximum likelihood logit estimator. Empirical researchers face a tradeoff between the lower resource costs associated with smaller samples and the increased confidence in the results gained from larger samples. Choice of sampling strategy is one tool researchers can use to reduce costs yet still attain desired confidence levels. The nine sampling strategies examined in this study include simple random sampling and eight variations of stratified random sampling. Bias, mean-square-error, percentage of models that are feasibly estimated, and percentage of simulated estimates that differ statistically from the true population parameters are used as measures of finite sample performance. The results show stratified random sampling by action (loan approval/denial) and race of the applicant, with balanced strata sizes and a bias correction for choice-based sampling, outperforms each of the other sampling strategies with respect to the four performance measures. These findings, taken together with supporting evidence presented in Scheuren and Sangha (1998) and Giles and Courchane (2000) make a strong argument for implementing such a sampling strategy in future fair lending exams.

NTIS

*Sampling; Maximum Likelihood Estimates; Mean Square Values; Confidence Limits*

**20080025235** Comptroller of the Currency, Washington, DC, USA; Cornell Univ., Ithaca, NY, USA

**Default Estimation for Low-Default Portfolios**

Kiefer, N. M.; Aug. 2006; 28 pp.; In English

Report No.(s): PB2007-112836; OCC/WP-2006-2; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The problem in default probability estimation for low-default portfolios is that there is little relevant historical data information. No amount of data processing can fix this problem. More information is required. Incorporating expert opinion formally is an attractive option.

NTIS

*Bayes Theorem; Inference; Probability Theory; Data Processing*

**20080025237** Comptroller of the Currency, Washington, DC, USA

**Effects of Choice-Based Sampling and Small-Sample Bias on Past Fair Lending Exams**

Dietrich, J.; Jun. 2001; 22 pp.; In English

Report No.(s): PB2007-112851; OCC/WP-2001-2; No Copyright; Avail.: National Technical Information Service (NTIS)

The Office of the Comptroller of the Currency uses choice-based sampling and limited sample sizes for statistically modeled fair lending exams. Both choice-based sampling and small sample sizes introduce bias into the maximum likelihood logit estimator, the standard estimator used by the OCC. This study applies results from Amemiya (1980) and Scott and Wild (1991) to estimate these biases for 16 recent exams. The results show that of 29 tests of the null hypothesis of no racial effect conducted during the 16 exams, the outcome of two would change if small sample bias were taken into account, and the outcome of six would change if choice-based sampling bias were taken into account. Overall, the bias from choice-based sampling is generally larger. Although this study does not attempt to establish whether better sampling strategies would have changed examination conclusions based on any of the 29 hypothesis tests, the findings show that such strategies would have prescribed more thorough manual followup reviews for at least five of the 29 tests.

NTIS

*Bias; Sampling; Selection*

**20080025238** Comptroller of the Currency, Washington, DC, USA

**Empirical Evaluation of Value at Risk by Scenario Simulation**

Abken, P. A.; Mar. 2000; 46 pp.; In English

Report No.(s): PB2007-112854; OCC/WP-2000-3; No Copyright; Avail.: National Technical Information Service (NTIS)

Scenario simulation was proposed by Jamshidian and Zhu (1997) as a method to separate computationally intensive portfolio revaluations from the simulation step in VaR by Monte Carlo. For multicurrency interest rate derivatives portfolios examined in this paper, the relative performance of scenario simulation is erratic when compared with standard Monte Carlo results. Although by design the discrete distributions used in scenario simulation converge to their continuous distributions, convergence appears to be slow, with irregular oscillations that depend on portfolio characteristics and the correlation structure of the risk factors. Periodic validation of scenario-simulated VaR results by cross-checking with other methods is advisable.

NTIS

*Derivation; Risk; Simulation*

**20080025239** Comptroller of the Currency, Washington, DC, USA; Cornell Univ., Ithaca, NY, USA

**Probability Approach to Default Probabilities**

Kiefer, N. M.; Mar. 15, 2007; 14 pp.; In English

Report No.(s): PB2007-112856; OCC/WP-2007-1; No Copyright; Avail.: National Technical Information Service (NTIS)

The probability approach to uncertainty and modeling is applied to default probability estimation. Default estimation for low-default portfolios has attracted attention as banks contemplate the requirements of Basel II.s IRB rules. Nicholas M. Kiefer proposes the formal introduction of expert information into quantitative analysis. An application treating the incorporation of expert information on the default probability is considered in detail.

NTIS

*Probability Theory; Risk Management*

**20080025240** Comptroller of the Currency, Washington, DC, USA; Cornell Univ., Ithaca, NY, USA

**Bank Failure: Evidence from the Colombian Financial Crisis**

Gomez-Gonzalez, J. E.; Kiefer, N. M.; Mar. 15, 2007; 27 pp.; In English

Report No.(s): PB2007-112857; OCC/WP-2007-2; No Copyright; Avail.: National Technical Information Service (NTIS)

Bank-specific determinants of bank failure during the financial crisis in Colombia are identified and studied using duration analysis. The process of failure of banks and related financial institutions during that period can be explained by differences in financial health and prudence across institutions. The capitalization ratio is the most significant indicator explaining bank failure. Increases in this ratio lead to a reduction in the hazard rate of failure at any given moment in time. This ratio exhibits a non-linear component. At lower levels of capitalization small differences in capitalization are associated with larger differences in failure rates. Our results thus provide empirical support for existing regulatory practice. Other important variables explaining bank failure dynamics are the bank's size and profitability.

NTIS

*Colombia; Determinants; Failure*

**20080025241** Comptroller of the Currency, Washington, DC, USA; American Univ., Washington, DC, USA  
**Markov Model of Bank Failure Estimated Using an Information-Theoretic Approach**

Glennon, D.; Golan, A.; Mar. 2003; 41 pp.; In English

Report No.(s): PB2007-112858; OCC/WP-2003-1; No Copyright; Avail.: National Technical Information Service (NTIS)

In this paper, we develop an early-warning bank failure model (EWM) designed specifically to capture the dynamic process underlying the transition from financially sound to closure. We model the transition process as a stationary Markov model and estimate the transition probabilities using a Generalized Maximum Entropy (GME) estimation technique. The GME estimation method is a member of the class of information-theoretic methods, is semi-parametric, and is better suited for estimating models in which the data are limited (e.g., few events, and data availability problems), highly collinear, and measured with error - conditions that often exist with micro-level banking data. In addition, this method allows us to incorporate prior information and impose fewer distributional assumptions relative to conventional maximum likelihood (or full information maximum likelihood) methods. We report estimates of the transition probabilities for nine transition states for the population of nationally chartered banks incorporating the effect of bank-specific and macroeconomic variables from 1984 through 1999.

NTIS

*Early Warning Systems; Failure; Information Theory; Markov Processes; Maximum Entropy Method*

**20080025242** Comptroller of the Currency, Washington, DC, USA; Rice Univ., Houston, TX USA  
**Multivariate Estimation for Operational Risk with Judicious Use of Extreme Value Theory**

El-Gamal, M.; Inanoglu, H.; Stengel, M.; Nov. 21, 2006; 40 pp.; In English

Report No.(s): PB2007-112859; OCC/WP-2006-3; No Copyright; Avail.: National Technical Information Service (NTIS)

The Basel II Accord requires participating banks to quantify operational risk according to a matrix of business lines and event types. Proper modeling of univariate loss distributions and dependence structures across those categories of operational losses is critical for proper assessment of overall annual operational loss distributions. We illustrate our proposed methodology using Loss Data Collection Exercise 2004 (LDCE 2004) data on operational losses across five loss event types. We estimate a multivariate likelihood-based statistical model, which illustrates the benefits and risks of using extreme value theory (EVT) in modeling univariate tails of event type loss distributions. We find that abandoning EVT leads to unacceptably low estimates of risk capital requirements, while indiscriminate use of EVT to all data leads to unacceptably high ones. The judicious middle approach is to use EVT where dictated by data, and after separating clear outliers that need to be modeled via probabilistic scenario analysis. We illustrate all computational steps in estimation of marginal distributions and copula with an application to one banks data (disguising magnitudes to ensure that banks anonymity). The methods we use to overcome heretofore unexplored technical problems in estimation of codependence across risk types scales easily to larger models, encompassing not only operational, but also other types of risks.

NTIS

*Losses; Multivariate Statistical Analysis; Risk*

**20080025281** BAE Systems, Merrimack, NH USA  
**Efficient Multi-Source Data Fusion for Decentralized Sensor Networks**

Haney, Philip J; Lloyd, Christopher M; Oct 1, 2006; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0008

Report No.(s): AD-A478867; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478867>

No abstract available

*Bayes Theorem; Multisensor Fusion; Networks*

**20080025298** Naval Postgraduate School, Monterey, CA USA  
**On Stochastic Stability of Regional Ocean Models With Uncertainty in Wind Forcing**

Ivanov, L M; Chu, P C; Oct 9, 2007; 17 pp.; In English

Report No.(s): AD-A478920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478920>

A shallow-water model was used to understand model error induced by non-Gaussian wind uncertainty. Although the model was simple, it described a generic system with many degrees of freedom randomized by external noise. The study focused on the nontrivial collective behavior of finite-amplitude perturbations on different scales and their influence on model

predictability. The error growth strongly depended on the intensity and degree of spatial inhomogeneity of wind perturbations. For moderate but highly inhomogeneous winds, the error grew as a power law. This behavior was a consequence of varying local characteristic exponents and nonlinear interactions between different scales. Coherent growth of perturbations was obtained for different scales at various stages of error evolution. For the nonlinear stage, statistics of prediction error could be approximated by a Weibull distribution. An approach based on the Kullback-Leibler distance (the relative entropy) and probability-weighted moments was developed for identification of Weibull statistics. Bifurcations of the variance, skewness and kurtosis of the irreversible predictability time (a measure of model prediction skill) were detected when the accepted prediction accuracy (tolerance) exceeded some threshold.

DTIC

*Error Analysis; Ocean Models; Shallow Water; Stability; Stochastic Processes; Wind (Meteorology)*

**20080025539** Naval Postgraduate School, Monterey, CA USA

**Japan Sea Thermohaline Structure and Circulation, Part 3: Autocorrelation Functions**

Chu, Peter C.; Guihua, Wang; Chen, Yuchun; Jun 2002; 21 pp.; In English

Report No.(s): AD-A479452; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The autocorrelation functions of temperature and salinity in the three basins (Ulleung, Japan, and Yamato Basins) of the Japan/East Sea are computed using the U.S. Navy's Master Oceanographic Observational Dataset for 1930-97. After quality control the dataset consists of 93 810 temperature and 50 349 salinity profiles. The decorrelation scales of both temperature and salinity were obtained through fitting the autocorrelation function into the Gaussian function. The signal-to-noise ratios of temperature and salinity for the three basins are usually larger than 2. The signal-to-noise ratio of temperature is greater in summer than in winter. There is more noise in salinity than in temperature. This might be caused by fewer salinity than temperature observations. The autocorrelation functions of temperature for the three basins have evident seasonal variability at the surface: less spatial variability in the summer than in the winter. The temporal (spatial) decorrelation scale is shorter (longer) in the summer than in the winter. Such a strong seasonal variability at the surface may be caused by the seasonal variability of the net surface heat flux. The autocorrelation functions of salinity have weaker seasonal variability than those of the temperature field. The temporal and horizontal decorrelation scales obtained in this study are useful for designing an optimal observational network.

DTIC

*Autocorrelation; Functions (Mathematics); Japan; Seas; Signal to Noise Ratios; Thermohaline Circulation*

**20080025933** Bureau of the Census, Washington, DC, USA

**Unlocking the Information in Integrated Social Data**

Abowd, J. M.; May 2002; 32 pp.; In English

Report No.(s): PB2007-113225; TP-2002-21; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Modern national and research statistical systems acquire their information from three related sources: censuses, periodic surveys, and administrative records. It focuses on benefits of using these three sources in a more integrated fashion. In particular, to reflect on the benefits to social science, twenty-first century statistical systems, and policy analysis that accrue from careful creation and analysis of integrated employer-employee data. When we first reviewed the creation and use of such data, there were already more than 100 scientific studies using data from 18 different countries.

NTIS

*Statistical Analysis; Systems Analysis*

**20080026139** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Space Applications of the FLUKA Monte-Carlo Code: Lunar and Planetary Exploration**

Anderson, V.; Ballarini, F.; Battistoni, G.; Campanella, M.; Carboni, M.; Cerutti, F.; Elkhayari, N.; Empl, A.; Fasso, A.; Ferrari, A.; Gadoli, E.; Gazelli, M. V.; LeBourgeois, M.; Lee, K. T.; Mayes, B.; Muraro, S.; Ottolenghi, A.; Pelliccioni, M.; Pinsky, L. S.; Rancati, T.; Ranft, J.; Roesler, S.; Sala, P. R.; Scannocchio, D.; Smirnov, G.; [2004]; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG8-1901; 101-60-15; Copyright; Avail.: CASI: [A02](#), Hardcopy

NASA has recognized the need for making additional heavy-ion collision measurements at the U.S. Brookhaven National Laboratory in order to support further improvement of several particle physics transport-code models for space exploration



applications. FLUKA has been identified as one of these codes and we will review the nature and status of this investigation as it relates to high-energy heavy-ion physics.

Author

*Monte Carlo Method; Heavy Ions; Ionic Collisions; Space Exploration; Lunar Exploration; Microgravity Applications*

**20080026149** Foster Consulting Services LLC, Tacoma, WA, USA

**Monte Carlo Simulation of Proton Upsets in Xilinx Virtex-II FPGA Using a Position Dependent Q(sub crit) with PROPSET**

O'Neill, Patrick M.; Kouba, Coy; Foster, Charles C.; July 17, 2006; 15 pp.; In English; IEEE Nuclear and Space Radiation Effects Conference, 17-21 Jul. 2006, Ponte Vedra Beach, Florida, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026149>

This paper describes new software simulation code for predicting single event upset data from measured heavy ion data, using methods, code, and algorithms already reported in the open literature. The measured data that is used to compare against the results of this new simulation code has also been reported in the open literature (R. Koga, et al). The new code is not provided as part of this paper, only the methodology used in generating the code. This paper presents results of basic research, not design-to information, and is representative of other papers reported in the open literature (see paper references). Therefore, the content of this paper is suitable for being made publicly available at the IEEE conference and the resulting IEEE journal.

Author

*Monte Carlo Method; Protons; Single Event Upsets; Heavy Ions; Computer Programs*

66

**SYSTEMS ANALYSIS AND OPERATIONS RESEARCH**

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

**20080023732** Sandia National Labs., Livermore, CA, USA

**Collective Systems: Physical and Information Exergies**

Robinett, R. D.; Wilson, D. G.; Apr. 2007; 102 pp.; In English

Report No.(s): DE2007-909392; SAND2007-2327; No Copyright; Avail.: National Technical Information Service (NTIS)

Collective systems are typically defined as a group of agents (physical and/or cyber) that work together to produce a collective behavior with a value greater than the sum of the individual parts. This amplification or synergy can be harnessed by solving an inverse problem via an information-flow/communications grid: given a desired macroscopic/collective behavior find the required microscopic/individual behavior of each agent and the required communications grid. The goal of this report is to describe the fundamental nature of the Hamiltonian function in the design of collective systems (solve the inverse problem) and the connections between and values of physical and information exergies intrinsic to collective systems. In particular, physical and information exergies are shown to be equivalent based on thermodynamics and Hamiltonian mechanics.

NTIS

*Exergy; Hamiltonian Functions; Thermodynamics; Systems Engineering; Systems Analysis*

**20080024062** La Sapienza Univ., Rome, Italy

**Mathematical Models of Smart Obstacles**

Zirilli, Francesco; Oct 1, 2006; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478782; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Acoustic Scattering; Mathematical Models*

**20080024174** NATO Research and Technology Organization, Neuilly-sur-Seine, France

**Building Robust Systems with Fallible Construction**

April 2008; 36 pp.; In English

Report No.(s): RTO-TR-IST-047; AC/323(IST-047)TP/45; Copyright; Avail.: CASI: C01, CD-ROM: A03, Hardcopy

The Task Group focused on identifying challenges that have not been adequately resolved by traditional Software Fault

Tolerance. The Task Group did not have the resources to itself undertake research to produce solutions, but felt that producing a catalogue of issues requiring further investigation was a useful first step leading to their eventual resolution, and in itself was a worthwhile contribution.

Author

*Fault Tolerance; Systems Integration; Computer Programs; Robustness (Mathematics); Systems Engineering*

**20080025087** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Advanced, Adaptive, Modular, Distributed, Generic Universal FADEC Framework for Intelligent Propulsion Control Systems**

Behbahani, Alireza R; Sep 2007; 48 pp.; In English

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

Report No.(s): AD-A478472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478472>

Today, each FADEC is unique and expensive to develop, produce, maintain, and upgrade for its particular application. Each FADEC is a centralized system, with a redundant, central computer and centrally located analog signal interfacing circuitry for interfacing with sensors and actuators located throughout the propulsion system. It is to establish a universal or common standard for engine controls and accessories. This will significantly reduce the high development and support costs across platforms. What is needed is a Universal FADEC (UF) Platform with a flexible process with commercial-off-the-shelf (COTS) technology and product solutions that are fully independent and composable, and reliable. The term UF implies open system architectures with common or universal standardized inputs and outputs with reusable software, and a reduced number of components. A centralized or distributed multi-sensor system that is capable of fusing gathered data and using it as a basis for making decisions will provide greater robustness, timeliness and fault tolerance.

DTIC

*Control; Digital Systems; Electronic Control; Engine Control; Multisensor Fusion; Propulsion System Configurations; Propulsion System Performance*

**20080025133** Air Force Research Lab., Rome, NY USA

**Hybrid Architectures for Evolutionary Computing Algorithms**

Burns, Daniel J; Jan 2008; 158 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-459T

Report No.(s): AD-A478532; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478532>

This report documents the results of an in-house project aimed at identifying, developing and evaluating applications of evolutionary computing methods to hard optimization problem test cases on a single PC computer, a cluster of computers, and hardware FPGA platforms. We surveyed the evolutionary computing literature and chose to focus on the Genetic Algorithm (GA). We applied the GA to Non-Linear Coupled Ordinary Differential Equation (ODE) Parameterization, the DNA Code Word Library Problem, and the Networked Sensor Power Management Policy Problem. The first problem used an ODE biomodel for Antigen-Antibody binding, and we demonstrated speed-ups on the order of 100-1000x by moving from interpreted languages to compiled C. We parallelized this C code using the Message Passing Interface (MPI), and demonstrated linear speed-ups on a cluster. A GA solution for the DNA Code Word Library Problem was also parallelized, and was faster than any algorithm found in the literature. We also developed hardware accelerated prototypes for the GA for this problem that achieved speed-ups on the order of 1000x. These prototypes used random and rank based selection, single point crossover mating, a declone operator, systolic arrays for the LLCS and Gibbs energy metrics, a multi-deme GA, and exhaustive search for producing locally optimum codes.

DTIC

*Algorithms; Architecture (Computers); Computer Programming; Differential Equations; Optimization*

**20080025321** Georgia Inst. of Tech., Atlanta, GA USA

**A Nonlinear Model Predictive Observer for Smart Projectile Applications**

Costello, Mark; Letniak, Ryan; Mar 2008; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911QX-06-C-0113; Proj-AH80

Report No.(s): AD-A478966; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478966>

The work reported here presents a nonlinear model predictive observer specialized to smart projectiles. The observer is

based on a two-step process consisting of an initial state predictor followed by a state estimate corrector. We generate the predictor state by simply integrating the projectile's fixed plane equations of motion forward in time while the corrector step updates the state estimate by the minimization of the difference between measurements and model-predicted measurements over a finite duration of time in the past. Since the proposed method permits a general nonlinear representation of the projectile, the corrector step requires the solution of a nonlinear minimization problem which is subsequently solved with the use of a damped Newton procedure. The nonlinear model predictive observer is exercised on a smart projectile that employs a typical array of sensors including global positioning system, a three-axis gyroscope, three-axis accelerometers, and a three-axis magnetometer. Results with this smart weapon observer are promising since the observer is capable of estimating the full state of the projectile, including orientation and translational velocity, when realistic noise and bias errors are included in the sensor measurements. Relative to other existing observers, the proposed observer is computationally intensive because of the need to solve a nonlinear minimization problem at each computational cycle of the observer.

DTIC

*Models; Nonlinearity; Optimization; Predictions; Projectiles*

**20080025451** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Fuzzy Logic Technique to Determine Search Time and Probability of Detection for Targets of Interest in Background Scenes**

Meitzler, Thomas J, Inventor; Singh, Harpreet, Inventor; Sohn, Euijung, Inventor; Jul 23, 2002; 15 pp.; In English  
Report No.(s): AD-D020335; PATENT-6 424 736 B1; No Copyright; Avail.: US Patent and Trademark Office  
ONLINE: <http://hdl.handle.net/100.2/ADD020335>

A method of determining the visibility of a target in a background uses search time as the output. A set of images of the target in the background is made, and selected input variables in each image are measured. The input variables relate to target size, target juxtaposition relative to the viewer's location, luminance of the target and luminance of the background scene. One version of our method additionally uses wavelet edge points as an input variable. Each input variable, as well as the output variable, has several applicable membership functions by which membership values are assigned to the variables. Choosing membership functions for variables is done by fuzzy rules. Applying the fuzzy rules and membership functions produces multiple values for the output variable. These values are defuzzified to obtain a crisp end result. This result can disqualify proposed target designs or to help select among several good designs of the target.

DTIC

*Detection; Fuzzy Systems; Patents; Probability Theory; Target Recognition*

**20080025483** New Jersey Inst. of Tech., Newark, NJ USA

**Uniform in Time Asymptotic and Numerical Methods for Propagation in Dielectric Exhibiting Fractional Relaxation and Efficient and Accurate Impedance Boundary Conditions for High-Order Numerical Schemes for the Time-Dependent Maxwell Equations**

Petropoulos, Peter G; Mar 14, 2008; 17 pp.; In English  
Contract(s)/Grant(s): FA9550-05-1-0162; 05NM034  
Report No.(s): AD-A479286; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we examine the small- and large-depth response of a Cole-Cole dielectric half-space subjected to a prescribed incident pulse; the case of delta-function incidence is employed to determine and analyze the resulting impulse response. Our purpose is to contrast our findings to the corresponding ones obtained for the Debye model in order to ascertain whether the time-domain waveforms obtained in a TDR experiment could serve as a means for selecting the most appropriate frequency-domain model for the experimentally obtained dielectric data. Our approach involves both asymptotic and numerical methods. We find that the Cole-Cole model's impulse response is infinitely smooth at the wavefront (small-depth), and determine its shape. It follows that sawtooth and square-pulse waveforms, and all other realistic waveforms, become smooth after travelling a brief time in any Cole-Cole model. This is in contrast to the case of the Debye impulse response which is discontinuous at the wavefront.

DTIC

*Asymptotic Methods; Boundary Conditions; Dielectrics; Electromagnetic Pulses; Impedance; Maxwell Equation; Numerical Analysis; Optical Measurement; Time Dependence*

**20080025541** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Computational Vision Modeling for Target Detection**

Gerhart, Grant; Meitzler, Thomas; Witus, Gary; Jun 1994; 9 pp.; In English

Report No.(s): AD-A479457; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The current DOD target acquisition models have two primary deficiencies: they use simplistic representations of the vehicle and background signatures, and a highly simplified description of the human observer. The current signature representation often fails for complex signature configurations and yields inaccurate detectability and marginal pay-off predictions for low signature vehicles. In addition it is not extensible to false alarms and temporal cues, and precludes applications to vehicle design guidance and diagnosis. The current human observer model is simplified to the same degree as the signature representation and as such does not extend to high fidelity target/background signature representations. In answer to these deficiencies, we have developed the TARDEC Visual Model (TVM) that is based upon emerging academic computational vision models (CVM). Recent advances in CVM have made dramatic improvements in the understanding of early human vision processes. A model of neural receptive fields includes a generic image representation of the spatial processing characteristics for early vision cortical areas. An input image is first divided into its three color opponent components with each axis further decomposed into a set of band pass spatial frequency filters (Gabor or wavelet transform filters) with different center frequencies and orientations. Signal to noise statistics are then calculated on each channel, appropriately aggregated over all channels using signal detection theory to predict probabilities of detection and false alarm.

DTIC

*Detection; Signatures; Target Acquisition; Targets*

**20080025866** NRNS, Inc., Ottawa, Ontario Canada

**Survey of Network Visualization Tools**

Gort, Adam; Gort, James; Dec 2007; 94 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479300; DRDC-0-CR-2007-280; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As a first step in determining the way ahead for research and development of network visualisation techniques, a product and literature search of network visualisation technologies was conducted. The contractors developed a taxonomy of network visualisation product attributes and entered products into a MySQL database accessed through a web interface using PHP scripts. A report containing a table for each of the 139 products was delivered in HTML format; each table includes the attributes that could be determined from the product's Internet presence or from sales staff, and screen captures where available. This document contains a re-formatted version of this full report, fitted to letter size paper and with unfilled rows removed from the tables to minimize the document length. The citation information for the 27 documents discovered in the literature search are listed at the end, along with the abstract of each.

DTIC

*Inspection; Networks; Software Development Tools; Surveys; Taxonomy; Visual Aids; Visual Observation*

**20080025912** National Defense Univ., Washington, DC USA

**So Many Zebras, So Little Time: Ecological Models and Counterinsurgency Operations (Defense Horizons, Number 62, February 2008)**

Drapeau, Mark D; Hurley, Peyton C; Armstrong, Robert E; Feb 2008; 9 pp.; In English

Report No.(s): AD-A479407; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Force ratios are an important variable in warfare and in nature. On the Serengeti, large zebra herds are constantly hunted by small prides of lions. But with their overwhelming majority, why don't the zebras unite and attack the lions? Hooves can be as deadly as claws when used correctly. And conversely, if the lions are such effective predators, why are there so many zebras? Ecological interactions between predators and their prey are complex. Sometimes the few prey on the many; picture a whale devouring thousands of docile microorganisms. And sometimes the many prey on the few, as with killer bees attacking an unsuspecting person. During the past century, the mathematics underlying different types of survival strategies for attacker and evader have been worked out by ecologists, and we now have a fairly good understanding of such relationships. While not a perfect metaphor, it is striking that these quantitative ecology models greatly resemble behavioral interactions during counterinsurgency operations. While a predator-prey model alone may be too simplistic to fully describe counterinsurgency, there are more detailed ecological models of competition that better capture the essence of the problem. The purpose of this paper is not to provide definitive solutions, but to suggest a framework for other researchers to adapt and expand upon. Indeed, many of the models discussed are common to both ecologists and economists. The goals of both types of modeling are similar: maximizing profits in terms of food or money at the least risk death or bankruptcy. From our preliminary work on the possible

applications of ecology to counterinsurgency, we hope that others more adept at the use of these quantitative models will make significant contributions to the area of predictive ability in combating terrorism and understanding unconventional warfare.  
DTIC

*Ecology; Horizon; Mathematical Models*

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### THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

**20080023830** Army War Coll., Carlisle Barracks, PA USA

#### **Chaos Theory and the Effort in Afghanistan**

Dobson, Rhea E; Feb 29, 2008; 37 pp.; In English

Report No.(s): AD-A478418; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478418>

This paper will examine the complex security environment in Afghanistan using Chaos Theory as a contextual foundation. Chaos Theory, in contrast to the classic Newtonian sciences, provides the capability of deriving patterns and predictability from seeming disorder. Its application within the physical sciences has yielded tremendous results and the theory has begun making inroads into the social and economic sciences. Chaos Theory provides a method of analysis for complex, non-linear systems such as the ones that challenge the coalition seeking to rebuild Afghanistan. Current strategic planning paradigms seek to simplify complex issues, often failing to recognize the complex interactions upon which these issues hinge. The paper will provide a brief overview of technical aspects of Chaos Theory and then use the Chaos Theory lens to examine the success of the Marshall Plan for Western Europe following the Second World War. The paper will then turn the focus to the present and examine the military, social, religious, and economic contexts of the current struggle in Afghanistan, offering recommendations to shape a future strategy to realize the coalition's goals.

DTIC

*Afghanistan; Chaos*

**20080023958** Texas Univ., Austin, TX USA

#### **B and F Projection Methods for Nearly Incompressible Linear and Nonlinear Elasticity and Plasticity using Higher-order NURBS Elements**

Elguedj, T; Bazilevs, Y; Calo, V M; Hughes, T J; Aug 2007; 62 pp.; In English

Contract(s)/Grant(s): N00014-03-0263

Report No.(s): AD-A478643; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper presents projection methods to treat the incompressibility constraint in small and large deformation elasticity and plasticity within the framework of Isogeometric Analysis. After reviewing some fundamentals of isogeometric analysis we investigate the use of higher-order Non-Uniform Rational B-Splines 'NURBS' within the B projection method. The higher-continuity property of such functions is explored in nearly incompressible applications and shown to produce accurate and robust results. A new nonlinear F projection method, based on a modified minimum potential energy principle and inspired by the B method is proposed for the large-deformation case. It leads to a symmetric formulation for which the consistent linearized operator for fully nonlinear elasticity is derived and used in a Newton-Raphson iterative procedure. The performance of the methods is assessed on several numerical examples, and results obtained are shown to compare favorably with other published techniques.

DTIC

*Elastic Properties; Nonlinear Systems; Nonlinearity; Plastic Properties*

**20080024035** Minnesota Univ., Minneapolis, MN USA

#### **Brain and Surface Warping via Minimizing Lipschitz Extensions (PREPRINT)**

Memoli, Facundo; Sapiro, Guillermo; Thompson, Paul; Jan 2006; 11 pp.; In English

Report No.(s): AD-A478743; IMA-PREPRINT-SER-2092; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Based on the notion Minimizing Lipschitz Extensions and its connection with the infinity Laplacian, a computational framework for surface warping and in particular brain warping 'the nonlinear registration of brain imaging data' is presented in this paper. The basic concept is to compute a map between surfaces that minimizes a distortion measure based on geodesic

distances while respecting the boundary conditions provided. In particular, the global Lipschitz constant of the map is minimized. This framework allows generic boundary conditions to be applied and allows direct surface-to-surface warping. It avoids the need for intermediate maps that flatten the surface onto the plane or sphere, as is commonly done in the literature on surface-based non-rigid brain image registration. The presentation of the framework is complemented with examples on synthetic geometric phantoms and cortical surfaces extracted from human brain MRI scans.

DTIC

*Brain; Image Processing; Partial Differential Equations; Pattern Registration*

**20080024066** Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA  
**Classifying Launch/Impact Events of Mortar and Artillery Rounds Utilizing DWT Derived Features and Feedforward Neural Networks**

Hohil, Myron E; Desai, Sachi; Morcos, Amir; Oct 1, 2006; 50 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478791; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Artillery; Feedforward Control; Launching; Neural Nets; Pattern Recognition; Signal Transmission; Sound Waves; Wavelet Analysis*

**20080025062** Texas Univ., Austin, TX USA

**Isogeometric Analysis of the Cahn-Hilliard Phase-Field Model**

Gomez, Hector; Calo, Victor M; Bazilevs, Yuri; Hughes, Thomas J; Dec 11, 2007; 47 pp.; In English

Contract(s)/Grant(s): N00014-03-0263

Report No.(s): AD-A478639; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Cahn-Hilliard equation involves fourth-order spatial derivatives. Finite element solutions are not common because primal variational formulations of fourth-order operators are well defined and integrable only if the finite element basis functions are piecewise smooth and globally  $C^1$ -continuous. There are a very limited number of two-dimensional finite elements possessing  $C^1$ -continuity applicable to complex geometries, but none in three-dimensions. We propose Isogeometric Analysis as a technology that possesses a unique combination of attributes for complex problems involving higher-order differential operators, namely, higher-order accuracy, robustness, two- and three-dimensional geometric flexibility, compact support, and, most importantly, the possibility of  $C^1$  and higher-order continuity. A NURBS-based variational formulation for the Cahn-Hilliard equation was tested on two- and three-dimensional problems. We present steady state solutions in two-dimensions and, for the first time, in three-dimensions. To achieve these results an adaptive time-stepping method is introduced. We also present a technique for desensitizing calculations to dependence on mesh refinement. This enables the calculation of topologically correct solutions on coarse meshes, opening the way to practical engineering applications of phase-field methodology.

DTIC

*Finite Element Method; Operators (Mathematics); Mathematical Models*

**20080025067** Army Engineer Research and Development Center, Vicksburg, MS USA  
**Locally Conservative, Stabilized Finite Element Methods for Variably Saturated Flow**

Kees, C E; Farthing, M W; Dawson, C N; Nov 6, 2007; 45 pp.; In English

Contract(s)/Grant(s): DMS-0411413

Report No.(s): AD-A478640; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Standard Galerkin finite element methods for variably saturated groundwater flow have several deficiencies. For instance, local oscillations can appear around sharp infiltration fronts without the use of mass-lumping, and velocity fields obtained from differentiation of pressure fields are discontinuous at element boundaries. Here, we consider conforming finite element discretizations based on a multiscale formulation along with recently developed, local postprocessing schemes. The resulting approach maintains the basic flexibility and appeal of traditional finite element methods, while controlling nonphysical oscillations and producing element-wise mass-conservative velocity fields. Accuracy and efficiency of the proposed schemes are evaluated through a series of steady-state and transient variably saturated ground-water flow problems in homogeneous as well as heterogeneous domains.

DTIC

*Finite Element Method; Saturation; Flow Distribution; Water Flow; Flow Stability*

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*.

**20080023727** Stanford Linear Accelerator Center, CA, USA

**Optimized Bunch Compressor for the International Linear Collider**

Seletskiy, S.; Tenebaum, P.; Jul. 2007; 3 pp.; In English

Report No.(s): DE2007-909539; SLAC/PUB-12638; No Copyright; Avail.: National Technical Information Service (NTIS)

The International Linear Collider (ILC) utilizes a two stage Bunch Compressor (BC) that compresses the RMS bunch length from 9 mm to 200 to 300 micrometers before sending the electron beam to the Main Linac. This paper reports on the new design of the optimized BC wiggler. It was reduced in length by more than 30%. The introduction of nonzero dispersion slope in the BC wigglers enabled them to generate the required compression while having a small SR emittance growth, a tunability range of over a factor of 2 in each wiggler, and less than 3% RMS energy spread throughout the entire system.

NTIS

*Bunching; Compressors*

**20080023729** College of William and Mary, Williamsburg, VA, USA

**Kinematics and Backgrounds for HAPPEX Measurements**

Moffit, B. J.; Aug. 31, 2006; 4 pp.; In English

Report No.(s): DE2007-909356; No Copyright; Avail.: Department of Energy Information Bridge

Measurements and systematic errors of the 4-momentum transfer squared (Q wedge 2) and backgrounds for the 2005 HAPPEX runs are described.

NTIS

*Electroweak Interactions (Field Theory); Kinematics*

**20080023730** Thomas Jefferson National Accelerator Facility, Newport News, VA, USA; Deutsches Elektronen-Synchrotron, Hamburg, Germany

**RF Gun Optimization Study**

Hofler, A.; Evtushenko, P.; Krasilnikov, M.; January 2006; 3 pp.; In English

Report No.(s): DE2007-909377; No Copyright; Avail.: National Technical Information Service (NTIS)

Injector gun design is an iterative process where the designer optimizes a few nonlinearly interdependent beam parameters to achieve the required beam quality for a particle accelerator. Few tools exist to automate the optimization process and thoroughly explore the parameter space. The challenging beam requirements of new accelerator applications such as light sources and electron cooling devices drive the development of RF and SRF photo injectors. A genetic algorithm (GA) has been successfully used to optimize DC photo injector designs at Cornell University (1) and Jefferson Lab (2). We propose to apply GA techniques to the design of RF and SRF gun injectors. In this paper, we report on the initial phase of the study where we model and optimize a system that has been benchmarked with beam measurements and simulation.

NTIS

*Radio Frequencies; Electronic Equipment; Particle Accelerators; Genetic Algorithms*

**20080023731** Jefferson (Thomas) National Accelerator Facility, Newport News, VA, USA

**RF-Thermal-Structural Analysis of a WaveGuide Higher Order Mode Absorber**

Cheng, G.; Daly, E. F.; Rimmer, R. A.; Stirbet, M.; Vogel, L.; January 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC05-06OR23177

Report No.(s): DE2007-909378; No Copyright; Avail.: National Technical Information Service (NTIS)

For an ongoing high current cryomodule project, a total of 5 higher order mode (HOM) absorbers are required per cavity. The load is designed to absorb Radio Frequency (RF) heat induced by HOMs in a 748.5MHz cavity. Each load is targeted at a 4 kW dissipation capability. Water cooling is employed to remove the heat generated in ceramic tiles and by surface losses on the waveguide walls. A sequentially coupled RF-thermal-structural analysis was developed in ANSYS to optimize the HOM load design. Frequency-dependent dielectric material properties measured from samples and RF power spectrum calculated by the beam-cavity interaction codes were considered. The coupled field analysis capability of ANSYS avoided mapping of results between separate RF and thermal/structural simulation codes. For verification purposes, RF results obtained

from ANSYS were compared to those from MAFIA, HFSS, and Microwave Studio. Good agreement was reached and this confirms that multiple-field coupled analysis is a desirable choice in analysis of HOM loads. Similar analysis could be performed on other particle accelerator components where distributed RF heating and surface current induced losses are inevitable.

NTIS

*Radio Frequencies; Structural Analysis; Thermal Analysis; Waveguides; Absorption; Linear Accelerators*

**20080023735** Department of Energy, Washington, DC, USA

**Laboratories for the 21st Century: Case Studies. Molecular Foundry, Berkeley, California (June 2007)**

Jun. 2007; 8 pp.; In English

Report No.(s): DE2007-909455; DOE/GO-102007-2338; No Copyright; Avail.: Department of Energy Information Bridge

The Molecular Foundry is a new, state-of-the art user facility for nanoscale materials on the research campus of Lawrence Berkeley National Laboratory (LBNL) in Berkeley, California. Like the foundries of the industrial revolution, the facility will be involved in building novel, possibly even revolutionary structures; however, here the structures will be built atom-by-atom on a nanoscale. These novel devices could include very precise nanosensors for detecting environmental contaminants, highly efficient and inexpensive flexible solar cells, and ultrafast nanocomputers.

NTIS

*Foundries; Research and Development; Detection; Contaminants*

**20080023739** Stanford Linear Accelerator Center, CA, USA

**Geometric Effects on Electron Cloud**

Wang, L.; Chao, A.; Wei, J.; Jul. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909531; SLAC-PUB-12640; No Copyright; Avail.: National Technical Information Service (NTIS)

The development of an electron cloud in the vacuum chambers of high intensity positron and proton storage rings may limit the machine performances by inducing beam instabilities, beam emittance increase, beam loss, vacuum pressure increases and increased heat load on the vacuum chamber wall. The electron multipacting is a kind of geometric resonance phenomenon and thus is sensitive to the geometric parameters such as the aperture of the beam pipe, beam shape and beam bunch fill pattern, etc. This paper discusses the geometric effects on the electron cloud build-up in a beam chamber and examples are given for different beams and accelerators.

NTIS

*Electron Beams; Electron Clouds*

**20080023740** Stanford Linear Accelerator Center, CA, USA; Fermi National Accelerator Lab., Batavia, IL, USA; Cambridge Univ., Cambridge, UK

**Resolution of a High Performance Cavity Beam Position Monitor System**

Walston, S.; Chung, C.; Fitsos, P.; Gronberg, J.; Ross, M.; Jul. 2007; 3 pp.; In English

Report No.(s): DE2007-909532; SLAC-PUB-12647; No Copyright; Avail.: National Technical Information Service (NTIS)

International Linear Collider (ILC) interaction region beam sizes and component position stability requirements will be as small as a few nanometers. It is important to the ILC design effort to demonstrate that these tolerances can be achieved ideally using beam-based stability measurements. It has been estimated that RF cavity beam position monitors (BPMs) could provide position measurement resolutions of less than one nanometer and could form the basis of the desired beam-based stability measurement. We have developed a high resolution RF cavity BPM system. A triplet of these BPMs has been installed in the extraction line of the KEK Accelerator Test Facility (ATF) for testing with its ultra-low emittance beam. A metrology system for the three BPMs was recently installed. This system employed optical encoders to measure each BPMs position and orientation relative to a zero-coefficient of thermal expansion carbon fiber frame and has demonstrated that the three BPMs behave as a rigid-body to less than 5 nm. To date, we have demonstrated a BPM resolution of less than 20 nm over a dynamic range of +/- 20 microns.

NTIS

*Beams (Radiation); Cavities; Monitors*



**20080023742** Stanford Linear Accelerator Center, CA, USA

**Adaptive Impedance Analysis of Grooved Surface Using the Finite Element Method**

Wang, L.; Jul. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909534; SLAC/PUB-12644; No Copyright; Avail.: National Technical Information Service (NTIS)

Grooved surface is proposed to reduce the secondary emission yield in a dipole and wiggler magnet of International Linear Collider. An analysis of the impedance of the grooved surface based on adaptive finite element is presented in this paper. The performance of the adaptive algorithms, based on an element-element h-refinement technique, is assessed. The features of the refinement indicators, adaptation criteria and error estimation parameters are discussed.

NTIS

*Finite Element Method; Impedance; Surface Properties; Wiggler Magnets*

**20080024024** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Thermal Characterization of a Hall Effect Thruster**

Bohnert, Alex M; Mar 2008; 105 pp.; In English

Report No.(s): AD-A478729; AFIT/GA/ENY/08-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The thermal characteristics of a Hall thruster directly influence thruster and spacecraft design. High temperatures affect the magnetic coil capabilities and cause higher insulator erosion rates, influencing both thruster performance and lifetime. The Hall thruster transfers heat through both radiation and conduction, and the spacecraft must handle this additional thermal energy. An infrared camera provides a non-intrusive method to analyze the thermal characteristics of an operational Hall thruster. This thesis contains the thermal analysis of a Busek Co. Inc. 200 W Hall thruster, using a FLIR ThermaCAM SC640 infrared camera. The Space Propulsion Analysis and System Simulator Laboratory at the Air Force Institute of Technology on Wright-Patterson Air Force Base provided the location for thruster set up and operation. The infrared camera furnishes the surface temperatures for the entire thruster, and approximates the transient heating behavior during start up, steady state, and shut down. Thermocouples verify and correct the camera data. Experimentally determined emissivities characterize the materials of the thruster. In addition, a view factor analysis between the camera pixels and the alumina sprayed portion of the cathode determines the exchange of radiation between the pixels and cathode surface. This process develops a technique to map surface temperatures of complex geometries with confidence in the actual values. Accurately mapping the surface temperatures of a Hall Effect thruster will improve both thruster efficiency and lifetime, and predict the thruster's thermal load on a satellite.

DTIC

*Hall Effect; Hall Thrusters*

**20080024163** Army Tank-Automotive Research and Development Command, Warren, MI USA

**System and Method for Induced Acceleration Mitigation for Seat Occupant**

Gonzalez, Rene G, Inventor; Sep 18, 2007; 7 pp.; In English

Report No.(s): AD-D020328; PATENT-7 270 045 B1; No Copyright; Avail.: US Patent and Trademark Office

A system for mitigation of induced acceleration to an occupant of a vehicle seat includes a substantially non-deforming structure having a top side with the vehicle seat mounted thereon and a bottom side forming a first portion of a floor of the vehicle, and at least one deformable bracket mounting the non-deforming structure to a second portion of the floor that is separate from the first portion of the floor. The at least one deformable bracket deforms, and the non-deforming structure extends through the floor when the vehicle is subjected to an upward force that is equal to or greater than a predetermined force that corresponds to an induced upward acceleration.

DTIC

*Acceleration (Physics); Patents; Seats*

**20080025193** Lawrence Livermore National Lab., Livermore, CA USA

**Ignition Target for the National Ignition Facility**

Atherton, L. J.; Moses, E. I.; Carlisle, K.; Kilkenny, J.; Mar. 13, 2007; 8 pp.; In English

Report No.(s): DE2007-909643; UCRL-CONF-229008; No Copyright; Avail.: Department of Energy Information Bridge

The National Ignition Facility (NIF) is a 192 beam Nd-glass laser facility presently under construction at Lawrence Livermore National Laboratory (LLNL) for performing inertial confinement fusion (ICF) and experiments studying high energy density (HED) science. When completed in 2009, NIF will be able to produce 1.8 MJ, 500 TW of ultraviolet light for

target experiments that will create conditions of extreme temperatures ( $>108$  DGK), pressures (10-GBar) and matter densities ( $> 100$  g/cm<sup>3</sup>). A detailed program called the National Ignition Campaign (NIC) has been developed to enable ignition experiments in 2010, with the goal of producing fusion ignition and burn of a deuterium-tritium (DT) fuel mixture in millimeter-scale target capsules. The first of the target experiments leading up to these ignition shots will begin in 2008. Targets for the National Ignition Campaign are both complex and precise, and are extraordinarily demanding in materials fabrication, machining, assembly, cryogenics and characterization. An overview of the campaign for ignition will be presented, along with technologies for target fabrication, assembly and metrology and advances in growth and x-ray imaging of DT ice layers. The sum of these efforts represents a quantum leap in target precision, characterization, manufacturing rate and flexibility over current state-of-the-art.

NTIS

*Ignition; Targets*

**20080025200** Stanford Linear Accelerator Center, CA, USA

**R Measurements with ISR in BaBar - Hadronic Part of Muon Magnetic Dipole Moment**

Taras, P.; January 2006; 4 pp.; In English

Report No.(s): DE2007-909770; SLAC/PUB-12583; No Copyright; Avail.: Department of Energy Information Bridge

Recent measurements of the quantity  $R$ , the ratio of annihilation  $\sigma$ , including those following Initial State Radiation, are discussed in the context of the hadronic part of  $i$ , the muon magnetic dipole moment. The data indicate that more precise theoretical and experimental values of  $i$  are needed to establish whether new physics has been observed in the measurement of  $i$ .

NTIS

*Annihilation Reactions; Dipole Moments; Hadrons; Magnetic Dipoles; Magnetic Moments; Muons*

**20080025203** Argonne National Lab., IL USA

**Measuring  $\sin^2 \theta_W$  with Parity Violation in Deep Inelastic Scattering with Baseline Spectrometers at JLab 12 GeV**

Reimer, P. E.; Jul. 2007; 3 pp.; In English

Report No.(s): DE2007-909874; DOE/ER-40150-4289; No Copyright; Avail.: National Technical Information Service (NTIS)

The couplings of leptons to quarks are fundamental parameters of the electroweak interaction. Within the framework of the Standard Model, these couplings can be related to  $\sin^2 \theta_W$ . Parity violation (PV) in deep inelastic scattering (DIS) is proportional to these couplings and hence sensitive  $\sin^2 \theta_W$ . PV-DIS, first measured at SLAC in the mid-1970's, was used to establish the Standard Model. The high quality and intensity of the upgraded 11 GeV CEBAF beam at Jefferson Laboratory will make it an ideal tool for PV studies.

NTIS

*Inelastic Scattering; Parity; Spectrometers; Linear Accelerators*

**20080025204** Fermi National Accelerator Lab., Batavia, IL, USA

**System for Exchanging Control and Status Messages in the NOvA Data Acquisition**

Biery, K.; Cooper, G.; Foulkes, S.; Guglielmo, G.; Piccoli, L.; January 2007; 7 pp.; In English

Report No.(s): DE2007-909891; FERMILAB-CONF-07-101-CD; No Copyright; Avail.: Department of Energy Information Bridge

In preparation for NOvA, a future neutrino experiment at Fermilab, we are developing a system for passing control and status messages in the data acquisition system. The DAQ system will consist of applications running on approximately 450 nodes. The message passing system will use a publish-subscribe model and will provide support for sending messages and receiving the associated replies. Additional features of the system include a layered architecture with custom APIs tailored to the needs of a DAQ system, the use of an open source messaging system for handling the reliable delivery of messages, the ability to send broadcasts to groups of applications, and APIs in Java, C++, and Python. Our choice for the open source system to deliver messages is EPICS. We will discuss the architecture of the system, our experience with EPICS, and preliminary test results.

NTIS

*Data Acquisition; Messages; Neutrinos*

**20080025209** Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA

**Three-Dimensional Lithographic Fabrication Technique**

Frauenglass, A., Inventor; 24 May 05; 22 pp.; In English

Contract(s)/Grant(s): ARO-DAAD19-99-1-0196

Patent Info.: Filed Filed 24 May 05; US-Patent-Appl-SN-11-136-306

Report No.(s): PB2007-109307; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Embodiments of a structure and embodiments of methods for fabricating structures provide three dimensional features defined by exposure to multiple wavelengths of light. In an embodiment, material is exposed to two different wavelengths of light. Embodiments of three dimensional structures may provide a variety of three-dimensional structural features and characteristics.

NTIS

*Fabrication; Lithography; Patent Applications*

**20080025228** McLeod and Moyne, P.C., Okekmos, MI, USA

**Method for the Preparation of Metal Oxides in Nanometric Particle Form**

Pinnavia, T. J., Inventor; Kim, S. S., Inventor; 23 Mar 05; 17 pp.; In English

Contract(s)/Grant(s): NSF-CHE-0211029

Patent Info.: Filed Filed 23 Mar 05; US-Patent-Appl-SN-11-087-841

Report No.(s): PB2007-109310; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A process is described for the synthesis of metal oxides in a nanometric particle form that cannot be easily obtained by conventional bulk synthesis techniques. The method makes use of Colloid Occluded Carbons (COC) and Colloid Imprinted Carbons (CIC) as reagents and as templating agents for the preparation of metal oxides in nanometric particle form. The nanometric particles are suitable useful in the field of chemical catalysis, particularly for petroleum refining when in porous form, and as sensors, optical wave guides, and coatings.

NTIS

*Metal Oxides; Patent Applications*

**20080025244** Lawrence Livermore National Lab., Livermore, CA USA; Cornell Univ., Ithaca, NY, USA

**Absolute Measurement of Electron Cloud Density**

Covo, M. K.; Molvik, A. W.; Cohen, R. H.; Friedman, A.; Seidl, P. A.; Jun. 22, 2007; 7 pp.; In English

Report No.(s): DE2007-910204; UCRL-CONF-232087; No Copyright; Avail.: National Technical Information Service (NTIS)

Beam interaction with background gas and walls produces ubiquitous clouds of stray electrons that frequently limit the performance of particle accelerator and storage rings. Counterintuitively we obtained the electron cloud accumulation by measuring the expelled ions that are originated from the beam-background gas interaction, rather than by measuring electrons that reach the walls. The kinetic ion energy measured with a retarding field analyzer (RFA) maps the depressed beam space-charge potential and provides the dynamic electron cloud density. Clearing electrode current measurements give the static electron cloud background that complements and corroborates with the RFA measurements, providing an absolute measurement of electron cloud density during a 5 ns duration beam pulse in a drift region of the magnetic transport section of the High-Current Experiment (HCX) at LLNL.

NTIS

*Cloud Cover; Cloud Physics; Electron Clouds; Ions; Kinetic Energy*

**20080025330** Army Research Lab., Aberdeen Proving Ground, MD USA

**A Model for Deformation and Fragmentation in Crushable Brittle Solids**

Clayton, John D; Mar 2008; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478988; ARL-RP-201; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478988>

A unified framework of continuum elasticity, inelasticity, damage mechanics, and fragmentation in crushable solid materials is presented. A free energy function accounts for thermodynamics of elastic deformation and damage, and thermodynamically admissible kinetic relations are given for inelastic rates (i.e., irreversible strain and damage evolution). The model is further specialized to study concrete subjected to ballistic loading. Numerical implementation proceeds within a finite element context in which standard continuum elements represent the intact solid and particle methods capture eroded material.

The impact of a metallic, spherical projectile upon a planar concrete target and the subsequent motion of the resulting cloud of concrete debris are simulated. Favorable quantitative comparisons are made between the results of simulations and experiments regarding residual velocity of the penetrator, mass of destroyed material, and crater and hole sizes in the target. The model qualitatively predicts aspects of the fragment cloud observed in high-speed photographs of the impact experiment, including features of the size and velocity distributions of the fragments. Additionally, two distinct methods are evaluated for quantitatively characterizing the mass and velocity distributions of the debris field, with one method based upon a local energy balance and the second based upon entropy maximization. Finally, the model is used to predict distributions of fragment masses produced during impact crushing of a concrete sphere, with modest quantitative agreement observed between results of simulation and experiment.

DTIC

*Brittleness; Crushing; Deformation; Fragmentation; Solids*

**20080025337** Battelle Pacific Northwest Labs., Richland, WA USA

**Modeling Transparent Armor Behaviors Subject to Projectile Impact**

Sun, Xin; Lai, Kevin C; Gorsich, Tara; Templeton, Douglas W; Jan 27, 2008; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC06-76RL01830

Report No.(s): AD-A479021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479021>

Design and manufacturing of transparent armor have been historically carried out using experimental approaches. In this study, we use advanced computational modeling tools to perform virtual design evaluations of transparent armor systems under different projectile impact conditions. AHPCRC developed modeling software EPIC'06 is used in predicting the penetration resistance of transparent armor systems. LaGrangian-based finite element analyses combined with particle dynamics are used to simulate the damage initiation and propagation process for the armor system under impact conditions. It is found that a 1-parameter single state model can be used to predict the impact penetration depth with relatively good accuracy, suggesting that the finely comminuted glass particles follow the behavior similar to a viscous fluid. Even though the intact strength of borosilicate and soda lime glass are different, the same fractured strength can be used for both glasses to capture the penetration depth.

DTIC

*Armor; Computerized Simulation; Glass; Impact Loads; Penetration; Projectiles; Transparence*

**20080025551** California Univ., Los Angeles, CA USA

**Timing-sync Protocol for Sensor Networks**

Ganeriwai, Saurabh; Kumar, Ram; Srivastava, Mani B; Jan 2003; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479533; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wireless ad-hoc sensor networks have emerged as an interesting and important research area in the last few years. The applications envisioned for such networks require collaborative execution of a distributed task amongst a large set of sensor nodes. This is realized by exchanging messages that are time-stamped using the local clocks on the nodes. Therefore, time synchronization becomes an indispensable piece of infrastructure in such systems. For years, protocols such as NTP have kept the clocks of networked systems in perfect synchrony. However, this new class of networks has a large density of nodes and very limited energy resource at every node; this leads to scalability requirements while limiting the resources that can be used to achieve them. A new approach to time synchronization is needed for sensor networks. In this paper, we present Timing-sync Protocol for Sensor Networks 'TPSN' that aims at providing network-wide time synchronization in a sensor network. The algorithm works in two steps. In the first step, a hierarchical structure is established in the network and then a pair wise synchronization is performed along the edges of this structure to establish a global timescale throughout the network. Eventually all nodes in the network synchronize their clocks to a reference node. We implement our algorithm on Berkeley notes and show that it can synchronize a pair of neighboring notes to an average accuracy of less than 20ms. We argue that TPSN roughly gives a 2x better performance as compared to Reference Broadcast Synchronization 'RBS' and verify this by implementing RBS on notes. We also show the performance of TPSN over small multihop networks of notes and use simulations to verify its accuracy over large-scale networks. We show that the synchronization accuracy does not degrade significantly with the increase in number of nodes being deployed,

DTIC

*Communication Networks; Protocol (Computers); Time Synchronization*

**20080025634** Wyoming Univ., Laramie, WY, USA

**Noval Composite Hydrogen-Permeable Membranes for Non-Thermal Plasma Reactors for the Decomposition of Hydrogen Sulfide. Annual Report October 1, 2005-September 30, 2006**

Argyle, M. D.; Ackerman, J. F.; Muknahallipatna, S.; Hamann, J. C.; Legowski, S.; Oct. 2006; 25 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT41963

Report No.(s): DE2007-895540; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of this experimental project is to design and fabricate a reactor and membrane test cell to dissociate hydrogen sulfide (H<sub>2</sub>S) in a non-thermal plasma and recover hydrogen (H<sub>2</sub>) through a superpermeable multi-layer membrane. Superpermeability of hydrogen atoms (H) has been reported by some researchers using membranes made of Group V transition metals (niobium, tantalum, vanadium, and their alloys), although it has yet to be confirmed in this study. Several pulsed corona discharge (PCD) reactors have been fabricated and used to dissociate H<sub>2</sub>S into hydrogen and sulfur. Visual observation shows that the corona is not uniform throughout the reactor. The corona is stronger near the top of the reactor in argon, while nitrogen and mixtures of argon or nitrogen with H<sub>2</sub>S produce stronger coronas near the bottom of the reactor. Both of these effects appear to be explainable base on the different electron collision interactions with monatomic versus polyatomic gases. A series of experiments varying reactor operating parameters, including discharge capacitance, pulse frequency, and discharge voltage were performed while maintaining constant power input to the reactor. At constant reactor power input, low capacitance, high pulse frequency, and high voltage operation appear to provide the highest conversion and the highest energy efficiency for H<sub>2</sub>S decomposition. Reaction rates and energy efficiency per H<sub>2</sub>S molecule increase with increasing flow rate, although overall H<sub>2</sub>S conversion decreases at constant power input. Voltage and current waveform analysis is ongoing to determine the fundamental operating characteristics of the reactors. A metal infiltrated porous ceramic membrane was prepared using vanadium as the metal and an alumina tube. Experiments with this type of membrane are continuing, but the results thus far have been consistent with those obtained in previous project years: plasma driven permeation or superpermeability has not been observed. A new test cell specially designed to test the membranes has been constructed to provide basic science data on superpermeability.

NTIS

*Decomposition; Hydrogen; Hydrogen Sulfide; Membranes; Sulfides; Thermal Plasmas; Thyratrons*

**20080025636** Brookhaven National Lab., Upton, NY, USA; Joint Inst. for Nuclear Research, Dubna, Russian Federation; International Atomic Energy Agency, Vienna, Austria; National Nuclear Data Center, Upton, NY, USA

**Evaluation of Tungsten Isotope in the Fast Neutron Range Including Cross-Section Covariance Estimation**

Capote, R.; Trkov, A.; Soukhovitskii, E.; Kodeli, I.; Leal, L. C.; Apr. 22, 2007; 6 pp.; In English

Contract(s)/Grant(s): DE-AC02-98CH10886

Report No.(s): DE2007-909976; BNL-78103-2007-CP; No Copyright; Avail.: National Technical Information Service (NTIS)

New evaluations for the tungsten isotopes 180,182,183,184,186W in the neutron energy range up to 60 MeV were produced. In the resonance range only minor adjustments to the resonance parameters were made due to a lack of adequate experimental data. Evaluations in the fast energy region were based on nuclear model calculations using the EMPIRE-2.19 code. Recently derived dispersive coupled-channel optical model potentials for W and Ta isotopes were instrumental to achieve a very good description of the available microscopic cross-section database. Model covariance data were generated with the Monte Carlo technique to produce a prior estimate for the covariance matrix. Experimental data were introduced through the GANDR system. The evaluated files were tested on selected fusion neutronics benchmarks and showed marked improvement compared to other existing evaluations.

NTIS

*Covariance; Fast Neutrons; Neutrons; Tungsten Isotopes; Cross Sections*

**20080025638** Brookhaven National Lab., Upton, NY, USA

**New ENDF/B-VII.0 Evaluations of Neutron Cross Sections for 32 Fission Products**

Lee, Y. O.; Herman, M.; Mughabghab, S. F.; Oblozinsly, P.; Kim, H.; Apr. 22, 2007; 6 pp.; In English

Contract(s)/Grant(s): DE-AC02-98CH10886

Report No.(s): DE2007-909978; BNL-78105-2007-CP; No Copyright; Avail.: National Technical Information Service (NTIS)

Neutron cross sections for fission products play important role not only in the design of extended burnup core and fast reactors, but also in the study of the backend fuel cycle and the criticality analysis of spent fuel. New evaluations in both the resonance and fast neutron regions were performed by the KAERI-BNL collaboration for 32 fission products. These were

95Mo, 101Ru, 103Rh, 105Pd, 109Ag, 131Xe, 133Cs, 141Pr, and complete isotope chains of 142..148;150Nd, 144;147;148..154Sm, and 156;158;160..164Dy. The evaluations cover a large amount of reaction channels, including all those needed for neutronics calculations. Also, they cover the entire energy range, from 10..5 eV to 20 MeV, including the thermal, resolved, and unresolved resonance regions, and the fast neutron region.

NTIS

*Fission Products; Neutron Cross Sections; Neutrons*

**20080025658** Brookhaven National Lab., Upton, NY, USA; International Atomic Energy Agency, Vienna, Austria; Ljubljana Univ., Ljubljana, Slovenia; Instituto Tecnológico de Aeronautica, Sao Jose dos Campos, Brazil

**Extension of the Nuclear Reaction Model Code EMPIRE to Actinides Nuclear Data Evaluation**

Capote, R.; Sin, M.; Trkov, A.; Herman, M.; Carlson, B. V.; Apr. 22, 2007; 6 pp.; In English

Contract(s)/Grant(s): DE-AC02-98CH10886

Report No.(s): DE2007-909979; BNL-78106-2007-CP; No Copyright; Avail.: National Technical Information Service

(NTIS)

Recent extensions and improvements of the EMPIRE code system are outlined. They add new capabilities to the code, such as prompt fission neutron spectra calculations using Hauser-Feshbach plus preequilibrium pre-fission spectra, cross section covariance matrix calculations by Monte Carlo method, fitting of optical model parameters, extended set of optical model potentials including new dispersive coupled channel potentials, parity-dependent level densities and transmission through numerically defined fission barriers. These features, along with improved and validated ENDF formatting, exclusive/inclusive spectra, and recoils make the current EMPIRE release a complete and well validated tool for evaluation of nuclear data at incident energies above the resonance region. The current EMPIRE release has been used in evaluations of neutron induced reaction files for 232Th and 231,233Pa nuclei in the fast neutron region at IAEA. Triple-humped fission barriers and exclusive pre-fission neutron spectra were considered for the fission data evaluation. Total, fission, capture and neutron emission cross section, average resonance parameters and angular distributions of neutron scattering are in excellent agreement with the available experimental data.

NTIS

*Actinide Series; Nuclear Reactions*

**20080025659** National Nuclear Data Center, Upton, NY, USA; Brookhaven National Lab., Upton, NY, USA

**New ENDF/B-VII.0 Library**

Oblozinsky, P.; Apr. 22, 2007; 8 pp.; In English

Contract(s)/Grant(s): DE-AC02-98CH10886

Report No.(s): DE2007-909980; BNL-78107-2007-CP; No Copyright; Avail.: National Technical Information Service

(NTIS)

We describe the new version of the Evaluated Nuclear Data File, ENDF/B-VII.0, of recommended nuclear data for advanced nuclear science and technology applications. The library, produced by the U.S. Cross Section Evaluation Working Group, was released in December 2006. The library contains data in 14 sublibraries, primarily for reactions with incident neutrons, protons and photons, based on the experimental data and nuclear reaction theory predictions. The neutron reaction sublibrary contains data for 393 materials. The new library was extensively tested and shows considerable improvements over the earlier ENDF/B-VI.8 library.

NTIS

*Libraries; Neutron Cross Sections; Neutrons*

**20080025660** National Nuclear Data Center, Upton, NY, USA

**Nuclear Science References Coding Manual. Revision 05/07**

Winchell, D. F.; May 24, 2007; 42 pp.; In English

Report No.(s): DE2007-909981; No Copyright; Avail.: Department of Energy Information Bridge

This manual is intended as a guide for Nuclear Science References (NSR) compilers. The basic conventions followed at the National Nuclear Data Center (NNDC), which are compatible with the maintenance and updating of and retrieval from the Nuclear Science References (NSR) file, are outlined.

NTIS

*Coding; Compilers; Data Bases; Information Retrieval*

**20080025661** Fermi National Accelerator Lab., Batavia, IL, USA; Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

**Muon Bunch Coalescing**

Johnson, R. P.; Ankenbrandt, C.; Bhat, C.; Popovic, M.; Bogacz, S. A.; Jun. 25, 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-FG02-05ER86253; DE-AC05-06OR231747

Report No.(s): DE2007-910021; JLAB-ACP-07-661; DOE/OR/23177-0090; No Copyright; Avail.: National Technical Information Service (NTIS)

The idea of coalescing multiple muon bunches at high energy to enhance the luminosity of a muon collider provides many advantages. It circumvents space-charge, beam loading, and wakefield problems of intense low energy bunches while restoring the synergy between muon colliders and neutrino factories based on muon storage rings. A sampling of initial conceptual design work for a coalescing ring is presented here.

NTIS

*Coalescing; Luminosity; Muons*

**20080025685** Fermi National Accelerator Lab., Batavia, IL, USA; California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA; Renaissance Technologies, Inc., Newtown, PA, USA; Wisconsin State Univ., Eau Claire, WI, USA

**Open Science Grid**

Pordes, R.; Petravick, D.; Kramer, B.; Olson, D.; Livny, M.; Jul. 17, 2007; 15 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-910187; FERMILAB-CONF-07-217-CD; No Copyright; Avail.: National Technical Information Service (NTIS)

The Open Science Grid (OSG) provides a distributed facility where the Consortium members provide guaranteed and opportunistic access to shared computing and storage resources. OSG provides support for and evolution of the infrastructure through activities that cover operations, security, software, troubleshooting, addition of new capabilities, and support for existing and engagement with new communities. The OSG SciDAC-2 project provides specific activities to manage and evolve the distributed infrastructure and support its use. The innovative aspects of the project are the maintenance and performance of a collaborative (shared & common) petascale national facility over tens of autonomous computing sites, for many hundreds of users, transferring terabytes of data a day, executing tens of thousands of jobs a day, and providing robust and usable resources for scientific groups of all types and sizes.

NTIS

*Computer Storage Devices; Data Base Management Systems; Security; Autonomy*

**20080025687** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Precision Determination of the Top Quark Mass**

Fernandez, P. A. M.; May 01, 2007; 14 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-910191; FERMILAB-CONF-07-138-E; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

*Precision; Quarks*

**20080025762** Knobbe Martens Olson and Bear, LLP, Irvine, CA, USA

**Method of Forming Nitrogen and Phosphorus Doped Amorphous Silicon as Resistor for Field Emission Display Device Baseplate**

Raina, K. K., Inventor; Moradi, B., Inventor; 27 Jun 05; 10 pp.; In English

Contract(s)/Grant(s): DARPA-DABT63-97-C-0001

Patent Info.: Filed Filed 27 Jun 05; US-Patent-Appl-SN-11-167-695

Report No.(s): PB2007-110578; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Described herein is a resistor layer for use in field emission display devices and the like, and its method of manufacture. The resistor layer is an amorphous silicon layer doped with nitrogen and phosphorus. Nitrogen concentration in the resistor layer is preferably between about 5 and 15 atomic percent. The presence of nitrogen and phosphorus in the silicon prevents diffusion of Si atoms into metal conductive layers such as aluminum, even up to diffusion and packaging temperatures. The nitrogen and phosphorus also prevent defects from forming at the boundary between the resistor layer and metal conductor.

This leads to better control over shorting and improved resistivity in the resistor.

NTIS

*Amorphous Materials; Amorphous Silicon; Display Devices; Field Emission; Nitrogen; Patent Applications; Phosphorus; Resistors; Silicon*

**20080025796** Pietragallo, Botic and Gordon, Pittsburgh, PA, USA; Seagate Technology, LLC, Scotts Valley, CA, USA

**Light Delivery Technique for Heat Assisted Magnetic Recording Head**

Gomez, K. A., Inventor; Challener, W. A., Inventor; Shivarama, R. A., Inventor; Chu, P. B., Inventor; 26 May 04; 14 pp.; In English

Contract(s)/Grant(s): NIST-70NANB1H3056

Patent Info.: Filed Filed 26 May 04; US-Patent-Appl-SN-10-854-564

Report No.(s): PB2007-110622; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A suspension arm for an optical transducer comprises a load beam, a slider coupled to the load beam by a gimbal assembly and including an optical transducer positioned adjacent to an end of the slider facing a pivot point of the suspension arm, and an optical fiber for transmitting light toward the transducer, wherein an end of the optical fiber is positioned adjacent to the transducer such that light emitted from the fiber passes directly to the transducer. Disc drives that include the suspension arm, and a method of transmitting light to an optical transducer, are also included.

NTIS

*Magnetic Recording; Patent Applications; Recording Heads*

**20080025834** Lawrence Livermore National Lab., Livermore, CA USA

**Compact Imaging Spectrometer Utilizing an Immersed Grating and Anamorphic Mirror**

Lerner, S. A., Inventor; 11 May 04; 6 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed Filed 11 May 04; US-Patent-Appl-SN-10-844-086

Report No.(s): PB2007-110616; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A compact imaging spectrometer comprising an entrance slit, an anamorphic mirror, a grating, and a detector array. The entrance slit directs light to the anamorphic mirror. The anamorphic mirror receives the light and directs the light to the grating. The grating receives the light from the anamorphic mirror and deflects the light back onto the anamorphic mirror. The anamorphic mirror focuses the light onto a detector array.

NTIS

*Imaging Spectrometers; Mirrors; Patent Applications; Spectrometers*

**20080025849** Ladas and Parry, Los Angeles, CA, USA

**Near Field Scanning Microscope Probe and Method for Fabricating Same**

Baehr-Jones, T., Inventor; Hochberg, M. J., Inventor; Scherer, A., Inventor; 26 Apr 05; 12 pp.; In English

Contract(s)/Grant(s): FA-9550-04-1-0413

Patent Info.: Filed Filed 26 Apr 05; US-Patent-Appl-SN-11-116-111

Report No.(s): PB2007-110604; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A near-field scanning microscopy probe and a method for doing the same. A metal plasmon or dielectric waveguide is connected to a deformable material and coupled to a dielectric waveguide on a chip. The probe pops up out of the plane of the chip. The probe can be easily integrated with standard on-chip optical components.

NTIS

*Fabrication; Microscopy; Near Fields; Patent Applications; Scanners*

**20080025891** Fermi National Accelerator Lab., Batavia, IL, USA

**Simulations of the Electron Cloud Buildups andSuppressions in Tevatron and Main Injector**

Zhang, X.; Ostiguy, J.; Chou, W.; January 2007; 3 pp.; In English

Report No.(s): DE2007-910184; FERMILAB-CONF-07-215-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

To assess the effects of the electron cloud on Main Injector intensity upgrades, simulations of the cloud buildup were carried out using POSINST and compared with ELOUD. Results indicate that even assuming an optimistic 1.3 maximum secondary electron yield, the electron cloud remains a serious concern for the planned future operational mode with 500



bunches,  $3e11$  proton per bunch. Electron cloud buildup can be mitigated in various ways. We consider a plausible scenario involving solenoids in straight section and a single clearing strip electrode (like SNEG in Tevatron) held at a potential of 500V. Simulations with parameters corresponding to Tevatron and Main Injector operating conditions at locations where special electron cloud detectors have been installed have been carried out and are in satisfactory agreement with preliminary measurements.

NTIS

*Electron Clouds; Injectors; Particle Accelerators; Retarding; Simulation*

**20080025893** Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel; Old Dominion Coll., Norfolk, VA, USA; Clermont-Ferrand Univ., France; Pennsylvania State Univ., University Park, PA, USA

**Rapidity Gap Survival in the Black-Disk Regime**

Frankfurt, L.; Hyde, C. E.; Strikman, M.; Weiss, C.; January 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC05-06OR23177

Report No.(s): DE2007-912622; No Copyright; Avail.: Department of Energy Information Bridge

We summarize how the approach to the black-disk regime (BDR) of strong interactions at TeV energies influences rapidity gap survival in exclusive hard diffraction  $pp \rightarrow p + H + p$  ( $H = \text{dijet, } Q\bar{Q}, \text{ Higgs}$ ). Employing a recently developed partonic description of such processes, we discuss (a) the suppression of diffraction at small impact parameters by soft spectator interactions in the BDR; (b) further suppression by inelastic interactions of hard spectator partons in the BDR; (c) correlations between hard and soft interactions. Hard spectator interactions substantially reduce the rapidity gap survival probability at LHC energies compared to previously reported estimates.

NTIS

*Gluons; Survival; Particle Theory; Probability Theory*

**20080025894** Fermi National Accelerator Lab., Batavia, IL, USA

**Technique for Monitoring Fast Tuner Piezoactuator Preload Forces for Superconducting RF Cavities**

Pischalnikov, Y.; Branlrd, J.; Carcagno, R.; Carcagno, B.; Chase, B.; January 2007; 4 pp.; In English

Report No.(s): DE2007-912639; FERMILAB-CONF-07-226-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

The technology for mechanically compensating Lorentz Force detuning in superconducting RF cavities has already been developed at DESY. One technique is based on commercial piezoelectric actuators and was successfully demonstrated on TESLA cavities. Piezo actuators for fast tuners can operate in a frequency range up to several kHz; however, it is very important to maintain a constant static force (preload) on the piezo actuator in the range of 10 to 50% of its specified blocking force. Determining the preload force during cool-down, warm-up, or re-tuning of the cavity is difficult without instrumentation, and exceeding the specified range can permanently damage the piezo stack. A technique based on strain gauge technology for superconducting magnets has been applied to fast tuners for monitoring the preload on the piezoelectric assembly. The design and testing of piezo actuator preload sensor technology is discussed. Results from measurements of preload sensors installed on the tuner of the Capture Cavity II (CCII) tested at FNAL are presented. These results include measurements during cool-down, warm-up, and cavity tuning along with dynamic Lorentz force compensation.

NTIS

*Cavities; Piezoelectric Actuators; Prestressing; Radio Frequencies; Superconducting Cavity Resonators; Superconductivity; Tuners*

**20080025914** Fermi National Accelerator Lab., Batavia, IL, USA

**Multipactor Simulations in Superconducting Cavities**

Goonin, I.; Solyak, N.; deFord, J.; Held, B.; January 2007; 3 pp.; In English

Report No.(s): DE2007-912638; FERMILAB-CONF-07-233-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

The multipactor (MP) is a well-known phenomenon. The existence of resonant trajectories can lead to electron avalanche under certain field levels and surface conditions, and can limit the performance of high power superconducting (SC) radio-frequency (RF) devices. In this paper we describe features of the ANALYST particle tracking code PT3P developed for MP simulations in real 3D RF structures, such as cavities, couplers, RF windows etc. Also we present the results of MP

simulations in HOM couplers of TESLA, SNS and FNAL 3rd harmonic cavities. We discuss the comparison of simulations with experimental results.

NTIS

*Cavities; Simulation; Superconducting Cavity Resonators; Superconductivity*

**20080025946** Florida State Univ., Tallahassee, FL, USA

**Photo-Production of Proton Antiproton Pairs**

Eugenio, P.; Stokes, B.; January 2007; 3 pp.; In English

Report No.(s): DE2007-912628; No Copyright; Avail.: Department of Energy Information Bridge

Results are reported on the reaction  $\gamma p \rightarrow p\bar{p}$ . A high statistic data set was obtained at the Thomas Jefferson National Accelerator Facility utilizing the CLAS detector and a tagged photon beam of 4.8 to 5.2 GeV incident on a liquid hydrogen target. The focus of this study was to search for possible intermediate resonances which decay to proton-antiproton. Both final state protons were detected in the CLAS apparatus whereas the antiproton was identified via missing mass. General features of the data are presented along with results on narrow and broad resonance studies.

NTIS

*Antiprotons; Proton-Antiproton Interactions; Protons; Liquid Hydrogen*

## 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*.

**20080023951** NASA Langley Research Center, Hampton, VA, USA

**Effects of Diffraction and Dispersion on Acoustic Radiation-Induced Static Pulses**

Cantrell, John H.; June 13, 2008; 14 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.07.01; No Copyright; Avail.: Other Sources

It is shown that the shapes of acoustic radiation-induced static strain and displacement pulses are defined locally by the energy density of the generating waveform and that diffraction and attenuation produce dramatic changes in the shape of static displacement pulses when using laser detection. The effects of dispersion on static pulses are obtained by including a dispersive term in the phase of the particle velocity solution to the nonlinear wave equation. The dispersion causes an evolutionary change in the shape of the energy density profile that leads to the generation of solitons experimentally observed in fused silica.

Author

*Dispensing; Diffraction; Sound Waves; Flux Density; Waveforms; Nonlinear Equations; Wave Equations*

**20080023985** Naval Research Lab., Bay Saint Louis, MS USA

**Ambient Noise Measurements in Mississippi Sound**

Newcomb, Joal J.; Stanic, Steve; Cranford, Alexandra; Vanderpool, Delphine; Solangi, Mobashir A; Mar 21, 2008; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478674; NRL/MR/7185--08-9117; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the spring, summer, and fall of 2004, underwater ambient noise measurements were conducted in the Mississippi Sound. The Naval Research Laboratory, Stennis Space Center (NRL--Stennis) and the Institute for Marine Mammal Studies (IMMS) collaborated in acquiring acoustic ambient noise data at eight (8) sites in the Mississippi Sound. The sites were chosen to represent sites of expected high anthropomorphic noise sources and a control site with few or no expected anthropomorphic noise sources.

DTIC

*Acoustics; Ambience; Noise (Sound); Noise Measurement; Sounds (Topographic Features); Underwater Acoustics*

**20080024023** Mississippi Univ., University, MS USA

**Advances in Acoustic Landmine Detection**

Sabatier, James A; Oct 1, 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0878; DAAB15-02-C-0024

Report No.(s): AD-A478728; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Mines (Ordnance); Sound Detecting and Ranging; Vibration*

**20080024042** Swedish Defence Research Establishment, Linköping, Sweden

**Robust Fusion of Multiple Microphone and Geophone Arrays in a Ground Sensor Network**

Lindgren, D; Habberstad, H; Holmberg, M; Lauberts, A; Oct 1, 2006; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478760; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Microphones; Multisensor Fusion; Networks; Seismology*

**20080024043** Defence Science and Technology Organisation, Edinburgh, Australia

**Detection and Localisation of a Ground Based Impulsive Sound Source using Acoustic Sensors Onboard a Tactical Unmanned Aerial Vehicle**

Ferguson, Brian G; Wyber, Ron J; Oct 1, 2006; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478761; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Acoustics; Drone Vehicles; Pilotless Aircraft; Position (Location); Signal Detectors; Surveillance*

**20080024049** Mississippi Univ., University, MS USA

**Advances in Technology to Support Battlefield Acoustic Sensing**

Bass, Henry E; Oct 2006; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478766; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Detection; Doppler Effect; Laser Applications; Vibrational Spectra*

**20080024053** 01dB-METRAVIB, Limonest, France

**Acoustic Sensing for Area Protection**

Baligand, B; Millet, J; Oct 1, 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478773; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Acoustics; Detection; Ear Protectors; Security; Signal Detectors; Target Recognition*

**20080024067** Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA

**Reliable Classification of High Explosive and Chemical/Biological Artillery Using Acoustic Sensors**

Hohil, Myron E; Desai, Sachi; Morcos, Amir; Oct 1, 2006; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478793; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Acoustics; Artillery; Biochemistry; Biological Effects; Classifications; Detection; Signal Detectors*

**20080024068** Mississippi Univ., University, MS USA

**Ultrasonic Methods for Human Motion Detection**

Sabatier, James M; Ekimov, Alexander E; Oct 1, 2006; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478795; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Signal Transmission; Sound Waves; Ultrasonics*

**20080025300** Naval Postgraduate School, Monterey, CA USA

**On the Impacts and Benefits of Implementing Full-Duplex Communications Links in an Underwater Acoustic Network**

Gibson, J; Larraza, A; Rice, J; Smith, K; Xie, G; Apr 2002; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NSF-ANI-0114014

Report No.(s): AD-A478925; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478925>

Acoustic signals offer a means of establishing wireless networks in shallow water regions. These networks may provide command and control for autonomous underwater vehicles, forward reporting by arrays of sensor grids, ad hoc communications links to covert forces, or positive control of unmanned, forward-deployed weapons systems. However, the capacity limitations and extreme propagation delays of acoustic communications must be addressed to ensure timely, predictable message delivery. This paper presents the status of current experimentation at the Naval Postgraduate School regarding the viability of full-duplex underwater acoustic communications. As implementation of full-duplex links requires partitioning the total capacity into distinct sub-channels, the paper presents a top-level description and specification of a capacity allocation protocol to mitigate the adverse impacts of such a partitioning when system load is light.

DTIC

*Communication Networks; Duplexers; Signal Transmission; Sound Waves; Underwater Acoustics; Underwater Communication*

**20080025323** 01dB-METRAVIB, Limonest, France

**Latest Achievements in Gunfire Detection Systems**

Millet, J; Baligand, B; Oct 2006; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478974; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478974>

No abstract available

*Acoustics; Detection; Gunfire; Ordnance; Signal Detectors*

**20080025340** Naval Academy, Annapolis, MD USA

**Nonlinear Acoustic Techniques for Land Mine Detection**

Korman, Murray S; Sabatier, James M; Apr 2002; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479046>

When airborne sound couples into the ground seismic waves can interact with a target buried in the soil and effect the vibration velocity of the surface. Acoustic-to-seismic coupling (using linear acoustic techniques) has proven to be an extremely accurate technology for locating buried land mines [J. M. Sabatier and N. Xiang, IEEE Trans. Geoscience and Remote Sensing 39, 1146-1154 (2001)] . Donskoy [SPIE Proceedings 3392, 211-217 (1998); 3710, 239-246 (1999)] has suggested a nonlinear technique that can detect an acoustically compliant buried mine that is insensitive to relatively noncompliant targets. (Utilizing both techniques could eliminate certain types of false alarms.) Airborne sound at two primary frequencies  $f_1$  and  $f_2$  undergo acoustic-to-seismic coupling and a superimposed seismic wave interacts with the compliant mine and soil to generate a difference frequency component that can effect the vibration velocity at the surface. Geophone measurements scanning the soil's surface at the difference frequency (chosen at a resonance) profile the mine with more relative sensitivity than the linear profiles - but off the mine some nonlinearity exists. Amplitude dependent frequency response curves for a harmonically driven mass-soil oscillator are used to find the nonlinearity of the soil acting as a 'soft' spring. Donskoy's nonlinear mechanism (over the mine) involves a simple model of the top surface of the mine-soil planar surface separating two elastic surfaces. During the compression phase of the wave, the surfaces stay together and then separate under the tensile phase due to a relatively high compliance of the mine. This 'bouncing' soil-mine interface is thought to be a bi-modular oscillator that is inherently nonlinear.

DTIC

*Acoustics; Mine Detectors; Mines (Ordnance); Nonlinearity*

**20080025341** Thales Underwater Systems, Sophia-Antipolis, France

**Acoustic/Seismic Ground Sensors for Detection, Localization and Classification on the Battlefield**

Lemer, Alain; Ywanne, Frederique; Oct 1, 2006; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479047>

No abstract available

*Acoustics; Antisubmarine Warfare; Classifications; Position (Location); Signal Detectors*

**20080025358** Naval Postgraduate School, Monterey, CA USA

**Effect of Suspended Sediment on Acoustic Detection Using Reverberation**

Chu, Peter C; Cornelius, Michael; Wagstaff, Mel; Jan 2005; 6 pp.; In English

Report No.(s): AD-A479143; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479143>

Sonar operates by ensonifying a broad swath of the seabed using a line array of acoustic projectors with acoustic backscattering from the ensonified sediment. The suspended sediment layer affects the sonar imagery through the volume scattering strength. Understanding the acoustic characteristics of the suspended sediment layer can aid the Navy in detecting sea mines with sonar imagery. In this study, the Navy's Comprehensive Acoustic Simulation System is used to investigate such an effect. A range of critical values of volume scattering strength for buried object detection is found through repeated model simulations.

DTIC

*Reverberation; Sediments; Sound Detecting and Ranging*

**20080025359** Florida State Univ., Tallahassee, FL USA

**A CAA Primer for Practicing Engineers**

Tam, Christopher; Apr 2008; 163 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): ATA-06-18; ATA-07-288

Report No.(s): AD-A479146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479146>

This is a CAA (computational aeroacoustics) primer written specifically for AEDC. This is not a document written for research in CAA. It is to be a user's guide for practicing engineers who have responsibilities of solving (through prediction) or resolving (through better understanding) aeroacoustics problems by extensive computation. Oftentimes established codes that may or may not have been designed for aeroacoustics applications are used. For this reason the accuracy and validity of the computed solution may be in question. In this situation this document serves to provide a reference to a proper CAA approach. CAA problems are very different from CFD (computational fluid dynamics) problems. In some situations special CAA treatments are required that are not encountered in CFD. Such methods are therefore not available in standard CFD or numerical analysis references. This document is to offer a discussion of a variety of CAA methods most of which are developed only relatively recently.

DTIC

*Aerodynamic Noise; Engineers*

**20080025456** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Radiator Cap Tool**

Adamczyk, Walter D, Inventor; Chopra, Kewal K, Inventor; Mar 9, 2004; 7 pp.; In English

Report No.(s): AD-D020348; PATENT-6 701-810 B2; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020348>

A radiator cap tool for removing a radiator cap comprising a base member that has at least two axially aligned rectangular apertures. A socket drive is disposed on one side to receive the drive portion of a socket handle. Two detents are disposed in the apertures extending orthogonally from the base member to form a gap on the side of the base member opposite the socket drive member. The detents are adjustable to vary the gap between the detents for use on various sized caps.

DTIC

*Acoustics; Patents; Signal Detectors*

**20080025492** Naval Submarine Medical Research Lab., Groton, CT USA

**Underwater and Dive Station Work-Site Noise Surveys**

Wolgemuth, Keith S; Cudahy, Edward A; Schwaller, Derek W; Mar 14, 2008; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479304; NSMRL/50204/TR--2008-1255; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Previous work performed by the Naval Submarine Medical Research Laboratory (NSMRL) had developed in-water permissible continuous noise exposure guidance Work performed by the Navy Experimental Diving Unit (NEDU) measuring in-water noise levels produced by in-water tools to develop permissible exposure levels based upon applying in- air guidance and temporary threshold shift (TTS) data This study extends this previous work by obtaining in-water and in-air noise measurements and a total noise dose for Navy divers during actual diving operations using a portable sound level meter system capable of both in-water and in-air measurements Noise measurements were used to calculate Navy Occupational Exposure Limits (NOEL) and doses for both helmeted and Self-Contained Underwater Breathing Apparatus (SCUBA) divers The results of both in-water and in-air measurements were used to calculate total noise dose and these dosages were compared to existing guidance.

DTIC

*Surveys*

**20080025498** Washington Univ., Seattle, WA USA

**Baleen Whale Acoustic Activity in the North Pacific: Historical Analysis and Current Occurrence**

Stafford, Kathleen M; Dec 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00024-02-D-6602

Report No.(s): AD-A479320; XB-ERD(N45); No Copyright; Avail.: Defense Technical Information Center (DTIC)

Unclassified historic acoustic data were used to examine long time scale changes in the seasonal and geographic occurrence of large whales in the Pacific and to correlate these changes with oceanographic variables such as sea surface temperature, chlorophyll alpha, etc. Distribution of northeastern Pacific blue whales (as indicated by the numbers of their calls), while insignificantly related to SST, did show a clear seasonal pattern both to chl alpha concentration (negative) and to the mixed layer depth (positive). It was speculated that the negative correlation with chl a might be due to a lag from primary to secondary productivity: as phytoplankton are eaten by zooplankton (which in turn become available to whales), the overall amount of chl alpha decreases. It is recommended that in collaboration with other agencies hydrophones be deployed in the northeastern Gulf of Alaska to provide current information on the occurrence of vocally active whale species, including low-requency baleen whales and higher frequency odontocetes. A likely time might be during the Northern Edge 2008 exercise in Prince William Sound. Meanwhile, a new efficient, low-power, low-cost recorder that can be easily deployed, in an array with other instruments or independently, from a mid-size vessel is being developed.

DTIC

*Acoustic Properties; Detection; Histories; Pacific Ocean; Whales*

**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*.

**20080024030** California Univ., Irvine, CA USA

**Quantum Computing and Control by Optical Manipulation of Molecular Coherences: Towards Scalability**

Apkarian, V A; Sep 14, 2007; 12 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0186

Report No.(s): AD-A478736; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Principles of quantum computing using molecular vibronic states and time-frequency resolved coherent anti-stokes Raman scattering (TFRCARS) were demonstrated through, and the execution of standard algorithms were elaborated along with measures of fidelity. These proof-of-principle implementations are on ensembles of molecules in the gas phase, unlikely to be a realistic architecture in practical implementations. We have therefore focused on solid-state implementations of the same, where now the understanding and control of decoherence of systems in intimate contact with their surrounding environment is the key scientific challenge. Very significant progress in this regard has been made in, (a) developing the tools

to probe quantum coherence and decoherence of vibronic states in phase space, (b) developing semi-classical methods for the analysis of the mechanics of decoherence, (c) demonstrating mesoscopic coherence ('cat'-states) and complete arrest of decoherence in stationary non-eigenstates prepared by environmentally induced coherence. Also, significant progress has been made in approaching the single molecule limit in TFRCARS implementations - a crucial step in considering scalable quantum computing using the molecular Hilbert space and nonlinear optics.

DTIC

*Quantum Computation; Vibration*

**20080024055** Budapest Univ. of Technology and Economics, Budapest, Hungary

**Dynamic Spectrum Allocation using Regional Spectrum Brokers**

Kovacs, Laszlo; Vidacs, Attila; Oct 1, 2006; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478775; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Allocations; Communication Networks; Spectra; Telecommunication*

**20080024077** Defence Science Technology Lab., Malvern, UK

**Spectrum Situational Awareness Capability: The Military Need and Potential Implementation Issues**

Howland, Paul; Farquhar, Stuart; Madahar, Bob; Oct 1, 2006; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478819; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Situational Awareness; Spectra; Telecommunication*

**20080025511** Georgia Inst. of Tech., Atlanta, GA USA

**Nanojets: Electrification, Energetics, Dynamics, Stability and Breakup**

Landman, Uzi; Nov 2007; 53 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0420

Report No.(s): AD-A479351; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research during this 6 month grant was devoted to finalizing our work on the effect of electric fields on dielectric nanodroplets, as may be found during the breakup of electrified nanojets and colloidal thrusters. In our extensive molecular dynamics simulation, performed for a 10nm droplet made of formamide molecules, the response of the nano-droplet to uniform electric fields was explored.

DTIC

*Electrification; Electrohydrodynamics; Molecular Dynamics; Stability*

## 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*.

**20080023962** Chicago Univ., Chicago, IL USA

**Experimental Investigation of Rapid Interface Dynamics in Particulate Media**

Jaeger, Heinrich M; Feb 28, 2008; 8 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0459; Proj-F1ATA07123B008

Report No.(s): AD-A478647; FPR-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research investigated nonlinear structural deformations driven by dynamic coupling of mechanical and fluid components in particulate media. The understanding of such deformations is of importance for the performance of Air Force systems. In particular, the interactions with the interstitial fluid, typically air, have been largely neglected in prior studies, yet are likely to become important at high strain rates. Using non-invasive high-speed x-ray and video imaging techniques, the dynamics of rapidly moving interfaces in three-dimensional particulate systems were tracked. Key research objectives achieved were (a) the development of quantitative x-ray radiography techniques for tracking the local packing density variations inside granular beds, (b) the detailed characterization of the interactions between moving interface, particulate bed

material and interstitial gas, and (c) the measurement of the drag experienced by fast-moving objects inside fine-grained granular beds both in the presence and the absence of interstitial gas.

DTIC

*Deformation; Particulates*

**20080025021** Library of Congress, Washington, DC USA

**U.S. Nuclear Cooperation with India: Issues for Congress**

Kerr, Paul K.; Feb 12, 2008; 40 pp.; In English

Report No.(s): AD-A478794; CRS-RL33016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

India and the USA announced July 27, 2007, that they had reached agreement on the text of a nuclear cooperation agreement. Since then, New Delhi and the International Atomic Energy Agency (IAEA) have met four times to formulate a nuclear safeguards agreement. Such an agreement is required by P.L. 109-401, the Henry J. Hyde USA-India Peaceful Atomic Energy Cooperation Act of 2006, which President Bush signed into law December 18, 2006. In his signing statement, President Bush noted that the act will strengthen the strategic relationship between the USA and India. With respect to particular provisions, President Bush stated that the executive branch would construe two sections of the bill as advisory only: policy statements in Section 103 and the restriction contained in Section 104 (d) (2) on transferring items to India that would not meet NSG guidelines. On the first, the President cited the Constitution's commitment to the presidency of the authority to conduct the Nation's foreign affairs; on the second, the President raised the question of whether the provision unconstitutionally delegated legislative power to an international body. In other words, the President was questioning whether Congress were ceding authority to approve U.S. exports to the Nuclear Suppliers Group. However, U.S. officials, including Secretary of State Rice, have formally told Congress multiple times that the USA government would abide by NSG guidelines. The President's signing statement also noted that the executive branch would construe provisions of the Act that mandate, regulate, or prohibit submission of information to the Congress, an international organization, in a manner consistent with the President's constitutional authority to protect and control information that could impair foreign relations, national security, the deliberative processes of the Executive, or the performance of the Executive's constitutional duties.

DTIC

*United States; Nuclear Electric Power Generation; India*

**20080025196** Lawrence Livermore National Lab., Livermore, CA USA

**Web-Based Nuclear Criticality Safety Bibliographic Database**

Koponen, B. L.; Huang, S.; Feb. 23, 2007; 6 pp.; In English

Report No.(s): DE2007-909650; UCRL/CONF-228312; No Copyright; Avail.: Department of Energy Information Bridge

A bibliographic criticality safety database of over 13,000 records is available on the Internet as part of the U.S. Department of Energy's (DOE) Nuclear Criticality Safety Program (NCSP) website. This database is easy to access via the Internet and gets substantial daily usage. The database enables users worldwide to locate nuclear criticality publications including, for example: Critical and sub critical experiments and their use in code validation; Criticality accidents and emergency response; Criticality standards and methodology; Evaluation methods including computer codes or hand calculations; Nuclear criticality safety theory and practice; and Evaluations of the International Criticality Safety Benchmark Evaluation Project (ICSBEP).

NTIS

*Bibliographies; Data Bases; Radiation Protection; Safety*

**20080025246** Lawrence Livermore National Lab., Livermore, CA USA

**Airbreathing Acceleration Toward Earth Orbit**

Whitehead, J. C.; Jul. 08, 2007; 7 pp.; In English

Report No.(s): DE2007-910206; UCRL-CONF-230882; No Copyright; Avail.: Department of Energy Information Bridge

As flight speed increases, aerodynamic drag rises more sharply than the availability of atmospheric oxygen. The ratio of oxygen mass flux to dynamic pressure cannot be improved by changing altitude. The maximum possible speed for airbreathing propulsion is limited by the ratio of air capture area to vehicle drag area, approximately Mach 6 at equal areas. Simulation of vehicle acceleration shows that the use of atmospheric oxygen offers a significant potential for minimizing onboard consumables at low speeds. These fundamental calculations indicate that a practical airbreathing launch vehicle would accelerate to near steady-state speed while consuming only onboard fuel, then transition to rocket propulsion. It is suggested



that an aircraft carrying a rocket-propelled vehicle to approximately Mach 5 could be a realistic technical goal toward improving access to orbit.

NTIS

*Air Breathing Boosters; Air Breathing Engines; Earth Orbits; Rocket Vehicles; Rocket-Based Combined-Cycle Engines*

**20080025517** Library of Congress, Washington, DC USA

**Managing the Nuclear Fuel Cycle: Policy Implications of Expanding Global Access to Nuclear Power**

Nikitin, Mary B; Parillo, Jill M; Squassoni, Sharon; Jan 20, 2008; 47 pp.; In English

Report No.(s): AD-A479369; No Copyright; Avail.: Defense Technical Information Center (DTIC)

After several decades of decline and disfavor, nuclear power is attracting renewed interest. New permit applications for 30 reactors have been filed in the USA, and another 150 are planned or proposed globally, with about a dozen more already under construction. In the USA, interest appears driven, in part, by provisions in the 2005 Energy Policy Act authorizing streamlined licensing that combine construction and operating permits, and tax credits for production from advanced nuclear power facilities. Moreover, the U.S. Department of Energy proposes to spend billions of dollars to develop the next generation of nuclear power technology.

DTIC

*Law (Jurisprudence); Nuclear Fuels; Nuclear Power Plants; Policies*

**20080025637** Brookhaven National Lab., Upton, NY USA; International Atomic Energy Agency, Vienna, Austria

**Deformation Dependent TUL Multi-Direct Model**

Wienke, H.; Capote, R.; Herman, M.; Sin, M.; Apr. 22, 2007; 6 pp.; In English

Contract(s)/Grant(s): DE-AC02-98CH10886

Report No.(s): DE2007-909977; BNL-78104-2007-CP; No Copyright; Avail.: Department of Energy Information Bridge

The Multi-Step Direct (MSD) module TRISTAN in the nuclear reaction code EMPIRE has been extended in order to account for nuclear deformation. The new formalism was tested in calculations of neutron emission spectra emitted from the  $^{232}\text{Th}(n,xn)$  reaction. These calculations include vibration-rotational Coupled Channels (CC) for the inelastic scattering to low-lying collective levels, deformed MSD with quadrupole deformation for inelastic scattering to the continuum, Multi-Step Compound (MSC) and Hauser-Feshbach with advanced treatment of the fission channel. Prompt fission neutrons were also calculated. The comparison with experimental data shows clear improvement over the spherical MSD calculations and JEFF-3.1 and JENDL-3.3 evaluations.

NTIS

*Deformation; Nuclear Deformation*

**20080025876** Army Lab. Command, White Sands Missile Range, NM USA

**Single Scattering Code AGAUSX: Theory, Applications, Comparisons, and Listing**

Shirkey, Richard C; Miller, August; Goedecke, George H; Behl, Yugal K; Jul 1980; 192 pp.; In English

Report No.(s): AD-A479561; ASL-TR-0062; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the overall running time of Mie codes may be greatly reduced by reducing the number of particle sizes treated, it is desirable to have a code in which one may specify an acceptable level of accuracy and which then uses only as many particle radius values as are needed to satisfy that requirement; AGAUSX is such a code. The user of AGAUSX can specify a 'convergence' level which represents the minimum fractional accuracy that is acceptable for certain results of a run. Other capabilities offered by AGAUSX include provisions for (1) producing phase functions, scattering fractions or an analytic phase function; (2) cycling over a range of wavelengths; (3) treating changes in hygroscopic particle sizes; (4) treating multicomponent aerosols differing in specific gravity and/or optical properties; (5) options whereby users can either input particle number density or mass density and mass concentration; (6) various size distribution models; and (7) automatic look up and/or interpolation of optical constants for liquid water. A comparison of AGAUSX with other Mie codes is also presented.

DTIC

*Aerosols; Scattering*

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*.

**20080023725** Dunlap, Coddling and Rogers, P.C, Oklahoma, OK, USA

**Nanoparticle Optical Storage Apparatus and Methods of Making and Using Same**

Chen, W., Inventor; 25 Feb 05; 40 pp.; In English

Contract(s)/Grant(s): AFOSR-F49620-00-C-0058; NSF-DMI-0060254

Patent Info.: Filed 25 Feb 05; US-Patent-Appl-SN-11-067-373

Report No.(s): PB2007-109094; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates in general to nanoparticles exhibiting luminescence such as photostimulated luminescence or photoluminescence and optical switching processes based upon such properties, in more particular, the use of such photostimulated luminescence exhibiting nanoparticles and switching nanoparticle for optical storage apparatuses and sensors as well as methods of making and using same.

NTIS

*Nanoparticles; Optical Switching; Luminescence; Optical Memory (Data Storage)*

**20080023935** Nebraska Univ., Lincoln, NE USA

**Small-Kernel Superresolution Methods for Microscanning Imaging Systems**

Shi, Jiazheng; Reichenbach, Stephen E; Howe, James D; Feb 2006; 13 pp.; In English

Report No.(s): AD-A478593; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two computationally efficient methods for superresolution reconstruction and restoration of microscanning imaging systems are presented. Microscanning creates multiple low-resolution images with slightly different sample scene phase shifts. The digital processing methods developed here combine the low-resolution images to produce an image with higher pixel resolution (i.e., superresolution) and higher fidelity. The methods implement reconstruction to increase resolution and restoration to improve fidelity in one-pass convolution with a small kernel. One method uses a small-kernel Wiener filter and the other method uses a parametric cubic convolution filter. Both methods are based on an end-to-end, continuous discrete continuous microscanning imaging system model. Because the filters are constrained to small spatial kernels they can be efficiently applied by convolution and are amenable to adaptive processing and to parallel processing. Experimental results with simulated imaging and with real microscanned images indicate that the small-kernel methods efficiently and effectively increase resolution and fidelity.

DTIC

*Image Reconstruction; Imaging Techniques; Kernel Functions; Restoration*

**20080024107** NASA Langley Research Center, Hampton, VA, USA

**Multi-Point Interferometric Rayleigh Scattering using Dual-Pass Light Recirculation**

Bivolaru, Daniel; Danehy, Paul M.; Cutler, Andrew D.; June 23, 2008; 8 pp.; In English; 26th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.06.02

Report No.(s): AIAA Paper-2008-3708; LAR-17235-1; Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper describes for the first time an interferometric Rayleigh scattering system using dual-pass light recirculation (IRS-LR) capable of simultaneously measuring at multiple points two orthogonal components of flow velocity in combustion flows using single shot laser probing. An additional optical path containing the interferometer input mirror, a quarter-wave plate, a polarization dependent beam combiner, and a high reflectivity mirror partially recirculates the light that is rejected by the interferometer. Temporally- and spatially-resolved acquisitions of Rayleigh spectra in a large-scale combustion-heated supersonic axi-symmetric jet were performed to demonstrate the technique. Recirculating of Rayleigh scattered light increases the number of photons analyzed by the system up to a factor of 1.8 compared with previous configurations. This is equivalent to performing measurements with less laser energy or performing measurements with the previous system in gas flows at higher temperatures.

Author

*Rayleigh Scattering; Optical Paths; Interferometry; Combustion; Supersonic Jet Flow; Flow Velocity; Gas Flow*

**20080024162** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Simultaneous 4-Stokes Parameter Determination Using A Single Digital Image**

Gerhart, Grant, Inventor; Matchko, Roy, Inventor; Feb 6, 2007; 11 pp.; In English

Report No.(s): AD-D020327; PATENT-7 173 698 B2; No Copyright; Avail.: US Patent and Trademark Office

A method for determining and displaying polarization profiles of points in a scene from a single imaging detector array, which utilizes a filter system comprised of a retarder, four linear polarizers, four lenses, a color filter, camera lens and CCD video camera. Light from points in a scene are transmitted through the system and exits with attenuated intensities unique for each wavelength of the light. A narrowband color filter selects the wavelength of interest. The four lenses in the system produce four images of the scene, which are recorded as a single CCD-image. The attenuated intensities in each of the four scene-images are used to calculate the Stokes parameters for selected points in the scene for the selected wavelength. A unique pseudo-color scheme that utilizes the Poincare sphere is used for encoding and displaying polarization parameters.

DTIC

*Image Processing; Patents*

**20080024216** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Experimental Verification of Dispersed Fringe Sensing as a Segment Phasing Technique using the Keck Telescope**

Shi, Fang; Chanan, Gary; Ohara, Catherine; Troy, Mitchell; Redding, David C.; Applied Optics; August 10, 2004; ISSN 0003-6935; Volume 43, Issue 23, pp. 4474-4481; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF AST-9876783; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1364/AO.43.004474>; <http://hdl.handle.net/2014/40832>

Dispersed fringe sensing (DFS) is an efficient and robust method for coarse phasing of segmented primary mirrors (from one quarter of a wavelength to as much as the depth of focus of a single segment, typically several tens of microns). Unlike phasing techniques currently used for ground-based segmented telescopes, DFS does not require the use of edge sensors in order to sense changes in the relative heights of adjacent segments; this makes it particularly well suited for phasing of space-borne segmented telescopes, such as the James Webb Space Telescope. We validate DFS by using it to measure the piston errors of the segments of one of the Keck telescopes. The results agree with those of the Shack-Hartmann-based phasing scheme currently in use at Keck to within 2% over a range of initial piston errors of +/-16 ( $\mu$ m).

Author

*Infrared Telescopes; Detection; Segmented Mirrors; James Webb Space Telescope; Errors*

**20080025088** Air Force Research Lab., Hanscom AFB, MA USA

**Refractive Index and Wavenumber Properties for Cyclotron Resonant Quasilinear Diffusion by Cold Plasma Waves**

Albert, J M; Jul 5, 2007; 9 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A478476; AFRL-RV-HA-TR-2008-1011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478476>

Wave-particle interactions have a large effect on magnetospheric particles, in the radiation belts and elsewhere. Bounce-averaged quasilinear diffusion coefficients have been calculated for whistler hiss and chorus and electromagnetic ion cyclotron waves (EMIC), which are all believed to play major roles. To perform these calculations efficiently, techniques have been developed that use properties of the refractive index of these modes to identify ranges of wave-normal angle that are compatible with cyclotron resonance in a given frequency band. Other cold plasma waves, in the L-X, L-O, R-X, and Z modes, can also resonate with energetic electrons, and some preliminary calculations of their diffusion coefficients have been reported. Here, it is shown that the refractive index of these modes allows the techniques developed for whistler and EMIC waves to be applied to them as well. Sample calculations are presented for Z mode waves. It is also observed that for any cold plasma mode, the wavenumber is an increasing function of frequency for a fixed value of wave-normal angle; this is proved algebraically with mild approximations and verified numerically for a very wide range of parameters. This allows a variant of the technique for efficiently calculating diffusion coefficients.

DTIC

*Cold Plasmas; Cyclotron Resonance; Cyclotrons; Diffusion Waves; Plasma Waves; Refractivity*

**20080025229** Vanderbilt Univ., Nashville, TN, USA

**Apparatus and Methods of Tissue Ablation Using Sr Vapor Laser System**

Ivanov, B. L., Inventor; Haglund, R. F., Inventor; Jansen, E. D., Inventor; Kostadinov, I., Inventor; Piston, D., Inventor; 24 May 05; 20 pp.; In English

Contract(s)/Grant(s): DOD-F49620-01-0429

Patent Info.: Filed 24 May 05; US-Patent-Appl-SN-11-136-073

Report No.(s): PB2007-109311; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus for ablating living tissue. In one embodiment, the apparatus includes a first Sr vapor laser for generating a first laser beam, a second Sr vapor laser for receiving and amplifying the first laser beam, and a spatial filter optically positioned between and coupled to the first Sr vapor laser and the second Sr vapor laser for allowing selected fractions of the first laser beam to be received and amplified by the second Sr vapor laser so as to generate a second laser beam with sufficient strength and beam quality in a single pulse for ablating living tissue.

NTIS

*Ablation; Lasers; Patent Applications; Vapors*

**20080025247** Lawrence Livermore National Lab., Livermore, CA USA

**Commissioning of a High-Brightness Photoinjector for Compton Scattering X-Ray Sources**

Anderson, S. G.; Gibson, D. J.; Hartemann, F. V.; Messerly, M.; Shverdin, M.; Jun. 27, 2007; 5 pp.; In English

Report No.(s): DE2007-910207; UCRL-PROC-232211; No Copyright; Avail.: Department of Energy Information Bridge

Compton scattering of intense laser pulses with ultrarelativistic electron beams has proven to be an attractive source of high-brightness x-rays with keV to MeV energies. This type of x-ray source requires the electron beam brightness to be comparable with that used in x-ray free electron lasers and laser and plasma based advanced accelerators. We describe the development and commissioning of a 1.6 cell RF photoinjector for use in Compton scattering experiments at LLNL. Injector development issues such as RF cavity design, beam dynamics simulations, emittance diagnostic development, results of sputtered magnesium photo-cathode experiments, and UV laser pulse shaping are discussed. Initial operation of the photoinjector is described.

NTIS

*Brightness; Compton Effect; Electron Scattering; X Ray Sources; X Rays*

**20080025458** Army Tank-Automotive Research and Development Command, Warren, MI USA

**System for Determining Stokes Parameters**

Gerhart, Grant R, Inventor; Matchko, Roy M, Inventor; Sep 25, 2007; 14 pp.; In English

Report No.(s): AD-D020350; PATENT-7 274 449 B1; No Copyright; Avail.: US Patent and Trademark Office

ONLINE: <http://hdl.handle.net/100.2/ADD020350>

A system for determining polarization profiles of points in a scene from video frames using Stokes parameters includes a scene having a region that emits scene light rays that correspond to the points in the scene, a color filter, a Stokes filter that includes a rotating retarder having angular positions  $\Omega$ , and a first linear polarizer having a transmission axis, a correlator that emits a correlator light ray, and that comprises a uniform light source, a second linear polarizer, and a fixed retarder, a video camera having a video frame, and a computer system. The scene light rays and the correlator light ray are substantially simultaneously transmitted through the color filter and the Stokes filter to the video camera, images corresponding to the scene light rays and the correlator light ray are projected onto respective pixels in the video frame and recorded as two-dimensional (2-D) arrays, and when the transmission axis of the first linear polarizer is fixed, the images corresponding to the scene light rays and the correlator light ray from four unique ones of the angular positions  $\Omega$  of the rotating retarder are used by programming in the computer system to calculate respective Stokes parameters of the points in the scene.

DTIC

*Digital Systems; Patents; Polarizers*

**20080025465** Princeton Univ., NJ USA

**Modulation Instability of Spatially-Incoherent Light Beams and Pattern Formation in Incoherent Wave Systems**

Kip, Detlef; Soljacic, Marin; Segev, Mordechai; Eugenieva, Evgenia; Christodoulides, Demetrios N; Jan 2000; 7 pp.; In English

Report No.(s): AD-A479237; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Modulation Instability (MI) is a universal process that appears in most nonlinear wave systems in nature. Because of MI,

small amplitude and phase perturbations (from noise) grow rapidly under the combined effects of nonlinearity and diffraction (or dispersion, in the temporal domain). As a result, a broad optical beam or a quasi-continuous wave pulse disintegrates during propagation, leading to filamentation or to break-up into pulse trains. Modulation instability is largely considered as a precursor of solitons, because the filaments (or pulse trains) that emerge from the MI process are actually trains of almost ideal solitons. Over the years, MI has been systematically investigated in connection with numerous nonlinear processes. Yet, it was always believed that MI is inherently a coherent process and thus it can only appear in nonlinear systems with a perfect degree of spatial/temporal coherence. Recently, the authors theoretically demonstrated that MI can also exist in relation with partially incoherent wave-packets or beams. They have made the first experimental observation of incoherent MI. They have shown that in a nonlinear partially coherent system patterns can form spontaneously (from noise) when the nonlinearity exceeds the threshold, and a periodic train of one-dimensional filaments emerges. At a higher value of nonlinearity, the incoherent 1D filaments display a two-dimensional instability and break up into self-ordered arrays of light spots. The ability to suppress MI has led to new families of solitons that have no counterpart whatsoever in the coherent regime. The discovery of incoherent MI actually reflects on many other nonlinear systems beyond optics: it implies that patterns can form spontaneously (from noise) in nonlinear many-body systems involving weakly-correlated particles, such as atomic gases at temperatures near Bose-Einstein-Condensation temperatures and electrons in semiconductors at the vicinity of the quantum Hall regime.

DTIC

*Incoherence; Light Beams; Light Transmission; Modulation; Nonlinear Optics; Perturbation; Stability*

**20080025776** Corning, Inc., Corning, NY, USA

**Optical Fiber and Method for Making Such Fiber**

Kimball, R. L., Inventor; Knowlton, R. A., Inventor; McCarthy, J. E., Inventor; Wang, J., Inventor; Walton, D. T., Inventor; 11 Feb 05; 22 pp.; In English

Contract(s)/Grant(s): DARPA-MDA972-02-3-004

Patent Info.: Filed Filed 11 Feb 05; US-Patent-Appl-SN-11-056-870

Report No.(s): PB2007-110545; No Copyright; Avail.: CASI: [A03](#), Hardcopy

According to one example of the invention an optical fiber comprises: (1) silica based, rare earth doped core having a first index of refraction  $n_{(sub\ 1)}$ ; (2) at least one silica based cladding surrounding the core and having a second index of refraction  $n_{(sub\ 2)}$ , such that  $n_{(sub\ 1)} > n_{(sub\ 2)}$ ; wherein at least one of the core or cladding is doped with  $Al_{(sub\ 2)}O_{(sub\ 3)}$ , such that the ratio of max wt % to min wt % of  $Al_{(sub\ 2)}O_{(sub\ 3)}$  concentration is less than 2:1.

NTIS

*Optical Fibers; Patent Applications*

**20080025777** Godward (Cooley), LLP, Palo Alto, CA, USA

**Apparatus, System, and Method for Optical Pulse Gain Enhancement for High-Finesse External Cavity**

Loewen, R. L., Inventor; Ruth, R. D., Inventor; 8 Apr 05; 40 pp.; In English

Contract(s)/Grant(s): NIH/GMS-4 R44 GM066511-02

Patent Info.: Filed Filed 8 Apr 05; US-Patent-Appl-SN-11-102-479

Report No.(s): PB2007-110544; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A passive optical resonator stores optical pulses within a cavity to increase the optical power level of input pulses via resonant reflections without the use of an internal optical gain medium. In one embodiment for a Compton backscattering system, the optical resonator is a passive high finesse optical resonator that includes a mirror that is transmissive to x-rays.

NTIS

*Augmentation; Cavities; Laser Cavities; Optical Properties; Patent Applications*

**20080025816** Army Belvoir Research and Development Center, Fort Belvoir, VA, USA

**Optical Imager for the 3-5 Micron Spectral Band**

Hall, J. M., Inventor; Vizgaitis, J. N., Inventor; 26 May 04; 6 pp.; In English

Patent Info.: Filed Filed 26 May 04; US-Patent-Appl-SN-10-853-244

Report No.(s): PB2007-110617; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An optical imager for use in the 3-5 micron spectral band. The imager comprises a large aperture positively-powered first objective lens made of a first material for collecting collimated light, and a slightly negatively-powered second objective lens made of a second material spaced behind the first objective lens to provide a color-corrected intermediate focal plane for the

collected light. The imager further includes a relay group of three lenses disposed behind the second objective lens for re-imaging the intermediate focal plane.

NTIS

*Images; Patent Applications; Spectral Bands*

**20080025831** Dorsey and Whitney, LLP, Denver, CO, USA

**Tunable Laser Having Liquid Crystal Waveguide**

Anderson, M. H., Inventor; Davis, S. R., Inventor; Rommel, S. D., Inventor; 21 Jan 05; 70 pp.; In English

Contract(s)/Grant(s): NSF-68-D-03-010; NSF-0319386

Patent Info.: Filed Filed 21 Jan 05; US-Patent-Appl-SN-10-040-549

Report No.(s): PB2007-110619; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A tunable laser for providing a laser beam with a selectable wavelength. In one example, the tunable laser includes a gain medium for generating the laser beam; a waveguide for processing the laser beam, the waveguide having liquid crystal material or other electro-optic material disposed therein; an optical path length control element disposed within said waveguide for controlling an effective optical path length of the laser cavity; and a wavelength selective element for controlling the wavelength of the laser beam. The tunable laser may be designed without any moving mechanical parts if desired.

NTIS

*Laser Beams; Liquid Crystals; Patent Applications; Tunable Lasers; Waveguides*

**20080025889** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Filtered Rayleigh Scattering Measurements in a Buoyant Flow Field**

Meents, Steven M; Mar 2008; 141 pp.; In English

Report No.(s): AD-A478957; AFIT/GAE/ENY/08-M22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478957>

Filtered Rayleigh Scattering (FRS) is a non-intrusive, laser-based flow characterization technique that consists of a narrow linewidth laser, a molecular absorption filter, and a high resolution camera behind the filter to record images. Gases of different species have different molecular scattering cross-sections that become apparent as they pass through the interrogating laser light source, and this difference is used to discriminate between the different gaseous components. This study focuses on the behavior of a buoyant helium jet exiting horizontally into ambient air, and more specifically this jet's tendency to form side lobes that are discharged from the core fluid under low flow rate conditions. This jet behavior is documented and examined with relation to Froude, Grashof, and Reynolds numbers, and the behavior patterns are noted.

DTIC

*Buoyancy; Flow Distribution; Rayleigh Scattering*

**20080025917** Pacific Northwest National Lab., Richland, WA, USA

**Upgrade of the AO Photoinjector Laser System for NML Accelerator Test Facility at Fermilab**

Ruan, J.; Edwards, H.; Filler, R. P.; Santucci, J. K.; January 2007; 3 pp.; In English

Report No.(s): DE2007-912641; FERMILAB-CONF-07-242-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

The current Fermilab AO Photoinjector laser system includes a seed laser, a flashlamp pumped multipass amplifier cavity, a flashlamp pumped 2-pass amplifier system followed by an Infra-Red (IR) to Ultra-Violet (UV) conversion stage. However the current system can only deliver up to 800 pulses due to the low efficiency of Nd:Glass used inside multi-pass cavity. In this paper we will report the effort to develop a new multi pass cavity based on Nd:YLF crystal end-pumped by diode laser. We will also discuss the foreseen design of the laser system for the NML accelerator test facility at Fermilab.

NTIS

*Lasers; Particle Accelerators; Test Facilities*

**20080025952** Viksnins Harris and Padys, PLLP, Saint Paul, MN, USA

**Data Storage Materials**

MacGillivray, L. R., Inventor; 10 Jun 05; 25 pp.; In English

Contract(s)/Grant(s): NSF-DMR0133138

Patent Info.: Filed 10 Jun 05; US-Patent-Appl-SN-11-150 587

Report No.(s): PB2007-113875; No Copyright; Avail.: CASI: A03, Hardcopy

The invention provides metal-organic complexes useful for storing information in an information storage system. The invention also provides methods for forming such complexes on a substrate, as well as apparatuses and systems comprising such complexes.

NTIS

*Data Storage; Optical Memory (Data Storage); Organometallic Compounds; Patent Applications*

## 75

### PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 *Geophysics*. For space plasmas see 90 *Astrophysics*.

**20080025184** Lawrence Livermore National Lab., Livermore, CA USA

#### **Imprinting Continuously Varying Topographical Structure Onto Large-Aperture Optical Surfaces Using Magnetorheological Finishing**

Menapace, J. A.; Davis, P. J.; Dixit, S.; Campbell, J. H.; Goplini, D.; Mar. 21, 2007; 6 pp.; In English

Report No.(s): DE2007-909623; UCRL-CONF-229266; No Copyright; Avail.: Department of Energy Information Bridge

Over the past four years we have advanced Magnetorheological Finishing (MRF) techniques and tools to imprint complex continuously varying topographical structures onto large-aperture (430 OE 430 mm) optical surfaces. These optics, known as continuous phase plates (CPPs), are important for high-power laser applications requiring precise manipulation and control of beam-shape, energy distribution, and wavefront profile. MRFs unique deterministic-sub-aperture polishing characteristics make it possible to imprint complex topographical information onto optical surfaces at spatial scale-lengths approaching 1 mm and surface peak-to-valleys as high as 22 mm. During this discussion, we will present the evolution of the MRF imprinting technology and the MRF tools designed to manufacture large aperture 430 OE 430 mm CPPs. Our results will show how the MRF removal function impacts and limits imprint fidelity and what must be done to arrive at a high-quality surface. We also present several examples of this imprinting technology for fabrication of phase correction plates and CPPs for use in high-power laser applications.

NTIS

*Apertures; High Power Lasers; Fabrication*

**20080025900** Massachusetts Inst. of Tech., Cambridge, MA, USA

#### **Nuclear Probing of Dense Plasmas. Final Report February 15, 2003 - February 14, 2007**

Petrasso, R. D.; May 15, 2007; 36 pp.; In English

Report No.(s): DE2007-909182; No Copyright; Avail.: National Technical Information Service (NTIS)

The object of inertial confinement fusion (ICF) is to compress a fuel capsule to a state with high enough density and temperature to ignite, starting a self-sustaining fusion burn that consumes much of the fuel and releases a large amount of energy. The national ICF research program is trying to reach this goal, especially through experiments at the OMEGA laser facility of the University of Rochester Laboratory of Laser Energetics (LLE), planned experiments at the National Ignition Facility (NIF) under construction at the Lawrence Livermore National Laboratory (LLNL), and experimental and theoretical work at other national laboratories. The work by MIT reported here has played several important roles in this national program.

NTIS

*Dense Plasmas; Plasma Diagnostics*

**20080025903** Massachusetts Inst. of Tech., Cambridge, MA, USA

#### **Nuclear Probing of Dense Plasmas and Implosion Physics at OMEGA, Z, OMEGA with EP, and the NIF. Annual Report February 15, 2006 - February 14, 2007**

Petrasso, R. D.; May 15, 2007; 18 pp.; In English

Report No.(s): DE2007-909183; No Copyright; Avail.: National Technical Information Service (NTIS)

After several reviews by National Laboratory participants and the DP office, MIT contracted Dexter Magnetic Technologies, a couple of years ago, to fabricate the most expensive component, which is a magnet. The MRS project at UR/LLE is now a program comprised of a couple concurrent efforts including the engineering of the MRS, and developing a new detection technique with improved signal-to-background characteristics. With the commitment of LLE to engineer the

interface of the spectrometer to OMEGA, we anticipate, according to plan, interfacing and qualifying the instrument on OMEGA in July this year. The instrument is called the Magnetic Recoil Spectrometer (MRS) because of its operating principle. The prototype ('OMEGA-MRS') and its planned interface on OMEGA have been designed, as shown in this document will be used for particle detection.

NTIS

*Dense Plasmas; Implosions; Plasmas (Physics); Fabrication*

## 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*.

**20080024022** Virginia Commonwealth Univ., Richmond, VA USA

#### **RHEEDAX Induced X-ray Fluorescence Analysis System for Oxide MBE**

Morkoc, Hadis; Mar 2008; 3 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0854

Report No.(s): AD-A478727; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A total reflection x-ray fluorescence spectroscopy system excited with an electron gun of reflection high-energy electron diffraction tool (RHEED-TRAXs) for in Situ material characterization has been designed, components have been purchased, and the tool has been assembled and installed on a Riber 3200 molecular-beam epitaxy system customized for oxide growth.

DTIC

*Molecular Beam Epitaxy; Oxides; X Ray Fluorescence*

**20080025194** Lawrence Livermore National Lab., Livermore, CA USA

#### **2006 Physics and Advanced Technologies in the News**

Hazi, A. U.; Apr. 02, 2007; 26 pp.; In English

Report No.(s): DE2007-909644; UCRL/TR-229639; No Copyright; Avail.: Department of Energy Information Bridge

Several outstanding research activities in the Physics and Advanced Technologies Directorate in 2006 were featured in Science and Technology Review, the monthly publication of Lawrence Livermore National Laboratory. Reprints of those articles accompany this report. Here we summarize other science and technology highlights, as well as the awards and recognition received by members of the Directorate in 2006.

NTIS

*Physics; Research and Development*

**20080025245** Lawrence Livermore National Lab., Livermore, CA USA

#### **Simulating Electron effects in Heavy-Ion Accelerators with Solenoid Focusing**

Sharp, W. M.; Grote, D. P.; Cohen, R. H.; Friedman, A.; Molvik, A. W.; Jun. 29, 2007; 5 pp.; In English

Report No.(s): DE2007-910205; UCRL-PROC-232336; No Copyright; Avail.: Department of Energy Information Bridge

Contamination from electrons is a concern for solenoid-focused ion accelerators being developed for experiments in high-energy-density physics. These electrons, produced directly by beam ions hitting lattice elements or indirectly by ionization of desorbed neutral gas, can potentially alter the beam dynamics, leading to a time-varying focal spot, increased emittance, halo, and possibly electron-ion instabilities. The electrostatic particle-in-cell code WARP is used to simulate electron-cloud studies on the solenoid-transport experiment (STX) at Lawrence Berkeley National Laboratory. We present self-consistent simulations of several STX configurations and compare the results with experimental data in order to calibrate physics parameters in the model.

NTIS

*Electron Accelerators; Electron Clouds; Ion Accelerators; Particle Accelerators; Simulation; Solenoids*

**20080025250** Lawrence Livermore National Lab., Livermore, CA USA

#### **Estimating the Reliability of the Lawrence Livermore National Laboratory (LLNL) Flash X-ray (FXR) Machine**

Ong, M. M.; Kihara, R.; Zentler, J. M.; Kreitzer, B. R.; DeHope, W. J.; Jun. 27, 2007; 6 pp.; In English

Report No.(s): DE2007-910212; UCRL-CONF-232217; No Copyright; Avail.: National Technical Information Service

(NTIS)

At Lawrence Livermore National Laboratory (LLNL), our flash X-ray accelerator (FXR) is used on multi-million dollar



hydrodynamic experiments. Because of the importance of the radiographs, FXR must be ultrareliable. Flash linear accelerators that can generate a 3 kA beam at 18 MeV are very complex. They have thousands, if not millions, of critical components that could prevent the machine from performing correctly. For the last five years, we have quantified and are tracking component failures. From this data, we have determined that the reliability of the high-voltage gas-switches that initiate the pulses, which drive the accelerator cells, dominates the statistics. The failure mode is a single-switch pre-fire that reduces the energy of the beam and degrades the X-ray spot-size. The unfortunate result is a lower resolution radiograph. FXR is a production machine that allows only a modest number of pulses for testing. Therefore, reliability switch testing that requires thousands of shots is performed on our test stand. Study of representative switches has produced pre-fire statistical information and probability distribution curves. This information is applied to FXR to develop test procedures and determine individual switch reliability using a minimal number of accelerator pulses.

NTIS

*Estimating; High Voltages; Linear Accelerators; Particle Accelerators; Radiography; Reliability; Switches; X Rays*

**20080025251** Lawrence Livermore National Lab., Livermore, CA USA

**Real-Life Pulse Flattening on the LLNL Flash X-Ray (FXR) Machine**

DeHope, W. J.; Jacob, J. S.; Kihara, R.; Ong, M. M.; Zentler, J. M.; Jun. 27, 2007; 5 pp.; In English

Report No.(s): DE2007-910213; UCRL-PROC-232202; No Copyright; Avail.: National Technical Information Service (NTIS)

High-resolution radiography using high-current electron accelerators based on the linear induction accelerator principle requires the linacs final spot on the X-ray target to be millimeter-sized. The requisite final focusing solenoid is adjusted for a specific beam energy at its entrance, hence, temporal variation of entrance beam energy results in a less than optimal time-averaged spot size. The FXR (Flash X-Ray) induction linac facility at Lawrence Livermore National Laboratory will be briefly described with an emphasis on its pulsed power system. In principle, the pulsed Blumleins at the heart of the system output a square pulse when discharged at the peak of their charging waveform so that, with correct cell timing synchronization, the effective beam output into the final focusing solenoid should be optimally flat. We have found that real-life consideration of transmission line and pulse power details in both the injector and accelerator sections of the machine results in significant energy variations in the final beam. We have implemented methods of measurement and analysis that permits this situation to be quantified and improved upon. The improvement will be linked to final beam spot size and enhancement in expected radiographic resolution.

NTIS

*Electron Accelerators; Flattening; High Current; Linear Accelerators; Particle Accelerators; X Rays*

**20080025252** Lawrence Livermore National Lab., Livermore, CA USA

**Multi-Beamlet Injector for Heavy-Ion Fusion: Experiments and Modeling**

Westenskow, W. A.; Grote, D.; Bieniosek, F.; Kwan, J.; Jun. 21, 2007; 7 pp.; In English

Report No.(s): DE2007-910214; UCRL-CONF-232025; No Copyright; Avail.: National Technical Information Service (NTIS)

We have performed experiments and modeling to evaluate a proposed merging beamlet approach for use in a compact high-brightness Heavy Ion Fusion injector. We used an RF plasma source to produce the initial beamlets. An extraction current density of 100 mA/cm<sup>2</sup> was achieved, and the thermal temperature of the ions was below 1 eV. An array of converging beamlets was used to produce a beam with the envelope radius, convergence, and ellipticity matched to an electrostatic quadrupole channel. Experimental results were in good quantitative agreement with computer simulations and have demonstrated the feasibility of this concept. The size of a driver-scale injector system using this approach will be several times smaller than one designed using traditional single large-aperture beams. The success of this experiment has possible significant economical and technical impacts on the architecture of HIF drivers.

NTIS

*Injectors; Ion Accelerators; Heavy Ions; Fusion*

**20080025351** Army Research Lab., Aberdeen Proving Ground, MD USA

**Multiscale Modeling of Point and Line Defects in Cubic Lattices**

Chung, P W; Clayton, J D; Jan 2007; 30 pp.; In English

Contract(s)/Grant(s): Proj-DRI-FY05-CIS10

Report No.(s): AD-A479122; ARL-RP-200; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479122>

A multilength scale method based on asymptotic expansion homogenization (AEH) is developed to compute minimum

energy configurations of ensembles of atoms at the fine length scale and the corresponding mechanical response of the material at the coarse length scale. This multiscale theory explicitly captures heterogeneity in microscopic atomic motion in crystalline materials, attributed, for example, to the presence of various point and line lattice defects. The formulation accounts for large deformations of nominally hyperelastic, monocrystalline solids. Unit cell calculations are performed to determine minimum energy configurations of ensembles of atoms of body-centered cubic tungsten in the presence of periodic arrays of vacancies and screw dislocations of line orientations [111] or [100]. Results of the theory and numerical implementation are verified versus molecular statics calculations based on conjugate gradient minimization (CGM) and are also compared with predictions from the local Cauchy-Born rule. For vacancy defects, the AEH method predicts the lowest system energy among the three methods, while computed energies are comparable between AEH and CGM for screw dislocations. Computed strain energies and defect energies (e.g., energies arising from local internal stresses and strains near defects) are used to construct and evaluate continuum energy functions for defective crystals parameterized via the vacancy density, the dislocation density tensor, and the generally incompatible lattice deformation gradient. For crystals with vacancies, a defect energy increasing linearly with vacancy density and applied elastic deformation is suggested, while for crystals with screw dislocations, a defect energy linearly dependent on the dislocation density tensor appears more appropriate than the quadratic dependency often encountered in the continuum plasticity literature.

DTIC

*Crystal Structure; Cubic Lattices; Point Defects; Single Crystals; Tungsten*

**20080025662** Thomas Jefferson National Accelerator Facility, Newport News, VA, USA

**Implications of Incomplete Energy Recovery in SRF-Based Energy Recovery Linacs**

Powers, T.; Tennant, C.; May 21, 2007; 3 pp.; In English

Contract(s)/Grant(s): AC05-06OR23177

Report No.(s): DE2007-910023; JLAB-ACT-07-670; DOE/OR/23177-0092; No Copyright; Avail.: National Technical Information Service (NTIS)

The choice of the loaded quality factor (QL) of a superconducting cavity is driven by many factors, including beam loading effects and microphonics. In accelerators with minimal beam loading, use of SRF cavities with relatively high loaded-Q allows one to employ lower power RF sources. Many individuals are therefore considering energy recovered linac designs making use of SRF cavities with loaded-Q values that are primarily limited by microphonic effects. While this is valid for machines which have near-ideal energy recovery, many applications do not necessarily fit this model. In some applications the second pass, energy recovered beam experiences a phase shift between one state of machine operation and a second state. One complication in this process is that the cavity resonance control algorithms are influenced by this phase shift. With respect to RF power requirements, this is a positive interaction inasmuch as the tuner partially compensates for the phase shift of the recovered beam. This work will go through the implications of partial energy recovery on the selection of the loaded-Q for cavity fundamental power couplers.

NTIS

*Cavities; Couplers; Linear Accelerators; Superconductivity*

**20080025934**; Heslin Rotherberg Farley and Mesiti, PC, Albany, NY, USA

**Method and Apparatus for Producing Large, Single-Crystals of Aluminum Nitride**

Schowalter, L. J., Inventor; Slack, G. A., Inventor; Rojo, C., Inventor; 3 Sep 04; 19 pp.; In English

Contract(s)/Grant(s): ONR-N00014-98-C-0053; AFRL-F33615-00-C-5531

Patent Info.: Filed Filed 3 Sep 04; US-Patent-Appl-SN-10-910-162

Report No.(s): PB2007-111580; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and apparatus for producing bulk single crystals of AlN having low dislocation densities of about 10,000 cm<sup>(sup -2)</sup> or less includes a crystal growth enclosure with Al and N.sub.2 source material therein, capable of forming bulk crystals. The apparatus maintains the N(sub 2) partial pressure at greater than stoichiometric pressure relative to the Al within the crystal growth enclosure, while maintaining the total vapor pressure in the crystal growth enclosure at super-atmospheric pressure. At least one nucleation site is provided in the crystal growth enclosure, and provision is made for cooling the nucleation site relative to other locations in the crystal growth enclosure. The Al and N(sub 2) vapor is then deposited to grow single crystalline low dislocation density AlN at the nucleation site. High efficiency ultraviolet light emitting diodes and ultraviolet laser diodes are fabricated on low defect density AlN substrates, which are cut from the low dislocation density AlN crystals. Bulk crystals of ZnO may also be produced using the method.

NTIS

*Aluminum Nitrides; Crystal Growth; Patent Applications; Single Crystals*

**20080025951** Townsend and Townsend and Crew, LLP, San Francisco, CA, USA

**Manufacturable Low-Temperature Silicon Carbide Deposition Technology**

Wijesundara, M. B. J., Inventor; Valente, G., Inventor; Howe, R. T., Inventor; Pisano, A. P., Inventor; Carraro, C., Inventor; 29 Jul 04; 22 pp.; In English

Contract(s)/Grant(s): DARPA-N660010118967; DARPA-NBCHCO10060

Patent Info.: Filed Filed 29 Jul 04; US-Patent-Appl-SN-10-903-864

Report No.(s): PB2007-113876; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of depositing silicon carbide on a substrate, including placing a substrate in a low pressure chemical vapor deposition chamber; flowing a single source precursor gas containing silicon and carbon into the chamber; maintaining the chamber at a pressure not less than approximately 5 mTorr; and maintaining the substrate temperature less than approximately 900 degrees C. The method also includes a method for depositing a nitrogen doped silicon carbide by the addition of nitrogen containing gas into the chamber along with flowing a single source precursor gas containing silicon and carbon into the chamber.

NTIS

*Deposition; Patent Applications; Silicon Carbides*

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*.

**20080023741** Stanford Linear Accelerator Center, CA, USA

**Precise Calculation of Traveling-Wave Periodic Structure**

Wang, L.; Li, Z.; Seryi, A.; Jul. 2007; 3 pp.; In English

Report No.(s): DE2007-909533; SLAC-PUB-12645; No Copyright; Avail.: National Technical Information Service (NTIS)

The effects of the round edge beam hole on the frequency and wake field are studied using variational method, which allows for rounded iris disk hole without any approximation in shape treatment. The frequency and wake field of accelerating mode and dipole mode are studied for different edge radius cases, including the flat edge shape that is often used to approximately represent the actual structure geometry. The edge hole shape has weak effect on the frequency, but much effect on the wake field. Our study shows that the amounts of wake fields are not precise enough with the assumption of the flat edge beam hole instead of round edge.

NTIS

*Traveling Waves; Particle Beams; Frequencies*

**20080023743** Stanford Linear Accelerator Center, CA, USA

**Simulation of the Beam-Ion Instability in the Electron Damping Ring of the International Linear Collider**

Wang, L.; Cai, Y.; Raubenheimer, T.; Jul. 2007; 3 pp.; In English

Report No.(s): DE2007-909535; SLAC-PUB-12643; No Copyright; Avail.: National Technical Information Service (NTIS)

Ion induced beam instability is one critical issue for the electron damping ring of the International Linear Collider (ILC) due to its ultra small emittance of 2pm. Bunch train filling pattern is proposed to mitigate the instability and bunch-by-bunch feedback is applied to suppress it. Multibunch train fill pattern is introduced in the electron beam to reduce the number of trapped ions. Our study shows that the ion effects can be significantly mitigated by using multiple gaps. However, the beam can still suffer from the beam-ion instability driven by the accumulated ions that cannot escape from the beam during the gaps. The effects of beam fill pattern, emittance, vacuum and various damping mechanism are studied using self-consistent program, which includes the optics of the ring.

NTIS

*Damping; Electron Beams; Ion Beams; Simulation; Stability; Linear Accelerators*

**20080023744** Stanford Linear Accelerator Center, CA, USA; European Organization for Nuclear Research, Geneva, Switzerland

**Electron Cloud in the Wigglers of the Positron Damping Ring of the International Linear Collider**

Wang, L.; Zimmermann, F.; Jul. 2007; 3 pp.; In English

Report No.(s): DE2007-909536; SLAC/PUB-12642; No Copyright; Avail.: National Technical Information Service (NTIS)

The ILC positron damping ring comprises hundreds of meters of wiggler sections, where many more photons than in the

arcs are emitted, and with the smallest beam pipe aperture of the ring. A significant electron-cloud density can therefore be accumulated via photo-emission and via beam-induced multipacting. In field-free regions the electron-cloud build up may be suppressed by adding weak solenoid fields, but the electron cloud remaining in the wigglers as well as in the arc dipole magnets can still drive single-bunch and multi-bunch beam instabilities. This paper studies the electron-cloud formation in an ILC wiggler section for various scenarios, as well as its character, and possible mitigation schemes.

NTIS

*Damping; Electron Clouds; Positrons; Wiggler Magnets; Linear Accelerators*

**20080023745** Stanford Linear Accelerator Center, CA, USA

**Suppression of Secondary Electron Emission Using Triangular Grooved Surface in the ILC Dipole and Wiggler Magnets**

Wang, L.; Bane, K.; Chen, C.; Himel, T.; Munro, M.; Jul. 2007; 3 pp.; In English

Report No.(s): DE2007-909537; SLAC/PUB-12641; No Copyright; Avail.: National Technical Information Service (NTIS)

The development of an electron cloud in the vacuum chambers of high intensity positron and proton storage rings may limit machine performance. The suppression of electrons in a magnet is a challenge for the positron damping ring of the International Linear Collider (ILC) as well as the Large Hadron Collider. Simulation show that grooved surfaces can significantly reduce the electron yield in a magnet. Some of the secondary electrons emitted from the grooved surface return to the surface within a few gyrations, resulting in a low effective secondary electron yield (SEY) of below 1.0. A triangular surface is an effective, technologically attractive mitigation with a low SEY and a weak dependence on the scale of the corrugations and the external magnetic field. A chamber with triangular grooved surface is proposed for the dipole and wiggler sections of the ILC and will be tested in KEKB in 2007. The strategy of electron cloud control in ILC and the optimization of the grooved chamber such as the SEY, impedance as well as the manufacturing of the chamber, are also discussed.

NTIS

*Electron Emission; Secondary Emission; Surface Properties; Wiggler Magnets; Linear Accelerators*

**20080023746** Stanford Linear Accelerator Center, CA, USA

**Compensation of the Effect of a Detector Solenoid on the Beam Size in the ILC**

Seletskiy, S.; Jul. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909538; SLAC/PUB-12639; No Copyright; Avail.: National Technical Information Service (NTIS)

In the International Linear Collider (ILC) the colliding beams must be focused to the nanometre size in order to reach the desired luminosity. The method of Weak Antisolensoid is used for the compensation of the effect of the Detector Solenoid on the beam size. The studies of this method require the computer simulation of the charged particles kinematics in the arbitrarily distributed solenoidal, dipole, quadrupole and higher multipole fields. We suggest the mathematical algorithm that allows to optimize parameters of antisolensoid for different configurations of Final Focus magnets and to compensate parasitic effects of the Detector Solenoid on the beam.

NTIS

*Solenoids; Linear Accelerators*

**20080023749** Lawrence Livermore National Lab., Livermore, CA USA

**Lattice QCD Thermodynamics First 5000 Trajectories**

Soltz, R.; Gupta, R.; Mar. 27, 2007; 22 pp.; In English

Report No.(s): DE2007-909918; UCRL-TR-229427; No Copyright; Avail.: National Technical Information Service (NTIS)

These results represent the first LQCD analysis for approximately 5000 trajectories with each of the p4rhmc and milc codes, with some of the lower temperature runs having fewer. Both runs were for lattice dimensions of 32x32x8. Some 32(sup 4) T=0 jobs were also run for p4rhmc. The p4 calculation was performed with v2.0 QMP MPI.X (semi-optimized p4 code using qmp over mpi) and milc version of the su3 rhmc susc eos executable dated Mar 1, 2007 on ubgl in the /usr/gapps/hip/qcd/milc/bin subdirectory (svn revision 28). As with previous runs, calculations were performed along lines of constant physics, with the light quark masses 2-3 times their physics values and the strange quark mass set by m(sub ud)=0.1m(sub s). Job submissions were performed using a new subSet.pl job submission script that locates current jobs and submits additional jobs with the same beta value as pending.

NTIS

*Quantum Chromodynamics; Thermodynamics; Trajectories*

**20080023945** Akron Univ., Akron, OH USA

**Controlling Interfacial Properties in Nanoenvironments: A Novel Technique of Intelligent Systems**

Qiao, Yu; Jan 14, 2008; 7 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0181

Report No.(s): AD-A478610; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In summary, it is validated experimentally that nanoporous materials of non-hysteretic sorption isotherm curves can be employed to develop volume memory systems. Under the working pressure, as temperature changes, the effective wettability varies, and thus the liquid tends to either infiltrate into or defiltrate out of the nanopores, resulting in a thermally controllable actuation behavior. Due to the large specific surface area, the wettability variation is greatly amplified. Consequently, the energy density can be much higher than that of conventional smart solids. In addition, through a controlled-temperature infiltration-defiltration experiment, it is validated that using electrolyte with temperature sensitive solubility can significantly increase the output energy density of nanoporous material functionalized liquids, providing a promising way to enhance their performance. The infiltration pressure does not vary monotonically with the temperature; rather, there exists a critical temperature at which the infiltration pressure reaches the maximum value, which can be attributed to the competition between the thermocapillary effect and the cation exchange effect. The former mechanism is dominant in the high-temperature range and the latter is more pronounced in the low-temperature range.

DTIC

*Environments; Intelligence*

**20080025361** Naval Postgraduate School, Monterey, CA USA

**Multi-Fractal Thermal Characteristics of the Southwestern GIN Sea Upper Layer**

Chu, Peter C; Jan 2004; 11 pp.; In English

Report No.(s): AD-A479150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479150>

Multifractal characteristics of the upper layer thermal structure in the southwestern Greenland Sea, Iceland Sea, and Norwegian Sea (GIN Sea) are analyzed using high-resolution, digital thermistor chain data. The energy spectrum at 20 m depth (cold sublayer) shows the existence of a spike at the scale of approximate 3 km representing the chimney scale. The graph dimension varies from higher values such as 1.89 at the surface to 1.44 - 1.50 in the warm intermediate layer. The stationarity decreases from the ocean surface to the warm intermediate layer. However, the information dimension varies slightly (0.92 to 0.90) that indicates low singularity.

DTIC

*Fractals; Ocean Surface; Seas; Thermistors*

**20080025462** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

**Effects of Leading Edge Film-Cooling and Surface Roughness on the Downstream Film-Cooling Along a Transonic Turbine Blade for Low and High Free-Stream Turbulence**

Raben, Sam; Vlachos, Pavlos; Ng, Wing; Feb 29, 2008; 63 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0250

Report No.(s): AD-A479229; VT-ME-2008-AFOSR-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is the culmination of a two year effort to demonstrate the capability for performing near wall high resolution Time Resolved Particle Image Velocimetry (TRDPIV) measurements in a transonic turbine. Performing TRDPIV in high speed wall bounded flows with high resolution/magnification often poses significant difficulties. For this reason, two preliminary studies were conducted in order to further understand the challenges that would be present in this type of environment. Hardware and algorithm advancements and developments ultimately enabled performing TRDPIV in the transonic cascade facility. However, high pressure, high speed and the turbine blade complex geometries (high curvature and acceleration) significantly inhibit our ability to deliver homogeneous distribution of flow tracers, especially in the near wall region resulting in low quality measurements and regions with randomly missing data. In addition to our experimental results this effort delivers a novel advanced data reconstruction methodology based on proper orthogonal decomposition that was developed to overcome the aforementioned limitation. The following report documents in detail the methods and results generated throughout this effort.

DTIC

*Film Cooling; Free Flow; Leading Edges; Low Turbulence; Supersonic Turbines; Surface Roughness; Turbine Blades; Turbulence*

**20080025480** Old Dominion Univ., Norfolk, VA USA

**Quantum Lattice Algorithms for 2D and 3D Magnetohydrodynamics**

Vahala, Linda; Nov 2007; 15 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0128

Report No.(s): AD-A479283; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the 3 years of this grant, we have continued our collaboration with Jeffrey Yepez (AFRL, Hancorn Field) and George Vahala (William & Mary) on both quantum and entropic lattice algorithms for the solution of nonlinear physics problems. Because of the extreme scalability of the algorithms that we have been developing, we were chosen for CAP-Phase II for the new IBM-P 5+ supercomputer (Babbage) at NAVO MSRC and also for CAP-Phase II on the 9000 core on the SGI-Altix at ASC.

DTIC

*Algorithms; Magnetohydrodynamics; Supercomputers*

**20080025542** Naval Postgraduate School, Monterey, CA USA

**Seasonal Variability of Thermohaline Front in the Central South China Sea**

Chu, Peter C; Guihua, Wang; Jan 2003; 15 pp.; In English

Report No.(s): AD-A479463; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An upper layer thermohaline front across the South China Sea (SCS) basin from the South Vietnamese coast (around 15 deg N) to Luzon Island (around 19 deg N) has been identified using the Navy's open domain Generalized Digital Environmental Model (GDEM) monthly mean temperature and salinity data on a 0.5 deg X 0.5 deg grid. This front does not occur at the surface in summer. The strength of this front is around 1 deg C/100 km at the surface and 1.4 deg C/100 km at the subsurface (50 m deep). A cross-basin current, inverted using the P-vector method is associating with the front. Meandering and eddies have been identified along this current. Seasonal and vertical variabilities of the thermohaline structure across this front are reported in this paper.

DTIC

*Annual Variations; China; Ocean Currents; Seas; Thermodynamic Properties*

**20080025791** Applied Materials, Inc., Santa Clara, CA, USA

**Multiple Electron Beam Systems**

Maldonado, J. R., Inventor; Coyle, S. T., Inventor; 28 May 04; 30 pp.; In English

Contract(s)/Grant(s): N66001-99-C-8624

Patent Info.: Filed Filed 28 May 04; US-Patent-Appl-SN-10-856-111

Report No.(s): PB2007-110612; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A multiple electron beam source comprises a photon source to generate a photon beam, a lens to focus the photon beam, a photocathode having a photon receiving surface and an electron emitting surface, and an array of electron transmission gates spaced apart from the electron emitting surface of the photocathode by a distance  $d_{sub\ g}$ . Each electron transmission gate comprises a membrane; an anode on a first surface of the membrane; an insulator on a second surface of the membrane; an aperture through the anode, insulator and membrane; and a gate electrode on the insulator. The gate electrode is positioned about the aperture and capable of receiving a gate control voltage that controls the transmission of electrons through that electron transmission gate. In one version, the multiple electron beam source comprises a photocathode stage assembly to move the photocathode relative to the array of electron transmission gates. In one version, the multiple electron beam source also comprises a plasmon-generating photon transmission plate comprising an array of photon transmission apertures and exterior surfaces capable of supporting plasmons.

NTIS

*Electron Beams; Photon Beams; Photocathodes; Membranes*

**SOCIAL AND INFORMATION SCIENCES (GENERAL)**

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see categories 81 through 85.

**20080024191** NASA Langley Research Center, Hampton, VA, USA

**The MY NASA DATA Project**

Chambers, Lin H.; Alston, Erica J.; Diones, D. D.; Moore, S. W.; Oots, P. C.; Phelps, C. S.; Mims, Forrest M., III; October 2006; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 23-428-94-01; Copyright; Avail.: CASI: [A03](#), Hardcopy

On the one hand, locating the right dataset, then figuring out how to use it, is a daunting task that is familiar to almost any scientist or graduate student in the fields of Earth system science. On the other hand, the ability to explore authentic Earth system science data, through inquiry-based education, is an important goal in US national education standards. Fortunately, in the digital age, tools are emerging that can make such data exploration commonplace at all educational levels. This paper describes the conception and development of one project that aims to bridge this gap: Mentoring and inquiry using NASA Data on Atmospheric and Earth science for Teachers and Amateurs (MY NASA DATA; [mynasadata.larc.nasa.gov](http://mynasadata.larc.nasa.gov)). With funding from NASA's Science Mission Directorate, this project was launched in early 2004 with the aim of developing microsets and identifying other enablers for making data accessible. A key feature of the project is a Live Access Server, the first educational implementation of this open source software, developed by NOAA, that makes it possible to explore multiple data formats through a single interface. This powerful tool is made more useful to the primary target audiences (K-12 and amateur scientists) through careful selection of the data offered, user-friendly explanations of the tool itself, and age-appropriate explanations of the parameters. However experience already shows that graduate students and even practicing scientists can also make use of this resource. The website also hosts teacher-contributed lesson plans, and seeks to feature reports of research projects that use the data.

Author

*Earth Sciences; Data Acquisition; Research; Education*

**20080025219** Gemini Observatory, Hilo, HI, USA

**Engaging Our Host Communities**

O'Meara, Stephen J.; Harvey, Janice; Garcia, Maria Antonietta; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 52-57; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

Noting that a well-informed public can be one of astronomy's most powerful allies, this article reviews the activities that the Gemini Observatories engaged to outreach to the local communities in Hawaii and Chile.

CASI

*Public Relations; Promotion; Astronomy*

**ADMINISTRATION AND MANAGEMENT**

Includes management planning and research.

**20080025213** Gemini Observatory, Hilo, HI, USA

**Gemini's Compass: Polly Roth**

Michaud, Peter; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 58-61; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

This article reviews the work that Polly Roth, the Associate Director of Administration does in support of the work and missions of the Gemini Observatory.

CASI

*Management; Personnel*

## 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*.

**20080023858** Army Construction Engineering Research Lab., Champaign, IL USA

**Layout Composer User's Guide: Through Beta Version 0.22**

Nachtigall, Susan D; Brucker, Beth A; Nov 2004; 40 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478554; ERDC/CERL-SR-04-32; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478554>

Layout Composer is one of the Facility Composer suite of tools, created for use by facility planners, designers, and engineers during the initial phases of facility planning and design. In Facility Composer, customer-specific and computable criteria are associated with a growing facility model that continues throughout the life cycle of the facility. Facility Composer's ability to maintain a linkage between criteria and project elements (site, building, story, etc.) is beneficial in that it: (1) helps in defining criteria and recording their rationale; (2) helps ensure that critical criteria are followed, and that desired characteristics are recorded and addressed; (3) helps organize criteria and makes them available at their point of use; and (4) simplifies creation, maintenance, and distribution of new criteria. This work has developed user documentation for the Layout Composer application, to help users rapidly create 2D and 3D conceptual facility designs solutions.

DTIC

*Layouts; Manuals; Software Development Tools*

**20080024007** Maryland Univ., College Park, MD USA

**How Do Users Find Things with PubMed? Towards Automatic Utility Evaluation with User Simulations**

Lin, Jimmy; Smucker, Mark D; Feb 2008; 18 pp.; In English  
Contract(s)/Grant(s): HR0011-06-C-0023

Report No.(s): AD-A478703; LAMP-TR-148; HCIL-2008-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the context of document retrieval in the biomedical domain, this paper explores the complex relationship between the quality of initial query results and the overall utility of an interactive system. We demonstrate that a content-similarity browsing tool can compensate for poor retrieval results, and that the relationship between retrieval performance and overall utility is non-linear. Arguments are advanced with user simulations, which characterize the relevance of documents that a user might encounter with different browsing strategies. With broader implications to IR, this work provides a case study of how user simulations can be exploited as a formative tool for automatic utility evaluation. Simulation-based studies provide researchers with an additional evaluation tool to complement interactive and Cranfield-style experiments.

DTIC

*Analogies; Biomedical Data; Information Retrieval; Information Systems; Simulation; User Requirements*

**20080024064** Office National d'Etudes et de Recherches Aeronautiques, Toulouse, France

**Information Sharing Policies for Coalition Systems**

Cholvy, Laurence; Garion, Christophe; Saurel, Claire; Oct 1, 2006; 33 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478787; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Information Systems; Mathematical Logic; Policies*

**20080025082** Bolt, Beranek, and Newman, Inc., Cambridge, MA USA

**Dynamic Reconfiguration and Interoperation in Infospace Communities**

Loyall, Joseph; Sharma, Praveen; Gillen, Matthew; Ye, Jianming; Shantz, Richard; Jan 2008; 149 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-C-0267; Proj-ICED

Report No.(s): AD-A478371; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478371>

Under the DynRIIC project, we produced results in two primary areas of QoS management for information spaces: architecture and algorithms. In the architecture area, we conceived, designed, and prototyped a multi-layered QoS



management architecture suitable for information spaces. The multi-layered QoS management system works alongside the information manager in an information space and assigns QoS levels and resource allocations, produces and enforces QoS policies, and actuates QoS controls, including resource controls and information shaping. In the algorithms area, we developed several QoS allocation algorithms that work with the QoS management system, including resource and QoS allocation for single and multiple information spaces. We evaluated the algorithms indicating the relative merits and use of these algorithms in various scenarios, and prototyped some of the algorithms in the QoS decision maker components of the QoS management system.

DTIC

*Algorithms; Information Systems; Management Planning*

**20080025085** Edinburgh Univ., UK

**Collaborative Operations for Personnel Recovery**

Tate, Austin; Dalton, Jeff; Stader, Jussi; Wickler, Gerhard; Hansberger, Jeffrey; Feb 2008; 98 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-03-2-0014; DARPA ORDER-U904; Proj-DAML

Report No.(s): AD-A478440; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478440>

The report describes the I-X framework and its application to personnel recovery. When the I-X framework is instantiated with a domain-specific model, it is referred to as an I-X application. Such an application has been developed during the Co-OPR project for the task of personnel recovery and personnel recovery training. The I-X technology was applied to develop a tool that can be used to support collaborative personnel recovery as observed at the US Joint Forces Command (USJFCOM) Joint Personnel Recovery Agency (JPRA) Personnel Recovery Education and Training Center (PRETC). The application was evaluated through a series of experiments that were conducted at AIAI in Edinburgh (using remote observation) and later at USJFCOM/J9 experimental facilities in Norfolk, VA. The report describes the experimental set-up that was used to evaluate the Co-OPR application and how the execution of these experiments was performed. Finally the results of these experiments are presented and analyzed, showing that the I-X framework provides a number of useful features that can be exploited for personnel recovery task-support applications.

DTIC

*Education; Military Operations; Military Personnel; Personnel; Rescue Operations; Software Development Tools*

**20080025126** Battelle Memorial Inst., Richland, WA USA

**GLASS BOX**

Curtis, Laura; Feb 2008; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0090; Proj-CASE

Report No.(s): AD-A478486; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478486>

The goals of this effort were to develop Glass Box capabilities to allow for the capturing of analyst activities and the associated data resources, track and log the results of automated processing to provide threads for analyzing decisions made, and infer higher level cognitive processes from this. Due to funding cuts to the sponsoring organization, this contract was terminated at a very early stage and these planned developments were not performed. This technical note represents the sum of the work that was performed.

DTIC

*Glass; Information Retrieval*

**20080025199** Texas Univ., Austin, TX, USA

**History Matching in Parallel Computational Environments. (Final Report, September 1, 2003-August 31, 2006)**

Bryant, S.; Srinivasan, S.; Barrera, A.; Kim, Y.; Yadav, S.; Dec. 2006; 78 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT15410

Report No.(s): DE2007-909833; No Copyright; Avail.: National Technical Information Service (NTIS)

In the probabilistic approach for history matching, the information from the dynamic data is merged with the prior geologic information in order to generate permeability models consistent with the observed dynamic data as well as the prior geology. The relationship between dynamic response data and reservoir attributes may vary in different regions of the reservoir due to spatial variations in reservoir attributes, fluid properties, well configuration, flow constrains on wells etc. This implies

probabilistic approach should then update different regions of the reservoir in different ways. This necessitates delineation of multiple reservoir domains in order to increase the accuracy of the approach. A general procedure for gradual updating of geological models within an assisted history matching framework was developed as part of this project. We have also developed a robust scheme for identifying reservoir regions using principal components analysis of sensitivities that will result in a more robust parameterization of the history matching process. In order to render the domain delineation procedure feasible regardless of the flow simulator used for the purpose of history matching, a unique new scheme was developed that utilizes the variance of grid block pressure values calculated over a suite of realizations. Several examples of application of this new approach to domain delineation and its integration within the history matching framework is demonstrated in this report.

NTIS

*Distributed Processing; Reservoirs*

**20080025206** Bureau of Transportation Statistics, Washington, DC USA

**How Freight Moves: Estimating Mileage and Routes Using an Innovative GIS (Geographic Information System) Tool**

Lewis, S. M.; Ammah-Tagoe, F.; Jun. 2007; 6 pp.; In English

Report No.(s): PB2007-112892; BTS-TR-001; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The Bureau of Transportation Statistics (BTS) has developed an innovative software tool, called GeoMiler, that is helping researchers better estimate freight travel. GeoMiler is being used to compute mileages along likely routes for the nearly 6 million freight shipments expected to be reported in the 2007 Commodity Flow Survey (CFS), the nations largest survey of freight movements. These computations are used in estimating modal ton-miles of freight a key measure for understanding the use and performance of our nations freight transportation system. BTS, part of the Research and Innovative Technology Administration (RITA) of the U.S. Department of Transportation (USDOT), developed GeoMiler using current Geographic Information System (GIS) technology to assign routes and calculate mileage from the true origin to the true destination of each freight shipment even when more than one freight mode is used. While developed for use in the CFS, the tools integration of core GIS technology and its modeling approach can be used for any multimodal freight movement at all geographic levels.

NTIS

*Cargo; Estimating; Geographic Information Systems; Routes; Transportation*

**20080025218** Gemini Observatory, Hilo, HI, USA

**Earthquake Readiness Workshop**

Sheehan, Michael; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 49-51; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

Two primary areas of focus were defined early in the preparation phase for the workshop on Earthquake Readiness for observatories; structural design considerations and safety.

Derived from text

*Earthquakes; Safety; Structural Design; Astronomical Observatories*

**20080025302** Army War Coll., Carlisle Barracks, PA USA

**Multinational Operations: A Selected Bibliography**

Moyer, Jeanette M; Feb 2007; 17 pp.; In English

Report No.(s): AD-A478929; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478929>

This selected bibliography focuses on the special challenges of Multinational Operations, such as command arrangements, interoperability, intelligence sharing, multilateralism, and cultural diversity. It does not include general descriptions of multinational operations and exercises. With the exception of some important older titles, most of the books, documents, articles, and online resources cited are dated 2001 to the present. All items in this bibliography are available in the U.S. Army War College (USAWC) Library. For users' convenience, at the end of the entries the compiler has added library call numbers, Internet addresses, or database links. Call numbers indicate the item's shelf location in the USAWC library. Please note that call numbers can vary from library to library. Web sites were accessed during January 2007. This bibliography and others, compiled by research librarians, are available online through the Library's home page.

DTIC

*Bibliographies; Military Operations; Warfare*

**20080025303** Army War Coll., Carlisle Barracks, PA USA

**U.S. National Security and Strategy: A Selected Bibliography**

Moyer, Jeanette M; Oct 2007; 38 pp.; In English

Report No.(s): AD-A478930; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478930>

The study of U.S. national security and strategy is embedded in the core of the curriculum of the U.S. Army War College (USAWC). Compiled as a springboard into the research and understanding of an intertwined subject area, this selected bibliography reflects books, documents, periodical articles, and web sites relating to this topic. With a few notable exceptions, the materials in this bibliography are dated 2004 to the present. For older materials, please see the bibliography titled 'U.S. National Security and Strategy,' compiled by Jane E. Gibish, February 2004. All items are available in the USAWC Library. For users' convenience, at the end of the entries the compiler has added library call numbers, Internet addresses, or database links. Web sites were accessed during October 2007. This bibliography and others, compiled by research librarians, are available online through the Library's home page.

DTIC

*Bibliographies; Law (Jurisprudence); Policies; Security; United States*

**20080025348** Naval Research Lab., Washington, DC USA

**On LSB Spatial Domain Steganography and Channel Capacity**

Moskowitz, Ira S; Lafferty, Patricia A; Ahmed, Farid; Mar 21, 2008; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A479102; NRL/MR/5540--08-9118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479102>

In this paper, we show that for a generic greyscale bitmap it is possible to successfully embed a steganographic payload that survives JPEG compression. We describe our channel model, explain the necessary information theory, and derive capacity estimations to back our hypotheses. We also contrast our approach with other information theoretic efforts in the field of steganography.

DTIC

*Channel Capacity; Information Theory; Steganography*

**20080025352** Army War Coll., Carlisle Barracks, PA USA

**Post-Traumatic Stress Disorder and the Military: A Selected Bibliography**

Sekela, Lori M; Mar 2008; 29 pp.; In English

Report No.(s): AD-A479123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479123>

Over the past several years, the topic of military mental healthcare has received renewed attention, both inside and outside the Armed Forces. This selected bibliography focuses on post-traumatic stress disorder (PTSD) and its presentation in military personnel. Included are references to books, documents, periodical articles, multimedia, and web sites related to this topic. A separate section concentrates on PTSD in members of the military and its relationship to age, gender, or ethnicity. This is followed by a section focusing on disability claims as the result of PTSD. With a few notable exceptions, the materials in this bibliography are dated 2005 to the present. For information prior to this period, please refer to the previous edition of Post-Traumatic Stress Disorder and the Military: A Selected Bibliography. (November 2005). All items in this bibliography are available through the USAWC Library.

DTIC

*Bibliographies; Injuries; Military Personnel*

**20080025374** Virginia Univ., Charlottesville, VA USA

**Publish and Subscribe with Reply**

Hill, Jonathan C; Knight, John C; Crickenberger, Aaron M; Honhart, Richard; Oct 23, 2002; 16 pp.; In English

Report No.(s): AD-A479195; UVA-TR-CS-2002-32; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479195>

Reply for Publish and Subscribe allows receivers of a publication to reply to the publisher. We demonstrate that Reply is a natural, efficient, and useful component of Publish/Subscribe. It is natural because it maintains the weakest possible coupling between senders and receivers. It is efficient because it stores computations discarded in publication forwarding, later

applying them to channel replies. Most importantly, it is useful because it increases the domain of applications for which Publish/Subscribe is suited. This paper includes discussion of Reply's utility, introduction of two algorithms with differing state storage and capabilities, their analysis for worst-case conditions, modeling of required resources, and presentation of a modular implementation of Reply for distributed Publish/Subscribe systems.

DTIC

*Electronic Publishing; Message Processing*

**20080025379** Massachusetts Univ., Amherst, MA USA

**Unsupervised Non-topical Classification of Documents**

Bekkerman, Ron; Eguchi, Koji; Allan, James; Jan 2006; 17 pp.; In English

Contract(s)/Grant(s): HR0011-06-C-0023

Report No.(s): AD-A479242; CIIR-TR-IR-472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479242>

We describe the problem of non-topical clustering of documents, the purpose of which is to divide a set of documents into clusters that share some aspect. We present experiments on the British National Corpus that cluster documents by genre. We show that words are superior to part of speech information for genre clustering, but that better results can be obtained by using both. We also demonstrate that the new multi-way distributional clustering approach is highly effective for this task because it requires less feature crafting than other techniques.

DTIC

*Algorithms; Classifications; Information Retrieval*

**20080025380** Massachusetts Univ., Amherst, MA USA

**Simple Questions for Interactive Information Retrieval**

Kumaran, Giridhar; Allan, James; Jan 2006; 7 pp.; In English

Contract(s)/Grant(s): HR0011-06-C-0023

Report No.(s): AD-A479245; CIIR-TR-IR-507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479245>

We explore simple questions that can be used for interactive information retrieval. We develop four techniques that have the potential to be used in an interactive setting. The techniques are designed to be easy to use and understand, and provide good improvements in performance with minimal effort from the user. We test the automatic versions of the techniques in two environments known to be difficult, and report significant improvements in performance as measured by MAP and GMAP over pseudo-relevance feedback. Our successful testing of one of the techniques in an interactive setting encourages the pursuit of more similar techniques to improve information retrieval with a new approach.

DTIC

*Feedback; Information Retrieval; On-Line Systems*

**20080025479** Massachusetts Univ., Amherst, MA USA

**Chemical/Radiation Hormesis Database, Evaluation of Hormetic Mechanisms and their Biomedical and Risk Assessment Implications**

Calabrese, Edward J; Mar 2008; 8 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0104

Report No.(s): AD-A479282; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project assessed the biomedical and toxicological literature for evidence of hormesis, its frequency in the literature and its underlying mechanistic foundation. This work was supported by the continued development of the hormesis database and the conduct of a high level international conference on hormesis held annually. Particular focus was given to the area of neuroscience and hormesis in the literature assessment. Fourteen manuscripts concerning hormesis and neuroscience have been accepted for publication in the journal *Critical Reviews in Toxicology* and will be published in 2008.

DTIC

*Data Bases; Risk Assessment*

**20080025521** Department of Defense, Washington, DC USA

**Department of Defense Information Sharing Strategy**

May 4, 2007; 25 pp.; In English

Report No.(s): AD-A479383; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense (DoD) Information Sharing Strategy provides the common vision, goals and approaches that

guide the many information sharing initiatives and investments for the Department. This Strategy fulfills the imperative identified in the Quadrennial Defense Review (QDR). The Information Sharing Strategy guides the Department's exchange of information within the DoD and with Federal, state, local, tribal, coalition partners, foreign governments and security forces, international organizations, non-governmental organizations, and the private sector, hereafter referred to as external partners. This Strategy describes the information sharing approach for the Office of the Secretary of Defense, the Chairman of the Joint Chiefs of Staff, the Combatant Commands, the Military Departments, the Office of the Inspector General of the DoD, the Defense Agencies, the DoD Field Activities, and all other organizational entities in the DoD. It guides the information sharing activities and operations among these DoD entities and with external partners. The Strategy establishes the Departmental foundation for strategic implementation planning.

DTIC

*Information Systems*

**20080025532** Virginia Univ., Charlottesville, VA USA

**Supporting the Requirements for Multi-Level Secure and Real-Time Databases in Distributed Environments**

Son, Sang H; Chaney, Craig; Jan 1997; 20 pp.; In English

Report No.(s): AD-A479421; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Conflicts in database systems with both real-time and security requirements can sometimes be unresolvable. We attack this problem by allowing a database to have partial security in order to improve on real-time performance when necessary. By our definition, systems that are partially secure allow security violations between only certain levels. We present the ideas behind a specification language that allows database designers to specify important properties of their database at an appropriate level. In order to help the designers, we developed a tool that scans a database specification and finds all unresolvable conflicts. Once the conflicts are located, the tool takes the database designer through an interactive process to generate rules for the database to follow during execution when these conflicts arise. We briefly describe the BeeHive distributed database system, and discuss how our approach can fit into the BeeHive architecture.

DTIC

*Data Bases; Real Time Operation; Security*

**20080025633** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Method to Create a High Resolution Database**

Reid, Alexander A, Inventor; May 20, 2003; 30 pp.; In English

Report No.(s): AD-D020357; PATENT-6 567 087 B1; No Copyright; Avail.: US Patent and Trademark Office

A new method of creating a realistic simulated terrain database results in a database that requires less computer memory for storage than prior simulated terrain databases. The new method generates a simulated surface that provides realistic disturbances to a real-time mathematical model of a vehicle traversing the simulated surface. The simulated surface is also output visually. The method uses fractal brownian motion to create the high-resolution terrain data-base in the frequency domain, and then the database is transformed to the spatial domain using a two-dimensional inverse Fast Fourier Transform. Then control points describing a NURBS surface are extracted from the transformed database, and thereafter geometric G(exp 1) continuity is created between surface patches represented by the NURBS control points. The surface patches form a high-resolution superimposed on a lower resolution surface produced by the image generator to a create a hybrid, high-resolution simulated terrain. The hybrid simulated terrain interacts with the vehicle model to provide a realistic experience to a human driver navigating the vehicle model over the terrain.

DTIC

*Computer Storage Devices; Data Bases; High Resolution; Patents*

**20080025651** International Business Machines Corp., Armonk, NY USA

**Methods and apparatus for extraction and tracking of objects from multi-dimensional sequence data**

Hill, Matthew L., Inventor; Chang, Yuan-Chi, Inventor; Li, Chung-Sheng, Inventor; Castelli, Vittorio, Inventor; Bergman, Lawrence David, Inventor; May 13, 2008; 15 pp.; In English

Contract(s)/Grant(s): NCC5-305

Patent Info.: Filed January 12, 2005; US-Patent-7,373,359; US-Patent-Appl-SN-11/034,288; No Copyright; Avail.: CASI:

A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025651>

An object tracking technique is provided which, given: (i) a potentially large data set; (ii) a set of dimensions along which

the data has been ordered; and (iii) a set of functions for measuring the similarity between data elements, a set of objects are produced. Each of these objects is defined by a list of data elements. Each of the data elements on this list contains the probability that the data element is part of the object. The method produces these lists via an adaptive, knowledge-based search function which directs the search for high-probability data elements. This serves to reduce the number of data element combinations evaluated while preserving the most flexibility in defining the associations of data elements which comprise an object.

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

*Probability Theory; Data Reduction; Analogies; Extraction; Knowledge Based Systems*

**20080025860** George C. Marshall European Center for Security Studies, Garmisch-Partenkirchen, Germany

**Information as a Key Resource: The Influence of RMA and Network-Centric Operations on the Transformation of the German Armed Forces**

Collmer, Sabine; Feb 2007; 28 pp.; In English

Report No.(s): AD-A479039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA479039>

Information technology has had an almost unparalleled influence on the modernization and transformation of the armed forces in Western societies in recent years. Many areas of the US military in particular have been specially equipped with modern network-shaped technology since the 1990s, with the aim of achieving a qualitatively new degree of precision and speed in military operations. The Revolution in Military Affairs (RMA), and its implementation in the doctrine of Network-Centric Warfare (NCW), have become new military strategy paradigms for the US armed forces. Along with the security policy redefinition of the threat situation following the end of the Cold War, this development constitutes the strongest impetus for change in the armed forces of Western European countries. This discussion must begin with a warning that the development being described is more complex than it may appear at first glance. The desire to attribute the transformation of the armed forces solely to technological innovation and a technodeterministic impetus is one-dimensional and falls far short of the truth. The concept underpinning the revolution in military affairs comprises a multitude of factors such as security policy, military strategy and socio-political decisions in addition to the technological ones, all of which exert their own influence in tandem with the new technology. For this reason, an explanation that attributes the changes in the armed forces of Western Europe solely to the considerable speed of technological innovation must necessarily be incomplete. Instead, technological progress appears to be embedded in political, social and strategic changes and decisions. A contribution that seeks to analyze the influence of RMA must consequently always take into account a whole cluster of causes and effects. New security policy constellations, new actors on the world stage and an increasing asymmetry of force form the background to contemporary armed conflicts.

DTIC

*Armed Forces; Germany*

**20080025921** National Defense Univ., Washington, DC USA

**Defense Horizons. Cyber Influence and International Security. Number 61**

Kramer, Franklin D; Wentz, Larry; Jan 2008; 13 pp.; In English

Report No.(s): AD-A479370; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Cyber influence is an ongoing source of power in the international security arena. Although the USA has an enormous cyber information capacity, its cyber influence is not proportional to that capacity. Impediments to American cyber influence include the vastness and complexity of the international information environment, multiplicity of cultures and differing audiences to which communications must be addressed, extensiveness and significance of contending or alternative messages, and complexity and importance of using appropriate influential messengers and message mechanisms. Enhancing the influence of the USA in cyberspace will require a multifaceted strategy that differentiates the circumstances of the messages, key places of delivery, and sophistication with which messages are created and delivered, with particular focus on channels and messengers. To improve in these areas, the USA must focus on actions that include discerning the nature of the audiences, societies, and cultures into which messages will be delivered; increasing the number of experts in geographic and cultural arenas, particularly in languages; augmenting resources for overall strategic communications and cyber influence efforts; encouraging long-term communications and cyber influence efforts along with short-term responses; and understanding that successful strategic communications and cyber influence operations cannot be achieved by the USA acting on its own; allies and partners are needed both to shape our messages and to support theirs.

DTIC

*Horizon; Security*

**20080025940** Government Accountability Office, Washington, DC, USA

**Information Technology: DHS's Human Capital Plan is Largely Consistent with Relevant Guidance, but Improvements and Implementation Steps are Still Needed**

Sep. 2007; 46 pp.; In English

Report No.(s): PB2007-112728; GAO-07-425; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In performing its missions, the Department of Homeland Security (DHS) relies extensively on information technology (IT). Recognizing this, DHS's fiscal year 2006 appropriations act required its Chief Information Officer (CIO) to submit a report to congressional appropriations committees that includes, among other things, an IT human capital plan, and the act directs GAO to review the report. GAO's review addressed (1) whether the IT human capital plan is consistent with federal guidance and associated best practices and (2) the status of the plan's implementation. In performing its review, GAO compared DHS's plan and supporting documentation with 27 practices in the Human Capital Assessment and Accountability Framework of the Office of Personnel Management, and examined plan implementation activities at three DHS component agencies.

NTIS

*Information Systems; Security*

**88**

**SPACE SCIENCES (GENERAL)**

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

**20080026064** British National Space Centre, London, UK

**Space:UK Is Anybody there? The UK Scientists Looking for Life, Issue 25**

Bibi, Azara, Editor; June 2008; 28 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

In this issue we find out how UK scientists are searching for signs of life in the Universe. There may even be other planets that support life in our own Solar System. Leading British space Scientist Colin Pillinger gives us his take on the UK's future in space science and exploration. He also reveals his involvement, nearly 40 years ago, in the Apollo missions to the Moon. We have our latest batch of questions from eager students wanting to know more about the mysteries of space-findout what happens if you're ever unlucky enough to get sucked into a black hole!

Derived from text

*Black Holes (Astronomy); Solar System; United Kingdom; Aerospace Sciences*

**89**

**ASTRONOMY**

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

**20080023776** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**James Webb Space Telescope Project (JWST) Overview**

Dutta, Mitra; May 21, 2008; 21 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023776>

This presentation provides an overview of the James Webb Space Telescope (JWST) Project. The JWST is an infrared telescope designed to collect data in the cosmic dark zone. Specifically, the mission of the JWST is to study the origin and evolution of galaxies, stars and planetary systems. It is a deployable telescope with a 6.5 m diameter, segmented, adjustable primary mirror. outfitted with cryogenic temperature telescope and instruments for infrared performance. The JWST is several times more sensitive than previous telescope and other photographic and electronic detection methods. It hosts a near infrared camera, near infrared spectrometer, mid-infrared instrument and a fine guidance sensor. The JWST mission objection and architecture, integrated science payload, instrument overview, and operational orbit are described.

Derived from text

*James Webb Space Telescope; Infrared Telescopes; Infrared Astronomy*

**20080024205** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Phase Curve Survey of the Irregular Saturnian Satellites: A Possible Method of Physical Classification**

Bauer, James M.; Grav, Tommy; Buratti, Bonnie J.; Hicks, Michael D.; Icarus 184; June 12, 2006; ISSN 0019-1035; Volume 184, pp. 181-187; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1016/j.icarus.2006.04.011>; <http://hdl.handle.net/2014/40853>

During its 2005 January opposition, the saturnian system could be viewed at an unusually low phase angle. We surveyed a subset of Saturn's irregular satellites to obtain their true opposition magnitudes, or nearly so, down to phase angle values of 0.01 deg. Combining our data taken at the Palomar 200-inch and Cerro Tololo Inter-American Observatory's 4-m Blanco telescope with those in the literature, we present the first phase curves for nearly half the irregular satellites originally reported by Gladman et al. [2001. Nature 412, 163-166], including Paaliaq (SXX), Siarnaq (SXXIX), Tarvos (SXXI), Ijiraq (SXXII), Albiorix (SXVI), and additionally Phoebe's narrowest angle brightness measured to date. We find centaur-like steepness in the phase curves or opposition surges in most cases with the notable exception of three, Albiorix and Tarvos, which are suspected to be of similar origin based on dynamical arguments, and Siarnaq. During its 2005 January opposition, the saturnian system could be viewed at an unusually low phase angle. We surveyed a subset of Saturn's irregular satellites to obtain their true opposition magnitudes, or nearly so, down to phase angle values of 0.01 deg. Combining our data taken at the Palomar 200-inch and Cerro Tololo Inter-American Observatory's 4-m Blanco telescope with those in the literature, we present the first phase curves for nearly half the irregular satellites originally reported by Gladman et al. [2001. Nature 412, 163-166], including Paaliaq (SXX), Siarnaq (SXXIX), Tarvos (SXXI), Ijiraq (SXXII), Albiorix (SXVI), and additionally Phoebe's narrowest angle brightness measured to date. We find centaur-like steepness in the phase curves or opposition surges in most cases with the notable exception of three, Albiorix and Tarvos, which are suspected to be of similar origin based on dynamical arguments, and Siarnaq.

Author

*Saturn (Planet); Phase Shift; Brightness; Centaur Launch Vehicle*

**20080024208** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Chandra X-ray Observations of Young Clusters, Volume II, Orion Flanking Fields Data**

Ramirez, Solange V.; Rebull, Luisa; Stauffer, John; Strom, Stephen; Hillenbrand, Lynne; Hearty, Thomas; Kopan, Eugene L.; Pravdo, Steven; Makidon, Russell; Jones, Burton; The Astronomical Journal; August 2004; Volume 128, pp. 787-804; In English; Original contains black and white illustrations

Contract(s)/Grant(s): GO2-3011X; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40848>

We present results of Chandra observations of two flanking fields (FFs) in Orion, outside the Orion Nebula Cluster (ONC). The observations were taken with the ACIS-I camera with an exposure time of about 48 ks each field. We present a catalog of 417 sources, which includes X-ray luminosity, optical and infrared photometry, and X-ray variability information. We have found 91 variable sources, 33 of which have a flarelike light curve and 11 of which have a pattern of a steady increase or decrease over a 10 hr period. The optical and infrared photometry for the stars identified as X-ray sources are consistent with most of these objects being pre-main-sequence stars with ages younger than 10 Myr. We present evidence for an age difference among the X-ray-selected samples of NGC 2264, Orion FFs, and ONC, with NGC 2264 being the oldest and ONC being the youngest.

Author

*X Ray Astrophysics Facility; Cameras; Astronomical Photometry; Infrared Photometry; X Ray Optics; X Ray Sources; Pre-Main Sequence Stars; Orion Nebula; Optical Measurement*

**20080024215** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**The Companion to the Central Mira Star of the Protoplanetary Nebula OH 231.8+4.2**

Contreras, C. Sanchez; DePaz, A. Gil; Sahai, R.; The Astrophysical Journal; November 20, 2004; Volume 616, pp. 519-524; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NSF 99-81546; WBS 399-20-61-00; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1086/424827>; <http://hdl.handle.net/2014/40827>

We present deep optical long-slit spectra of the peculiar protoplanetary nebula (PPN) OH 231.8+4.2 obtained with the 6.5 m Baade Telescope at Las Campanas Observatory (Chile). In addition to the molecular absorption bands characteristic of the M9-10 III star inside OH 231.8+4.2 (QX Pup), we identify lines of the Balmer series in absorption, which do not form in the cool atmospheres of late M-type stars. We also confirm the presence of a blue continuum excess with an intensity that is a factor 30 larger than that expected for an M9-10 III star. Our results indicate the presence of a source hotter than QX Pup



illuminating OH 231.8+4.2 that is likely a main-sequence star with spectral type A. We discuss how the formation and nebular evolution of OH 231.8+4.2 could have been affected by the presence of a binary system in its core.

Author

*Absorption Spectra; Molecular Absorption; Main Sequence Stars; Nebulae; Late Stars; Continuums; Balmer Series*

**20080024219** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; Department of the Army, USA

**Confirmation of a Radio-Selected Galaxy Overdensity at  $z=1.11$**

Stern, Daniel; Holden, Brad; Stanford, S. A.; Spinard, Hyron; *The Astronomical Journal*; June 2003; Volume 125, pp. 2759-2768; In English; Original contains black and white illustrations

Contract(s)/Grant(s): W-7405-ENG-48; GO2-3194; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1086/374229>; <http://hdl.handle.net/2014/40834>

We report the discovery of a galaxy overdensity at  $z = 1.11$  associated with the  $z = 1.110$  high-redshift radio galaxy MG1 J04426+0202 (hereafter MG 0442+0202). The group, CI 0442+0202, was found in a near-infrared survey of  $z > 1$  radio galaxies undertaken to identify spatially coincident regions with a high density of objects red in I-K' color, typical of  $z > 1$  elliptical galaxies. Spectroscopic observations from the Keck I telescope reveal five galaxies within 35' of MG 0442+0202 at  $1.10 < z < 1.11$ . These member galaxies have broadband colors and optical spectra consistent with passively evolving elliptical galaxies formed at high redshift. Archival ROSAT observations reveal a 3 ( $\sigma$ ) detection of soft X-ray emission coincident with CI 0442+0202 at a level 5 times greater than expected for the radio galaxy. These data suggest a rich galaxy cluster and inspired a 45 ks Chandra X-Ray Observatory observation. As expected, the radio galaxy is unresolved by Chandra but is responsible for approximately half the observed X-ray flux. The remaining ROSAT flux is resolved into four point sources within 15' of the radio galaxy, corresponding to a surface density 2 orders of magnitude higher than average for X-ray sources at these flux levels [ $S(0.5-2 \text{ keV}) > 5 \times 10(\text{exp } -16) \text{ ergs cm } (\text{exp } -2) \text{ s}(\text{exp } -1)$ ]. One of these point sources is identified with a radio-quiet type II quasar at  $z = 1.863$ , akin to sources recently reported in deep Chandra surveys. The limit on an extended hot intracluster medium in the Chandra data is  $S(1-6 \text{ keV}) < 1.9 \times 10^{-15} \text{ ergs cm } (\text{exp } -2) \text{ s}(\text{exp } -1)$  (3 ( $\sigma$ ), 30' radius aperture). Though the X-ray observations do not confirm the existence of a massive bound cluster at  $z > 1$ , the success of the optical/near-infrared targeting of early-type systems near the radio galaxy validates searches using radio galaxies as beacons for high-redshift large-scale structure. We interpret CI 0442+0202 as a massive cluster in the process of formation.

Author

*Galactic Clusters; Galaxies; Quasars; Radio Galaxies; Red Shift; X Ray Sources; X Ray Astronomy*

**20080025039** California Inst. of Tech., Pasadena, CA, USA

**Spitzer 24 Micron Observations of Optical/Near-Infrared-Selected Extremely Red Galaxies: Evidence for Assembly of Massive Galaxies at  $Z$  approximately equal to 1-2?**

Yan, Lin; Choi, Philip I.; Fadda, D.; Marleau, F. R.; Soifer, B. T.; Im, M.; Armus, L.; Frayer, D. T.; Storrie-Lombardi, L. J.; Thompson, D. J.; Teplitz, H. I.; Helou, G.; Appleton, P. N.; Chapman, S.; Fan, F.; Heinrichsen, I.; Lacy, M.; Shupe, D. L.; Squires, G. K.; Surace, J.; Wilson, G.; *The Astrophysical Journal Supplement Series*; September 2004; Volume 154, pp. 75-79; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NASA 1407; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40850>

We carried out direct measurement of the fraction of dusty sources in a sample of extremely red galaxies with  $(R - K_s) \geq 5.3 \text{ mag}$  and  $K_s < 20.2 \text{ mag}$ , using 24 micron data from the Spitzer Space Telescope. Combining deep 24 micron  $K_s$ - and  $R$ -band data over an area of  $\sim 64 \text{ arcmin}(\text{sup } 2)$  in ELAIS N1 of the Spitzer First Look Survey (FLS), we find that 50%  $\pm$  6% of our extremely red object (ERO) sample have measurable 24 micron flux above the 3 ( $\sigma$ ) flux limit of 40 ( $\mu\text{Jy}$ ). This flux limit corresponds to a star formation rate (SFR) of 12 solar masses per year  $\sim 1$ , much more sensitive than any previous long-wavelength measurement. The 24 micron-detected EROs have 24 micron/2.2 micron and 24 micron/0.7 micron flux ratios consistent with infrared luminous, dusty sources at  $z \geq 1$ , and are an order of magnitude too red to be explained by an infrared quiescent spiral or a pure old stellar population at any redshift. Some of these 24 micron-detected EROs could be active galactic nuclei; however, the fraction among the whole ERO sample is probably small, 10%-20%, as suggested by deep X-ray observations as well as optical spectroscopy. Keck optical spectroscopy of a sample of similarly selected EROs in the FLS field suggests that most of the EROs in ELAIS N1 are probably at  $z \sim 1$ . The mean 24 micron flux (167 ( $\mu\text{Jy}$ )) of the 24 micron-detected ERO sample roughly corresponds to the rest-frame 12 micron luminosity,  $(\nu)L(\nu)(12 \text{ micron})$ , of  $3 \times 10(\text{exp } 10)(\text{deg})$  solar luminosities at  $z \sim 1$ . Using the  $c \text{ IRAS } (\nu)L(\nu)(12 \text{ micron})$  and infrared luminosity  $\text{LIR}(8-1000 \text{ micron})$ , we infer that the  $(\text{LIR})$  of the 24 micron- detected EROs is  $3 \times 10(\text{exp } 11)$  and  $1 \times 10(\text{exp } 12)$  solar luminosities at  $z = 1.0$  and similar to that of local luminous infrared galaxies (LIRGs) and ultraluminous infrared galaxies (ULIRGs). The

corresponding SFR would be roughly 50-170 solar masses per year. If the timescale of this starbursting phase is on the order of 108 yr as inferred for the local LIRGs and ULIRGs, the lower limit on the masses of these 24 micron-detected EROs is  $5 \times 10^{(exp 9)}$  to  $2 \times 10^{(exp 10)}$  solar masses. It is plausible that some of the starburst EROs are in the midst of a violent transformation to become massive early type galaxies at the epoch of  $z \sim 1-2$ .

Author

*Active Galactic Nuclei; Infrared Astronomy Satellite; Infrared Radiation; Near Infrared Radiation; Space Infrared Telescope Facility; Red Shift; Luminosity*

**20080025040** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Apparent Stellar Wobble by a Planet in a Circumstellar Disk: Limitations on Planet Detection by Astrometry**

Takeuchi, Taku; Velusamy, T.; Lin, D. N. C.; Astrophysical Journal; January 10, 2005; Volume 618, pp. 987-1000; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-10612; NSF AST99-87417; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40851>

Astrometric detection of a stellar wobble on the plane of the sky will provide us the next breakthrough in searching for extrasolar planets. The Space Interferometry Mission (SIM) is expected to achieve high-precision astrometry as accurate as 1 ( $\mu$ )as, which is precise enough to discover a newborn Jupiter mass planet around a pre-main-sequence (PMS) star in the Taurus-Auriga star-forming region. PMS stars, however, have circumstellar disks that may be obstacles to the precise measurement of the stellar position. We present results on disk influences on the stellar wobble. The density waves excited by a planet move both the disk's mass center and the photocenter. The motion of the disk mass center induces an additional wobble of the stellar position, and the motion of the disk photocenter causes a contamination in the measurement of the stellar position. We show that the additional stellar motion dynamically caused by the disk's gravity is always negligible but that the contamination by the disk light can interfere with the precise measurement of the stellar position if the planet's mass is smaller than approximately 10MJ. The motion of the disk photocenter is sensitive to a slight change in the wave pattern and the disk properties. Measurements by interferometers are generally insensitive to extended sources such as disks. Because of this property, SIM will not suffer significant contamination by the disk light, even if the planet's mass is as small as 1M(sub J).

Author

*Astrometry; Gravitational Effects; Extrasolar Planets; Stellar Orbits; Accretion Disks; Planet Detection*

**20080025043** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Stardust Encounters Comet 81P/Wild 2**

Tsou, P.; Brownlee, D. E.; Anderson, J. D.; Bhaskaran, S.; Chevront, A. R.; Clark, B. C.; Duxbury, T.; Economou, T.; Green, S. F.; Hanner, M. S.; Horz, F.; Kissel, J.; McDonnell, J. A. M.; Newburn, R. L.; Ryan, R. E.; Sandford, S. A.; Sekanina, Z.; Tuzzolino, A. J.; Vellinga, J. M.; Zolensky, M. E.; Journal Of Geophysical Research; December 22, 2004; Volume 109; 8 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2004JE002317>; <http://hdl.handle.net/2014/40845>

Stardust successfully encountered comet 81P/Wild 2 on 2 January 2004 at a distance of 236.4 +/- 1 km. All encounter investigations acquired valuable new and surprising findings. The time-of-flight spectrometer registered 29 spectra during flyby and measured the first negative ion mass spectra of cometary particles. The dust detectors recorded particles over a broad mass range,  $10^{(exp -11)}$  to  $10^{(exp -4)}$  g. Unexpectedly, the dust distribution along Stardust's flight path was far from uniform, but instead occurred in short 'bursts', suggesting in-flight breakup of fragments ejected from the nucleus. High-resolution, stunning images of the Wild 2 surface show a diverse and complex variety of landforms not seen from comets 1P/Halley and 19P/Borrelly or icy satellites of the outer solar system. Longer-exposure images reveal large numbers of jets projected nearly around the entire perimeter of the nucleus, many of which appear to be highly collimated. A triaxial ellipsoidal fit of the Wild 2 nucleus images yields the principal nucleus radii of 1.65 X 2.00 X 2.75 km (+/- 0.05 km). The orientations and source locations on the nucleus surface of 20 highly collimated and partially overlapping jets have been traced. There is every indication that the expected samples were successfully collected from the Wild 2 coma and are poised for a return to Earth on 15 January 2006.

Author

*Stardust Mission; Wild 2 Comet; Gas Giant Planets; Flyby Missions; Ellipsoids; Dust; Halley's Comet*

**20080025045** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Astrometric Discovery of GJ 164B**

Pravdo, Steven H.; Shaklan, Stuart B.; Henry, Todd; Benedict, G. Fritz; The Astrophysical Journal; December 20, 2004; Volume 617, pp. 1323-1329; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources  
ONLINE: doi.10.1086/425653; <http://hdl.handle.net/2014/40831>

We discovered a low-mass companion to the M dwarf GJ 164 with the CCD-based imaging system of the Stellar Planet Survey astrometric program. The existence of GJ 164B was confirmed with Hubble Space Telescope NICMOS imaging observations. A high-dispersion spectral observation in V sets a lower limit of  $\Delta m > 2.2$  mag between the two components of the system. Based on our parallax value of  $82 \pm 8$  mas, we derive the following orbital parameters:  $P = 2.04 \pm 0.03$  yr,  $a = 103 \pm 0.03$ , and  $M_{\text{total}} = 0.265 \pm 0.020 M_{\odot}$ . The component masses are  $M_A = 0.170 \pm 0.015 M_{\odot}$  and  $M_B = 0.095 \pm 0.015 M_{\odot}$ . Based on its mass, colors, and spectral properties, GJ 164B has spectral type M6-M8 V.

Author

*Imaging Techniques; Hubble Space Telescope; Parallax; Stars*

**20080025124** Air Force Research Lab., Hanscom AFB, MA USA

**Seeking Radio Emissions from Hypervelocity Micrometeoroid Impacts: Early Experimental Results from the Ground**

Starks, M J; Cooke, D L; Dichter, B K; Chhabildas, L C; Reinhart, W D; Thornhill, III, T F; Nov 15, 2006; 8 pp.; In English  
Contract(s)/Grant(s): Proj-5021

Report No.(s): AD-A478479; AFRL-RV-HA-TR-2008-1014; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478479>

High-velocity impact experiments have been conducted to look for radio frequency (RF) emissions from impact-produced plasmas that could be used to identify micrometeoroid impacts to spacecraft in orbit. Launched by a three-stage light gas gun, 17 mm diameter by 0.9 mm thick Ti6Al-4V flyer plates impacted 0.75 mm thick indium (In) foil at more than  $10 \text{ km s}^{-1}$ . The resulting collision presumably ionized some fraction of the vaporized in cloud, which was accelerated to about  $12 \text{ km s}^{-1}$ . This weak In plasma then passed through a wide-band detection system that looked for RF emissions. Over the course of five shots during the experiment, no conclusive plasma emissions from the In were detected. However, strong evidence indicates that significant charge is accumulated on the flyer plate during acceleration and flight, possibly producing Paschen discharge to the chamber walls. Finally, plasma may be produced by the launcher secondary to launching the plate, leading to further contamination of the results. These effects have significant consequences for RF experiments attempted in launching systems of this type.

DTIC

*Emission; Experiment Design; Hypervelocity Impact; Meteoroids; Micrometeoroids; Radio Frequencies*

**20080025210** Gemini Observatory, Hilo, HI, USA

**Gemini Focus: Newsletter of the Gemini Observatory**

Michaud, Peter, Editor; Fisher, R. Scott, Editor; Peterson, Caroly Collins, Editor; June 2008; 68 pp.; In English; See also 20080025211 - 20080025226; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The contents include: 1) Supernova Birth Seen in Real Time; 2) Intermediate-Mass Black Hole in Omega Centauri; 3) Collisions of Planetary Embryos in the Pleiades; 4) Taking the Measure of a Black Hole; 5) Arp 299 through the LGS AO Looking Glass; 6) To Coldly Go Where No Brown Dwarf Has Gone Before; 7) Recent Science Highlights; 8) NICI Update; 9) GNIRS Update; 10) FLAMINGOS-2 Update; 11) MCAO System Status; 12) Aspen Instrument Update; 13) Earthquake Readiness Workshop; 14) Engaging Our Host Communities; 15) Gemini's Compass: Polly Roth; and 16) The Workhorse's Caretaker: Rodrigo Carrasco.

CASI

*Gemini Project; Black Holes (Astronomy); Astronomical Observatories; Celestial Bodies*

**20080025214** Gemini Observatory, Hilo, HI, USA

**The Workhorse's Caretaker: Rodrigo Carrasco**

Tytell, David; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 62-65; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

This article reviews the interests, life and accomplishments of Rodrigo Carrasco, the instrument scientist for the Gemini Multi-Object Spectrograph (GMOS).

CASI

*Scientists; Biography*

**20080025215** Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA

**Taking the Measure of a Black Hole**

Prestwich, Andrea; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 19-22; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

How do you measure the mass of a black hole? This question is addressed in this article. The way astronomers measure the mass of a Black hole is when it is part of a binary system with a 'normal' star. The orbital period and radial velocity of the normal star is recorded, and Kepler's law is used to obtain a mass for the system. This article focuses on two newly discovered black hole binaries, M33 X-7 and IC 10 X-1. They are the first extragalactic black hole binaries to have dynamically measured masses.

CASI

*Black Holes (Astronomy); Local Group (Astronomy); Starburst Galaxies; Binary Stars; Stellar Luminosity; Stellar Evolution*

**20080025216** Max-Planck-Inst. fuer Extraterrestrische Physik, Germany

**Intermediate-Mass Black Hole in Omega Centauri**

Noyola, Eva; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 11-14; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

This article reviews the search for an intermediate mass black hole. Using an archival image from the Hubble Space Telescope's Advanced Camera for Surveys, the authors measured the radial density profile for the central parts of the Omega Centauri star cluster. The kinematics were investigated to measure the velocity of the stars in the central region of the cluster. After reviewing other possible explanations for the observations, the authors concluded that a central black hole of 40,000 solar masses.

CASI

*Black Holes (Astronomy); Kinematics; Star Clusters; Stellar Mass*

**20080025220** Gemini Observatory, La Serena, Chile

**NICI Update**

Hayward, Tom; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 37-38; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

The Near-Infrared Coronagraphic Imager (NICI) continues to advance toward the start of its planet hunting campaign and queue science operations with a series of improvements and commissioning runs at Gemini South during 2007 and early 2008. Derived from text

*Coronagraphs; Near Infrared Radiation; Astronomical Photography; Astronomical Observatories*

**20080025222** Gemini Observatory, La Serena, Chile

**To Coldly Go Where No Brown Dwarf Has Gone Before**

Artigau, Etienne; Delorme, Philippe; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 28-30; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

The search for substellar objects had a frustrating beginning. More than 20 years passed between the theoretical groundwork that predicted the existence of brown dwarfs and the discovery of the first unambiguous substellar object in 1995: Gl229b. Despite this slow start, about 650 L and T dwarfs have now been identified, mostly thanks to the 2-Micron All Sky Survey (2MASS), the Sloan Digital Sky Survey (SDSS) and the Deep Near-Infrared Survey of the Southern Sky (DENIS). This article reviews the work of the Gemini team that is investigating these objects.

Derived from text

*Dwarf Stars; Subdwarf Stars; Stellar Evolution; Stellar Temperature; Cool Stars*

**20080025223** Gemini Observatory, Hilo, HI, USA

**Recent Science Highlights**

Roy, Dean-Rene; Fisher, R. Scott; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 31-36; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

The discoveries on several projects of interest to scientist are briefly reviewed. These are: Gycolotron Radiation from interacting Dwarf Star Pair; More Evidence of Gas Inflows Toward Galaxy Nucleus; Eruptive V1647 Orionis is Taking a Nap; The Birthplace of Supernova 2007gr in NGC 1058, A Second Look at RY Tauri Reveals New Jet; and Seeing Double (Nuclei) in NGC 3256

CASI

*Galaxies; Astronomy; Astrophysics; Astronomical Observatories; Astronomical Photography*

**20080025224** Gemini Observatory, La Serena, Chile

**Arp 299 through the LGS AO Looking Glass**

Gratadour, Damien; Roy, Jean-Rene; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 23-27; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

The study of star formation in merging systems in the local universe is of particular use in the understanding of galactic evolution. We observed Arp 299 during the nights of April 30 and May 1, 2007 with Altair-LGS/NIRI in the H and K bands. The f/14 mode was employed in order to get the widest field possible while keeping a reasonable (Nyquist) sampling of the point-spread function (PSF). The western nucleus was used as a guide source for tip/tilt correction while the laser itself was placed at the center of the field to get as homogeneous a correction as possible. The Strehl ratio (a metric for the AO compensation quality) ranged from 15 to 17 % in the K band and 10 to 15% in the H band. Strehl was quite uniform across the field thanks to the use of the laser guide star that reduced the anisoplanatic effect that normally degrades the off-axis image quality in classical AO systems. Our observations of Arp 299 are the deepest H- and K-band images of this object with a resolution of 0.1 arcsecond or better. They supersede previous data obtained with the Near-infrared Camera and Multiobject Spectrograph (NICMOS) on HST. The reduced data reveal a large amount of detail. The quality achieved with the LGS AO system allowed several new stellar clusters to be detected for the first time. Moreover, the f/i4 mode (with a field of view of almost 50 arcseconds) provides a high-resolution snapshot of the whole system which is especially important for the study of the central bridge that links the two main components of the system.

Derived from text

*Galactic Evolution; Star Clusters; Star Formation*

**20080025225** Princeton Univ., Princeton, NJ, USA

**Supernova Birth Seen in Real Time**

Berger, Edo; Soderberg, Alicia; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 7-10; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

This article describes the sequence of a supernova explosion, and explains why it is difficult to observe the actual explosion. The steps taken to explore the Supernova 2008D (SN2008D) are reviewed. The conclusion is drawn that all core collapse supernovae can be detected at the time of explosion using a wide-field x-ray instrument. The detection of neutrinos and gravitational waves may ultimately hold the key to unraveling the mystery of the supernova explosion mechanism.

CASI

*Real Time Operation; Supernovae; Stellar Physics; Stellar Mass Ejection; X Ray Astronomy*

**20080025226** California Univ., Los Angeles, CA, USA

**Collisions of Planetary Embryos in the Pleiades**

Rhee, Joseph; Gemini Focus: Newsletter of the Gemini Observatory; June 2008, pp. 15-18; In English; See also [20080025210](#); Original contains color illustrations; Copyright; Avail.: Other Sources

This article reviews the search for excess emission in the mid-infrared around the main-sequence stars using Spitzer archive data. Spitzer multi-band imaging photometer (MIPS) 24-micron images have a fairly large field of view (6 x 5 arcminutes); which means that, in addition to a target object, many field stars appear in most MIPS images. HD23514 (located in the Pleiades star cluster) was discovered. It is a warm and dusty Sun-like star. The article examines the research that was done to understand this star, and possible inferences for the formation of terrestrial planets in their early development.

CASI

*Main Sequence Stars; Pleiades Cluster; Terrestrial Planets; Planetary Evolution; Extrasolar Planets; Protoplanetary Disks; Zodiacal Dust*

**20080025291** Naval Observatory, Flagstaff, AZ USA

**The SDSS DR4 White Dwarf Catalog**

Kleinman, S J; Eisenstein, Daniel J; Liebert, James; Harris, Hugh C; Jan 2007; 4 pp.; In English  
Report No.(s): AD-A478892; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478892>

Following up on the Kleinman et al. (2001) white dwarf catalog from the Sloan Digital Sky Survey Data Release One, Eisenstein et al. (2006) have an updated version from Data Release Four. Here we report on what the catalog contains and highlight some differences between this and the earlier effort.

DTIC

*Catalogs (Publications); Dwarf Stars; White Dwarf Stars*

**20080025299** Arizona Univ., Tucson, AZ USA

**White Dwarfs From the SDSS: 90 Prime - Goin' Deep in the White Dwarf Luminosity Function**

Liebert, James; Kilic, Mukremin; Williams, Kurtis A; von Hippel, Ted; Winget, Don; Munn, Jeff; Harris, Hugh C; Levine, Stephen; Metcalfe, Travis S; Aug 2006; 7 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): AST-0307321; AST-0607480  
Report No.(s): AD-A478922; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA478922>

A large sample of cool white dwarfs from the Sloan Digital Sky Survey has been used to construct a luminosity function (LF), with the selection based on the method of reduced proper motion. While the sample is 60 times larger than that from our Luyten Half Second proper motion survey, its sensitivity to the region past the peak of the LF is severely limited by the necessity to match positions with detections from Palomar plates. A new survey to realize the full limiting magnitudes of the SDSS is described.

DTIC

*Dwarf Stars; Luminosity; White Dwarf Stars*

**20080025475** Friends of the Observatory, Los Angeles, CA USA

**Completing the Educational Exhibits Supporting the Initial Planetarium Show at Griffith Observatory**

Lombardo, Camille; Pine, Mark; Mar 18, 2008; 3 pp.; In English  
Contract(s)/Grant(s): FA9550-05-1-0352

Report No.(s): AD-A479254; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Gottlieb Transit Corridor is a key educational exhibit that enhances the impact of the inspirational storytelling of the new planetarium show that was funded by the FY2004-O5 grant. It provides an 'aha!' moment to all who encounter the exhibit as the motion and nature of the sky are dramatically demonstrated before the visitors' eyes. From a learning standpoint, astronomy is often considered a gateway for interest in other sciences. Science literacy is imperative in this age of fast moving technology and global economy. The challenge for an institution such as Griffith Observatory is that the public's understanding of astronomy is filled with misleading information derived from science fiction, antiquated ideas, and incomplete awareness of new information. This creative new outdoor exhibit reveals the celestial meridian and the motion of the sky using physical architecture. It is in well thought-out, distinctive, immersive environments like the Transit Corridor that visitors have the opportunity to engage in the practice and excitement of observation through real experiences and to become astronomical observers. Such experiences are the basis for genuine educational inspiration that motivates tomorrow's scientists and educators to want to know more. Inspiration based upon observation is the educational objective of the Transit Corridor.

DTIC

*Astronomy; Corridors; Education; Learning; Observatories; Planetariums*

**20080025505** Defence Research and Development Canada, Valcartier, Quebec Canada

**Evaluation of the Iterative Method for Image Background Removal in Astronomical Images**

Levesque, Martin P; Lelievre, Mario; Feb 2008; 30 pp.; In English

Report No.(s): AD-A479337; DRDC-V-TN-2007-344; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For surveillance of space purposes, algorithms were developed to automatically detect satellite streaks in astronomical images (Ref. 2 and 3). However, the performances of the algorithms for the background removal were not tested. This technical note contains a short analysis that proves that image backgrounds are adequately removed with the algorithms

described in Ref. 2. It also contains an algorithm variation that makes it more reliable. The analysis of image residues shows that the residual background is fainter than the detection sensitivity threshold and does not affect the detection performance.  
DTIC

*Algorithms; Astronomical Photography; Astronomy; Cameras; Image Processing*

## 90

### ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

**20080023952** Texas Univ., Austin, TX USA

#### **An Attempt to Detect Coronal Mass Ejections in Lyman-alpha Using SOHO Swan**

Mays, M L; St Cyr, O C; Quemerais, E; Ferron, S; Bertaux, J; Yashiro, S; Howard, R; Mar 1, 2007; 14 pp.; In English  
Report No.(s): AD-A478625; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this study, the possibility that coronal mass ejections (CMEs) may be observed in neutral Lyman-alpha emission was investigated. An observing campaign was initiated for SWAN (Solar Wind ANisotropies), a Lyman-alpha; scanning photometer on board the Solar and Heliospheric Observatory (SOHO) dedicated to monitoring the latitude distribution of the solar wind from its imprints on the interstellar sky background. This was part of SOHO Joint Observing Program (JOP) 159 and was an exploratory investigation as it was not known how, or even if, CMEs interact with the solar wind and interstellar neutral hydrogen at this distance (approximately 60 and 120 Rs). The study addresses the lack of methods for tracking CMEs beyond the field-of-view of current coronagraphs (30 Rs). In our first method we used LASCO white-light coronagraphs on SOHO, and EIT, an extreme ultraviolet imaging telescope also on SOHO, to identify CME candidates which, subject to certain criteria, should have been observable in SWAN. The criteria included SWAN observation time and location, CME position angle, and extrapolated speed. None of the CME candidates that we discuss were identified in the SWAN data. For our second method we analyzed all of the SWAN data for 184 runs of the observing campaign, and this has yielded one candidate CME detection. The candidate CME appears as a dimming of the background Lyman-alpha intensity representing approximately 10% of the original intensity, moving radially away from the Sun. Multiple candidate CMEs observed by LASCO and EIT were found which may have caused this dimming. Here we discuss the campaign, data analysis technique and statistics, and the results.

DTIC

*Coronal Mass Ejection; Lyman Alpha Radiation*

**20080024083** Romanian Academy, Bucharest, Romania

#### **Quasi-Static Modelling of the Ionosphere-Magnetosphere Coupling: Ionospheric Localized Effects**

Echim, M; Roth, M; De Keyser, J; Sep 2006; 9 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A478837; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

*Ionospheric Disturbances; Kinetics; Magnetosphere-Ionosphere Coupling; Magnetospheres*

**20080025086** Air Force Research Lab., Hanscom AFB, MA USA

#### **Proton Flux Anisotropy in Low Earth Orbit**

Ginet, Gregory P; Dichter, Bronislaw K; Brautigam, Donald H; Madden, Dan; Dec 3, 2007; 7 pp.; In English  
Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A478471; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478471>

Proton flux anisotropy as a function of altitude in the South Atlantic Anomaly (SAA) is investigated using data from the Compact Environment Sensor (CEASE) flown onboard the Tri-Service Experiment-5 (TSX-5) satellite from June 2000 to July 2006. In a 410 x 1710 km, 69 degree inclination orbit, TSX-5 spanned a broad range of the low Earth orbit regime. Using measurements of total dose, integral energy flux >40 MeV and the differential flux at 40 MeV sorted into 3 degree latitude x 3 degree longitude x 50 km altitude bins and averaged over the entire mission, the components arising from eastward and westward traveling protons have been determined in areas of the SAA where CEASE detection efficiency is not compromised. For the first time, ratios of these components have been compared to predictions of East-West effect models above 400 km. There is good agreement in general with the anisotropy becoming apparent at approximately 1200 km (moving down) and increasing rapidly starting at approximately 1000 km, the magnitude and rate depending on location within the anomaly.

Measurement of the differential flux at 40MeV are compared to predictions of standard radiation belt models as a function of altitude and found to be substantially higher in magnitude than AP8, though a comprehensive survey has not yet been performed.

DTIC

*Anisotropy; Anomalies; Low Earth Orbits; Protons; Radiation Belts*

**20080025089** Air Force Research Lab., Hanscom AFB, MA USA; Dartmouth Coll., Hanover, NH, USA; Aerospace Corp., Los Angeles, CA, USA; Boston Univ., Boston, MA, USA

**Global MHD Test Particle Simulations of >10 MeV Radiation Belt Electrons During Sudden Storm Commencement**

Kress, B T; Hudson, M K; Looper, M D; Albert, J; Lyon, J G; Goodrich, C C; Sep 22, 2007; 12 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A478477; AFRL-RV-HA-TR-2008-1012; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478477>

Prior to 2003, there are two known cases where ultrarelativistic (>or~ 10MeV) electrons appeared in the Earth's inner zone radiation belts in association with high speed interplanetary shocks: the 24 March 1991 and the less well-studied 21 February 1994 storms. During the March 1991 event electrons were injected well into the inner zone on a timescale of minutes, producing a new stably trapped radiation belt population that persisted for ~10 years. More recently, at the end of solar cycle 23, a number of violent geomagnetic disturbances resulted in large variations in ultrarelativistic electrons in the inner zone, indicating that these events are less rare than previously thought. Here we present results from a numerical study of shock-induced transport and energization of outer zone electrons in the 1-7 MeV range, resulting in a newly formed 10-20 MeV electron belt near L~3. Test particle trajectories are followed in time-dependent fields from an MHD magnetospheric model simulation of the 29 October storm sudden commencement.

DTIC

*Electrons; Magnetohydrodynamics; Radiation Belts; Simulation; Storms; Sudden Storm Commencements*

**20080025125** Air Force Research Lab., Hanscom AFB, MA USA

**Simple Approximations of Quasi-Linear Diffusion Coefficients**

Albert, J M; Dec 1, 2007; 10 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A478480; AFRL-RV-HA-TR-2008-1013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA478480>

Quasi-linear diffusion by cyclotron-resonant plasma waves is likely a key ingredient of the behavior of electrons in the Earth's radiation belts. Multidimensional dynamical simulations are under development, which require the diffusion coefficients to be evaluated quickly as well as accurately. The recently developed parallel propagation approximation replaces the integration over wavenormal distribution to a closed form expression, and can be quite accurate. However, it can also perform badly, especially for electron energy  $\geq 1$  MeV. Here, the accuracy, justification, and limits of the approximation are explored, and an improved version is presented. It is based on a previously developed procedure for identifying wavenormal angles compatible with imposed cutoffs on the wave frequency distribution. Because it also requires evaluation at only a small number of points, it features computational efficiency comparable to the parallel propagation version, while preserving contributions from oblique waves and all relevant harmonic numbers. Detailed comparisons are presented using an established model of nightside chorus.

DTIC

*Cyclotron Resonance; Diffusion Coefficient; Plasma Waves*

**20080025163** NASA Marshall Space Flight Center, Huntsville, AL, USA

**The Gravity Probe B Experiment**

Kolodziejczak, Jeffrey; April 04, 2008; 11 pp.; In English; Owlabama Blast, 4-6 Apr. 2008, Birmingham, AL, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: C01, CD-ROM: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080025163>

This presentation briefly describes the Gravity Probe B (GP-B) Experiment which is designed to measure parts of Einstein's general theory of relativity by monitoring gyroscope orientation relative to a distant guide star. To measure the



miniscule angles predicted by Einstein's theory, it was necessary to build near-perfect gyroscopes that were approximately 50 million times more precise than the best navigational gyroscopes. A telescope mounted along the central axis of the dewar and spacecraft provided the experiment's pointing reference to a guide star. The telescope's image divide precisely split the star's beam into x-axis and y-axis components whose brightness could be compared. GP-B's 650-gallon dewar, kept the science instrument inside the probe at a cryogenic temperature for 17.3 months and also provided the thruster propellant for precision attitude and translation control. Built around the dewar, the GP-B spacecraft was a total-integrated system, comprising both the space vehicle and payload, dedicated as a single entity to experimentally testing predictions of Einstein's theory.

CASI

*Gravity Probe B; Gravitational Effects; Relativity; Data Acquisition*

**20080025686** Fermi National Accelerator Lab., Batavia, IL, USA

**Data Acquisition, Storage and Control Architecture for the SuperNova Acceleration Probe**

Prosser, A.; Cardoso, G.; Chramowicz, J.; Marriner, J.; Rivera, R.; May 01, 2007; 6 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-910188; FERMILAB-CONF-07-097-CD; No Copyright; Avail.: Department of Energy Information Bridge

The SuperNova Acceleration Probe (SNAP) instrument is being designed to collect image and spectroscopic data for the study of dark energy in the universe. In this paper, we describe a distributed architecture for the data acquisition system which interfaces to visible light and infrared imaging detectors. The architecture includes the use of NAND flash memory for the storage of exposures in a file system. Also described is an FPGA-based lossless data compression algorithm with a configurable pre-scaler based on a novel square root data compression method to improve compression performance. The required interactions of the distributed elements with an instrument control unit will be described as well.

NTIS

*Dark Energy; Data Acquisition; SNAP; Supernovae*

**20080026138** NASA Johnson Space Center, Houston, TX, USA

**Is Q for Quantum? From Quantum Mechanics to Formation of the Solar System**

Wilson, T. L.; Mittlefehldt, D. W.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 953033.03.05.02; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026138>

The realization in 1985 that fullerenes exist in nature [1] as a third form of carbon-carbon clustering, continues to inspire new areas of research. In particular, the study of closed-cage endohedral fullerenes [2-6] is of scientific interest because of its potential application in a number of promising fields from medical imaging to astrophysics. One of these is to provide a possible chronometer for studying the age and origin of certain astromaterials in the solar system. Fullerenes are closed carbon cages that are fundamentally related to a long-standing debate over the 'Q-Phase' origin of planetary noble gases in carbonaceous chondrites [7]. Although Q-phase has been identified as the carrier of planetary noble gases [8- 10], its physical nature has not been explained. Our limited understanding of it is based primarily on the laboratory chemical processing which it survives as well as the fact that it must have been widely distributed in the solar nebula [11]. Yet as important as it might be while preoccupying some 30 years of research, the question of what actually is Q-phase remains unresolved.

Derived from text

*Quantum Mechanics; Carbonaceous Chondrites; Imaging Techniques; Solar Nebula; Meteoritic Composition; Astrophysics*

**20080026165** NASA Johnson Space Center, Houston, TX, USA

**Gravitational Focusing and the Computation of an Accurate Moon/Mars Cratering Ratio**

Matney, Mark J.; March 11, 2006; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

There have been a number of attempts to use asteroid populations to simultaneously compute cratering rates on the Moon and bodies elsewhere in the Solar System to establish the cratering ratio (e.g., [1],[2]). These works use current asteroid orbit population databases combined with collision rate calculations based on orbit intersections alone. As recent work on meteoroid fluxes [3] have highlighted, however, collision rates alone are insufficient to describe the cratering rates on planetary surfaces - especially planets with stronger gravitational fields than the Moon, such as Earth and Mars. Such calculations also need to include the effects of gravitational focusing, whereby the spatial density of the slower-moving impactors is preferentially 'focused' by the gravity of the body. This leads overall to higher fluxes and cratering rates, and is highly dependent on the

detailed velocity distributions of the impactors. In this paper, a comprehensive gravitational focusing algorithm originally developed to describe fluxes of interplanetary meteoroids [3] is applied to the collision rates and cratering rates of populations of asteroids and long-period comets to compute better cratering ratios for terrestrial bodies in the Solar System. These results are compared to the calculations of other researchers.

Derived from text

*Asteroids; Cratering; Gravitational Fields; Mars Craters; Planetary Surfaces*

**20080026190** NASA Johnson Space Center, Houston, TX, USA

**Microstructural Study of Micron-Sized Craters Simulating Stardust Impacts in Aluminum 1100 Targets**

Leroux, Hugues; Borg, Janet; Troadec, David; Djouadi, Zahia; Horz, Friedrich; [2006]; 37 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): 339767.04.06.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

Various microscopic techniques were used to characterize experimental micro-craters in aluminium foils to prepare for the comprehensive analysis of the cometary and interstellar particle impacts in aluminium foils to be returned by the Stardust mission. First, SEM (Scanning Electron Microscopy) and EDS (Energy Dispersive X-ray Spectroscopy) were used to study the morphology of the impact craters and the bulk composition of the residues left by soda-lime glass impactors. A more detailed structural and compositional study of impactor remnants was then performed using TEM (Transmission Electron Microscopy), EDS, and electron diffraction methods. The TEM samples were prepared by Focused Ion Beam (FIB) methods. This technique proved to be especially valuable in studying impact crater residues and impact crater morphology. Finally, we also showed that InfraRed microscopy (IR) can be a quick and reliable tool for such investigations. The combination of all of these tools enables a complete microscopic characterization of the craters.

Author

*Hypervelocity Impact; Projectile Cratering; Metal Foils; Aluminum; Cosmic Dust; Chemical Composition; Characterization; Microstructure; Particle Size Distribution*

**20080026197** NASA Johnson Space Center, Houston, TX, USA

**SIMS Studies of Allende Projectiles Fired into Stardust-type Aluminum Foils at 6 km/s**

Hoppe, Peter; Stadermann, Frank J.; Stephan, Thomas; Floss, Christine; Leitner, Jan; Marhas, Kuljeet; Horz, Friedrich; [2006]; 26 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GJ26G; 330767/-4/-6/-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

We have explored the feasibility of C-, N-, and O-isotopic measurements by NanoSIMS and of elemental abundance determinations by TOF-SIMS on residues of Allende projectiles that impacted Stardust-type aluminum foils in the laboratory at 6 km/s. These investigations are part of a consortium study aimed at providing the foundation for the characterization of matter associated with micro-craters that were produced during the encounter of the Stardust space probe with comet 81P/Wild 2. Eleven experimental impact craters were studied by NanoSIMS and eighteen by TOF-SIMS. Crater sizes were between 3 and 190 microns. The NanoSIMS measurements have shown that the crater morphology has only a minor effect on spatial resolution and on instrumental mass fractionation. The achievable spatial resolution is always better than 200 nm, and C- and O-isotopic ratios can be measured with a precision of several percent at a scale of several 100 nm, the typical size of presolar grains. This clearly demonstrates that presolar matter, provided it survives the impact into the aluminum foil partly intact, is recognizable even if embedded in material of Solar System origin. TOF-SIMS studies are restricted to materials from the crater rim. The element ratios of the major rockforming elements in the Allende projectiles are well characterized by the TOF-SIMS measurements, indicating that fractionation of those elements during impact can be expected to be negligible. This permits information on the type of impactor material to be obtained. For any more detailed assignments to specific chondrite groups, however, information on the abundances of the light elements, especially C, is crucial.

Author

*Projectiles; Wild 2 Comet; Metal Foils; Chondrites; Fractionation; Impactors*

**20080026198** NASA Johnson Space Center, Houston, TX, USA

**Focused Ion Beam Recovery of Hypervelocity Impact Residue in Experimental Craters on Metallic Foils**

Graham, G. A.; Teslich, N.; Dai, Z. R.; Bradley, J. P.; Kearsley, A. T.; Horz, F.; [2006]; 22 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): W-7405-Eng-48; NNH04AB49I; WBS 339767.04.06.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Stardust sample return capsule will return to Earth in January 2006 with primitive debris collected from Comet

81P/Wild-2 during the fly-by encounter in 2004. In addition to the cometary particles embedded in low-density silica aerogel, there will be microcraters preserved in the Al foils (1100 series; 100 micrometers thick) that are wrapped around the sample tray assembly. Soda lime spheres (approximately 49  $\mu$ m in diameter) have been accelerated with a light-gas-gun into flight-grade Al foils at 6.35 km s<sup>-1</sup> to simulate the potential capture of cometary debris. The preserved crater penetrations have been analyzed using scanning electron microscopy (SEM) and x-ray energy dispersive spectroscopy (EDX) to locate and characterize remnants of the projectile material remaining within the craters. In addition, ion beam induced secondary electron imaging has proven particularly useful in identifying areas within the craters that contain residue material. Finally, high-precision focused ion beam (FIB) milling has been used to isolate and then extract an individual melt residue droplet from the interior wall of an impact penetration. This enabled further detailed elemental characterization, free from the background contamination of the Al foil substrate. The ability to recover pure melt residues using FIB will significantly extend the interpretations of the residue chemistry preserved in the Al foils returned by Stardust.

Author

*Ion Beams; Imaging Techniques; Hypervelocity Impact; Projectile Cratering; Metal Foils; Cosmic Dust; Chemical Composition*

**20080026204** NASA Langley Research Center, Hampton, VA, USA; Prairie View Agricultural and Mechanical Coll., TX, USA; California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

#### **Isotopic Dependence of GCR Fluence behind Shielding**

Cucinotta, Francis A.; Wilson, John W.; Saganti, Premkumar; Kim, Myung-Hee Y.; Cleghorn, Timothy; Zeitlin, Cary; Tripathi, Ram K.; [2006]; 40 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI:

A03, Hardcopy

In this paper we consider the effects of the isotopic composition of the primary galactic cosmic rays (GCR), nuclear fragmentation cross-sections, and isotopic-grid on the solution to transport models used for shielding studies. Satellite measurements are used to describe the isotopic composition of the GCR. For the nuclear interaction data-base and transport solution, we use the quantum multiple-scattering theory of nuclear fragmentation (QMSFRG) and high-charge and energy (HZETRN) transport code, respectively. The QMSFRG model is shown to accurately describe existing fragmentation data including proper description of the odd-even effects as function of the iso-spin dependence on the projectile nucleus. The principle finding of this study is that large errors ( $\pm 100\%$ ) will occur in the mass-fluence spectra when comparing transport models that use a complete isotopic-grid (approx. 170 ions) to ones that use a reduced isotopic-grid, for example the 59 ion-grid used in the HZETRN code in the past, however less significant errors ( $< \pm 20\%$ ) occur in the elemental-fluence spectra. Because a complete isotopic-grid is readily handled on small computer workstations and is needed for several applications studying GCR propagation and scattering, it is recommended that they be used for future GCR studies.

Author

*Galactic Cosmic Rays; Isotopes; Nuclear Interactions; Fragmentation; Computational Grids; Primary Cosmic Rays; Quantum Theory*

## 91

### LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

**20080023785** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Overview of NASA Projects**

Rickan, Douglas L.; April 16, 2008; 51 pp.; In English; Original contains black and white illustrations; No Copyright;

Avail.: CASI: C01, CD-ROM: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023785>

This viewgraph presentation reviews NASA's efforts in Regolith simulants. This effort is in support of future lunar missions.

CASI

*Regolith; Analogs; Lunar Crust; Lunar Rocks*

**20080023907** NASA Langley Research Center, Hampton, VA, USA

**Overview of the Mars Sample Return Earth Entry Vehicle**

Dillman, Robert; Corliss, James; June 23, 2008; 8 pp.; In English; 6th International Planetary Probe Workshop, 23-27 Jun. 2008, Atlanta, GA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 305311.01.07.42; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023907>

NASA's Mars Sample Return (MSR) project will bring Mars surface and atmosphere samples back to Earth for detailed examination. Langley Research Center's MSR Earth Entry Vehicle (EEV) is a core part of the mission, protecting the sample container during atmospheric entry, descent, and landing. Planetary protection requirements demand a higher reliability from the EEV than for any previous planetary entry vehicle. An overview of the EEV design and preliminary analysis is presented, with a follow-on discussion of recommended future design trade studies to be performed over the next several years in support of an MSR launch in 2018 or 2020. Planned topics include vehicle size for impact protection of a range of sample container sizes, outer mold line changes to achieve surface sterilization during re-entry, micrometeoroid protection, aerodynamic stability, thermal protection, and structural materials selection.

Author

*Mars Sample Return Missions; Aerodynamic Stability; Atmospheric Entry; Thermal Protection; Mars Surface Samples; Micrometeoroids; Planetary Protection*

**20080024217** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Geologic Evolution of the Martian Dichotomy in the Ismenius Area of Mars and Implications for Plains Magnetization**

Smrekar, S. E.; McGill, G. E.; Raymond, C. A.; Dimitriou, A. M.; Journal of Geophysical Research; November 13, 2004; Volume 109; 19 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2004JE002260>; <http://hdl.handle.net/2014/40840>

The origin of the Martian dichotomy, which divides highlands from lowlands, is unknown. We examine a section of the dichotomy (50 - 90E) defined by steep scarps and normal faults. Stratigraphy and age relationships preclude the formation of the 2.5 km high boundary via erosion. The abrupt disappearance of topographic knobs similar to 300 - 500 km to the northeast is interpreted as a buried fault. Alignment of the buried fault with grabens, stratigraphy, and age determinations using crater counts indicate that the lowland bench is down faulted highlands crust. The estimated local strain (3.5%) and fault pattern are broadly consistent with gravitational relaxation of a plateau boundary. Magnetic and gravity anomalies occur on either side of the buried fault. Admittance analysis indicates isostatic compensation. Although nonunique, a model with a 10 km thick intracrustal block under the lowland bench, a 20 km thick block under the plains, and an excess density of 200 kg/m<sup>3</sup> provides a good fit to the isostatic anomaly. A good fit to a profile of the magnetic field perpendicular to the dichotomy is produced using uniformly polarized intracrustal blocks 10 - 20 km thick, an intensity of 6 Am/m, a field inclination of -30 degrees, and gaps aligned with the isostatic anomalies. One interpretation is that high-density intrusions demagnetized the crust after dynamo cessation and that low-lying magnetized areas could be down faulted highlands crust. Another model (inclination of 30 degrees) has magnetized crust beneath the isostatic anomalies, separated by gaps. The gaps could result from hydrothermal alteration of the crust along fault zones.

Author

*Magnetic Anomalies; Mars (Planet); Planetary Geology; Dichotomies; Planetary Evolution*

**20080024229** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**On Combining Thermal-Infrared and Radio-Occultation Data of Saturn's Atmosphere**

Flasar, F. M.; Schinder, P. J.; Conrath, B. J.; [2008]; 1 pp.; In English; Saturn After Cassini-Huygens Symposium/ESA, Science and Technology Facilities Council, 28 Jul. - 1 Aug. 2008, London, UK; Copyright; Avail.: Other Sources; Abstract Only

Radio-occultation and thermal-infrared measurements are complementary investigations for sounding planetary atmospheres. The vertical resolution afforded by radio occultations is typically approximately 1 km or better, whereas that from infrared sounding is often comparable to a scale height. On the other hand, an instrument like CIRS can easily generate global maps of temperature and composition, whereas occultation soundings are usually distributed more sparsely. The starting point for radio-occultation inversions is determining the residual Doppler-shifted frequency, that is the shift in frequency from what it would be in the absence of the atmosphere. Hence the positions and relative velocities of the spacecraft, target atmosphere, and DSN receiving station must be known to high accuracy. It is not surprising that the inversions can be susceptible to sources of systematic errors. Stratospheric temperature profiles on Titan retrieved from Cassini radio occultations were found to be very susceptible to errors in the reconstructed spacecraft velocities (approximately equal to 1

mm/s). Here the ability to adjust the spacecraft ephemeris so that the profiles matched those retrieved from CIRS limb sounding proved to be critical in mitigating this error. A similar procedure can be used for Saturn, although the sensitivity of its retrieved profiles to this type of error seems to be smaller. One issue that has appeared in inverting the Cassini occultations by Saturn is the uncertainty in its equatorial bulge, that is, the shape in its iso-density surfaces at low latitudes. Typically one approximates that surface as a geopotential surface by assuming a barotropic atmosphere. However, the recent controversy in the equatorial winds, i.e., whether they changed between the Voyager (1981) era and later (after 1996) epochs of Cassini and some Hubble observations, has made it difficult to know the exact shape of the surface, and it leads to uncertainties in the retrieved temperature profiles of one to a few kelvins. This propagates into errors in the retrieved helium abundance, which makes use of thermal-infrared spectra and synthetic spectra computed with retrieved radio-occultation temperature profiles. The highest abundances are retrieved with the faster Voyager-era winds, but even these abundances are somewhat smaller than those retrieved from the thermal-infrared data alone (albeit with larger formal errors). The helium abundance determination is most sensitive to temperatures in the upper troposphere. Further progress may include matching the radio-occultation profiles with those from CIRS limb sounding in the upper stratosphere.

Author

*Radio Occultation; Thermal Energy; Infrared Detectors; Planetary Atmospheres; Atmospheric Sounding; Saturn*

**20080025049** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Laboratory Evidence for a Key Intermediate in the Venus Atmosphere: Peroxychloroformyl Radical**

Pernice, Holger; Garcia, Placido; Willner, Helge; Francisco, Joseph S.; Mills, Franklin P.; Allen, Mark; Yung, Yuk L.; Proceedings of The National Academy of Sciences of the USA Of America; September 28, 2004; Volume 101, No. 39, pp. 14007-14010; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources  
ONLINE: <http://dx.doi.org/10.1073/pnas.0405501101>; <http://hdl.handle.net/2014/40849>

For two decades, the peroxychloroformyl radical, ClC(O)OO, has played a central role in models of the chemical stability of the Venus atmosphere. No confirmation, however, has been possible in the absence of laboratory measurements for ClC(O)OO. We report the isolation of ClC(O)OO in a cryogenic matrix and its infrared and ultraviolet spectral signatures. These experiments show that ClC(O)OO is thermally and photolytically stable in the Venus atmosphere. These experimental discoveries validate the existence of ClC(O)OO, confirm several longstanding model assumptions, and provide a basis for the astronomical search for this important radical species.

Author

*Planetary Atmospheres; Atmospheric Models; Chloroform; Radicals; Atmospheric Chemistry; Chemical Composition; Atmospheric Composition*

**20080025192** Lawrence Livermore National Lab., Livermore, CA USA

**FY06 LDRD Final Report 'Next-Generation X-ray Optics: Focusing Hard x-rays.'**

Pivovarov, M. J.; Mar. 06, 2007; 18 pp.; In English

Report No.(s): DE2007-909641; UCRL-TR-228700; No Copyright; Avail.: National Technical Information Service (NTIS)

The original goal of our research was to open up a new class of scientific experiments by increasing the power of newly available x-ray sources by orders of magnitude. This was accomplished by developing a new generation of x-ray optics, based on hard x-ray (10200 keV) reflective and diffractive focusing elements. The optical systems we envision begin with a core reflective optic, which has the ability to capture and concentrate x-rays across a wide range of energies and angles band, combined with diffractive optics, based on large-scale multilayer structures, that will further enhance the spatial, spectral and temporal resolving power of the system. Enabling technologies developed at LLNL such as precise mounting of thermally formed substrates, smoothing techniques and multilayer films of ultra-high reflectance and precision were crucial in the development and demonstration of our research objectives. Highlights of this phase of the project include: the design and fabrication of a concentrator optic for the Pleiades Thomson X-ray source located at LLNL, smoothing of glass substrates through application of polyimide films, and the design, fabrication and testing of novel volume multilayers structures. Part of our research into substrate smooth led to the development of a new technique (patent pending) to construct high-quality, inexpensive x-ray optics. This innovation resulted in LLNL constructing a x-ray optic for the CERN Axion Solar Telescope (CAST) and allowed LLNL to join the international experiment.

NTIS

*Diffractive Optics; Focusing; X Rays*

**20080025272** State Univ. of New York, Stony Brook, NY, USA; California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA; California Univ., Santa Cruz, CA, USA

**New Approaches for Modeling Type Ia Supernovae**

Zingale, M.; Almgren, A. S.; Bell, J. B.; Day, M. S.; Rendleman, C. A.; Jun. 25, 2007; 8 pp.; In English

Contract(s)/Grant(s): DE-AC02-05CH11231

Report No.(s): DE2007-910243; LBNL-63087; No Copyright; Avail.: National Technical Information Service (NTIS)

Type Ia supernovae (SNe Ia) are the largest thermonuclear explosions in the Universe. Their light output can be seen across great distances and has led to the discovery that the expansion rate of the Universe is accelerating. Despite the significance of SNe Ia, there are still a large number of uncertainties in current theoretical models. Computational modeling offers the promise to help answer the outstanding questions. However, even with today's supercomputers, such calculations are extremely challenging because of the wide range of length and timescales. In this paper, we discuss several new algorithms for simulations of SNe Ia and demonstrate some of their successes.

NTIS

*Algorithms; Supernovae; Thermonuclear Explosions; Models*

**20080026000** NASA Johnson Space Center, Houston, TX, USA

**Lunar Surface Scenarios: Habitation and Life Support Systems for a Pressurized Rover**

Anderson, Molly; Hanford, Anthony; Howard, Robert; Touns, Larry; March 05, 2006; 8 pp.; In English; ASCE Earth and Space 2005, 5-8 Mar. 2006, Houston, TX, USA; Copyright; Avail.: CASI: [A02](#), Hardcopy

Pressurized rovers will be a critical component of successful lunar exploration to enable safe investigation of sites distant from the outpost location. A pressurized rover is a complex system with the same functions as any other crewed vehicle. Designs for a pressurized rover need to take into account significant constraints, a multitude of tasks to be performed inside and out, and the complexity of life support systems to support the crew. In future studies, pressurized rovers should be given the same level of consideration as any other vehicle occupied by the crew.

Author

*Roving Vehicles; Pressurized Cabins; Pressure Vessel Design; Reliability Engineering; Complex Systems; Life Support Systems; Lunar Exploration; Habitability; Lunar Surface*

**20080026001** NASA Johnson Space Center, Houston, TX, USA

**Reduced Pressure Atmosphere Impacts on Life Support and Internal Thermal Systems**

Anderson, Molly; July 17, 2006; 1 pp.; In English; International Conference on Environmental Systems, 17-20 Jul. 2006, Norfolk, VA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Selecting the appropriate atmosphere for a spacecraft and mission is a complicated problem. NASA has previously used atmospheres from Earth normal composition and pressure to pure oxygen at low pressures. Future exploration missions will likely strike a compromise somewhere between the two, trying to balance operation impacts on EVA, safety concerns for flammability and health risks, life science and physiology questions, and other issues. Life support systems and internal thermal control systems are areas that will have to respond to changes in the atmospheric composition and pressure away from the Earthlike conditions currently used on the International Space Station. This paper examines life support and internal thermal control technologies currently in use or in development to find what impacts in design, efficiency and performance, or feasibility might be expected. Understanding these changes should be helpful in producing better results during future trade studies or mission analyses.

Author

*Life Support Systems; Temperature Control; Pressure Reduction; Low Pressure; Space Missions; Atmospheric Composition*

**20080026005** NASA Johnson Space Center, Houston, TX, USA

**Prospecting for Methane in Arabia Terra, Mars - First Results**

Allen, Carlton C.; Oehler, Dotyhy Z.; Venechuk, Elizabeth M.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Methane has been measured in the Martian atmosphere at concentrations of approx. 10 ppb. Since the photochemical lifetime of this gas is approx. 300 years, it is likely that methane is currently being released from the surface. Possible sources for the methane include 1) hydrothermal activity, 2) serpentinization of basalts and other water-rock interactions, 3) thermal maturation of sedimentary organic matter, and 4) metabolism of living bacteria. Any such discovery would revolutionize our

understanding of Mars. Longitudinal variations in methane concentration, as measured by the Planetary Fourier Spectrometer (PFS) on Mars Express, show the highest values over Arabia Terra, Elysium Planum, and Arcadia-Memnonia, suggesting localized areas of methane release. We are using orbital data and methodologies derived from petroleum exploration in an attempt to locate these release points.

Derived from text

*Mars Atmosphere; Methane; Mars Surface; Planetary Geology*

**20080026011** NASA Johnson Space Center, Houston, TX, USA

**The Evolution of the EH4 Chondrite Indarch at High Pressure and Temperature: The First Experimental Results**

Berthet, S.; Malavergne, V.; Righter, K.; Corgne, A.; Combes, R.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.:

CASI: [A01](#), Hardcopy

Chondrite groups are characterized by variations in bulk composition and oxidation state, illustrating in part heterogeneity in the early solar nebula. Planetary accretion could be explained by at least two different scenarios: the homogeneous [1] and heterogeneous accretion models [2, 3]. In particular, for the formation of the Earth, some studies (e.g. [2, 3]) assume that one component is highly reduced material comparable to enstatite chondrites, devoid of volatile elements but containing all other elements in C1 abundance ratios. To derive constraints on the understanding of early differentiation processes, studies of the silicate phase relations and their interactions with metal, at relevant P-T-fO<sub>2</sub>, are required. Melting relations and equilibrium partitioning behaviour have been studied on peridotitic and chondritic starting compositions at pressures and temperatures corresponding to the transition zone and lower mantle [4, 5, 6]. However, enstatite chondrites, which are highly reduced primitive meteorites, have not yet been studied experimentally under such conditions. Thus, multianvil experiments have been performed at 20-25 GPa and 2000-2400 C on the EH4 chondrite Indarch.

Author

*Chondrites; High Pressure; Enstatite; Solar Nebula; Meteorites; Oxidation*

**20080026012** NASA Johnson Space Center, Houston, TX, USA

**Genesis Solar Wind Sample Curation: A Progress Report**

Allton, Judith H.; Calaway, M. J.; Rodriguez, M. C.; Hittle, J. D.; Wentworth, S. J.; Stansbery, E. K.; McNamara, K. M.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

In the year since the Genesis solar wind collector fragments were returned, early science samples, specimens for cleaning experiments, and science allocations have been distributed. Solar wind samples are stored under nitrogen and handled in an ISO Class 4 (Class 10) laboratory. For array collector fragments, a basic characterization process has been established. This characterization consists of identification of solar wind regime, whole fragment image for identification and surface quality, higher magnification images for contaminant particle density, and assessment of molecular film contaminant thickness via ellipsometry modeling. Compilations of this characterization data for AuOS (gold film on sapphire), and sapphire from the bulk solar wind for fragments greater than 2 cm are available. Removal of contaminant particles using flowing ultrapure water (UPW) energized megasonically is provided as requested.

Derived from text

*Solar Wind; Genesis Mission; Sampling; Concentrators*

**20080026013** NASA Johnson Space Center, Houston, TX, USA

**Widespread Layers in Arabia Terra: Implications for Martian Geologic History**

Venechuk, Elizabeth M.; Oehler, D. Z.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, Houston, TX, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Layered rocks in Arabia Terra have been the focus of several recent papers. Studies have focused on the layers found in crater basins located in the southwest portion of the region. However, Mars Orbiter Camera (MOC) images have identified layered deposits across the region. Terrestrial layered rocks are usually sedimentary, and often deposited in water. Thus extensive layered sequences in Arabia Terra may indicate locations of past, major depositional basins on Mars. Other mechanisms can also create layered rocks, or the appearance of layered rocks, including volcanism (both lava flows and ash falls), wind-blown deposits, and wave-cut terraces at shorelines. By identifying where in the region layers occur, and classifying the layers according to morphology and albedo, past depositional environments may be identified. Arabia Terra is characterized by heavily cratered Noachian plains, as well as a rise from -4000 m in the northwest to 4000 m in the southeast

(Mars Orbital Laser Altimeter [MOLA] datum). This slope may have provided a constraint on sediment deposition and thus layer formation. While most of the region is Noachian in age, a significant percentage of the area is identified as Hesperian. Although the history of the Arabia Terra initially seems to be straightforward cratered plains with several younger units atop them analysis of high-resolution imagery may reveal a more complex history.

Derived from text

*Mars Surface; Planetary Geology; Structural Basins; Folds (Geology); Geomorphology*

**20080026025** NASA Johnson Space Center, Houston, TX, USA

**Frontiers of Life Sciences: The Human Exploration of the Moon and Mars**

North, Regina M.; Pellis, Neal R.; April 10, 2005; 1 pp.; In English; 4th Science Centre World Congress, 10-14 Apr. 2005, Rio de Janeiro, Brazil; Copyright; Avail.: Other Sources; Abstract Only

The rapid development of the productive processes after World War II extended human settlements into new ecological niches. Advances in Life Sciences played a decisive role supporting the establishment of human presence in areas of the planet where human life could have not existed otherwise. The evolution of life support systems, and the fabrication of new materials and technologies has enabled humans to inhabit Polar Regions, ocean surfaces and depths; and to leave Earth and occupy Low Earth Orbit. By the end of the 20<sup>th</sup> Century, stations in the Antarctic and Arctic, off shore oil platforms, submarines, and space stations had become the ultimate demonstration of human ability to engineer habitats at Earth extreme environments and outer space. As we enter the 21<sup>st</sup> Century, the next development of human settlements will occur through the exploration of the Moon, Mars, and beyond. The major risks of space exploration derive from long exposure of humans and other life systems to radiation, microgravity, isolation and confinement, dependence on artificial life support systems, and unknown effects (e.g., altered magnetic fields, ultrahigh vacuum on bacteria, fungi, etc.). Countermeasures will require a complete characterization of human and other biological systems adaptation processes. To sustain life in transit and on the surface of the Moon and Mars will require a balance of spacecraft, cargo, astronaut crews, and the use of in situ resources. Limitations on the number of crewmembers, payloads, and the barrenness of the terrain require a novel design for the capabilities needed in transit and at exploration outpost sites. The planned destinations have resources that may be accessed to produce materials, food, shelter, power, and to provide an environment compatible with successful occupation of longterm exploration sites. Once more, the advancements of Life Sciences will be essential for the design of interplanetary voyages and planetary surface operations. This presentation delineates the role of Life Sciences and its frontiers, especially Cell Science, in the context of human exploration. Life support systems, food production, and medical equipment encompass many of vital aspects related to the new vision for NASA.

Author

*Moon; Manned Mars Missions; Mars (Planet); Life Sciences; Life Support Systems*

**20080026035** NASA Johnson Space Center, Houston, TX, USA

**Asteroid-Meteorite Links: The Vesta Conundrum(s)**

Pieters, C. M.; Binzel, R.; Bogard, D.; Hiroi, T.; Mittlefehldt, D. W.; Nyquist, L.; Rivkin, A.; Takeda, H.; [2006]; 17 pp.; In English; IAU; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Although a direct link between the HED meteorites and the asteroid 4 Vesta is generally acknowledged, several issues continue to be actively examined that tie Vesta to early processes in the solar system. Vesta is no longer the only basaltic asteroid in the Main belt. In addition to the Vestoids of the Vesta family, the small asteroid Magnya is basaltic but appears to be unrelated to Vesta. Similarly, diversity now identified in the collection of basaltic meteorites requires more than one basaltic parent body, consistent with the abundance of differentiated parent bodies implied by iron meteorites. The timing of the formation of the Vestoids (and presumably the large crater at the south pole of Vesta) is unresolved. Peaks in Ar-Ar dates of eucrites suggest this impact event could be related to a possible late heavy bombardment at least 3.5 Gyr ago. On the other hand, the optically fresh appearance of both Vesta and the Vestoids requires either a relatively recent resurfacing event or that their surfaces do not weather in the same manner thought to occur on other asteroids such as the ordinary chondrite parent body. Diversity across the surface of Vesta has been observed with HST and there are hints of compositional variations (possibly involving minor olivine) in near-infrared spectra.

Author

*Vesta Asteroid; Solar System; Mineralogy; Iron Meteorites*



**20080026038** NASA Johnson Space Center, Houston, TX, USA

**Overview of the Spirit Mars Exploration Rover Mission to Gusev Crater: Landing Site to Backstay Rock in the Columbia Hills**

Arvidson, R. E.; Squyres, S. W.; Anderson, R. C.; Bell, J. F., III; Blaney, D.; Brueckner, J.; Cabrol, N. A.; Calvin, W. M.; Carr, M. H.; Christensen, P. R.; Clark, B. C.; Crumpler, L.; Des Marais, D. J.; deSouza, P. A., Jr.; d'Uston, C.; Economou, T., et al.; [2005]; 61 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

Spirit landed on the floor of Gusev Crater and conducted initial operations on soil covered, rock-strewn cratered plains underlain by olivine-bearing basalts. Plains surface rocks are covered by wind-blown dust and show evidence for surface enrichment of soluble species as vein and void-filling materials and coatings. The surface enrichment is the result of a minor amount of transport and deposition by aqueous processes. Layered granular deposits were discovered in the Columbia Hills, with outcrops that tend to dip conformably with the topography. The granular rocks are interpreted to be volcanic ash and/or impact ejecta deposits that have been modified by aqueous fluids during and/or after emplacement. Soils consist of basaltic deposits that are weakly cohesive, relatively poorly sorted, and covered by a veneer of wind blown dust. The soils have been homogenized by wind transport over at least the several kilometer length scale traversed by the rover. Mobilization of soluble species has occurred within at least two soil deposits examined. The presence of mono-layers of coarse sand on wind-blown bedforms, together with even spacing of granule-sized surface clasts, suggest that some of the soil surfaces encountered by Spirit have not been modified by wind for some time. On the other hand, dust deposits on the surface and rover deck have changed during the course of the mission. Detection of dust devils, monitoring of the dust opacity and lower boundary layer, and coordinated experiments with orbiters provided new insights into atmosphere-surface dynamics.

Author

*Mars Exploration; Rocks; General Overviews; Mars Landing Sites; Igneous Rocks*

**20080026049** NASA Johnson Space Center, Houston, TX, USA

**Iron-Tolerant Cyanobacteria for Human Habitation beyond Earth**

Brown, Igor; Sarkisova, Svetlana; Jones, Jeff; Sternberg, Paul; Bayless, David; McKay, David S.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Institute Conference, 13-17 Mar. 2006, League City, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

In light of the President's Moon/Mars initiative, lunar exploration has once again become a priority for NASA. In order to establish permanent bases on the Moon and proceed with human exploration of Mars, two key problems will be addressed: first, the production of O<sub>2</sub> and second, the production of methane (CH<sub>4</sub>). While O<sub>2</sub> is required for life support systems (LSS), both liquid O<sub>2</sub> and CH<sub>4</sub> are needed as an oxidizer and a propellant, respectively for the Lunar Surface Access Module (LSAM) and the Crew Exploration Vehicle (CEV). Unlike previous propulsion systems, the new CEV will use liquid oxygen (LO<sub>2</sub>) as an oxidizer and liquid methane (LCH<sub>4</sub>) as a propellant. Existing technology (e.g. hydrogen reduction) for the production of liquid oxygen from lunar regolith is very energy intensive and requires high temperature reactors. We propose an alternative approach using iron-tolerant cyanobacteria. We have found that iron-tolerant cyanobacteria (IT CB) are capable of etching iron-bearing minerals, which may lead to bonds breaking between Fe and O of common lunar mare basalt Feoxides including ilmenite, pseudobrookite, ferropseudobrookite, and armalcolite with the subsequent release of both Fe, Ti and oxygen as by-products. We also propose to use CB biomass for CH<sub>4</sub> production as carbon stock and a propellant. Both processes can be accomplished in an energy and cost effective manner because sunlight will be used as an energy source and allows the reactions at ambient temperatures between 10-60 C. Current evaluations include assessing the thermodynamics of such biogenic reactions using a variety of nutrients and atmospheric parameters, as well as assessing the rates and species variation effects of the driving reactions.

Author

*Bacteria; Iron; Earth (Planet); Mineralogy; Lunar Exploration; Exobiology; Human Beings*

**20080026052** NASA Johnson Space Center, Houston, TX, USA

**Improving the Near-Earth Micrometeoroid and Orbital Debris Environment Definition with LADC**

Liou, J.-C.; Giovane, F.; Corsaro, R.; Stansbery, E.; October 02, 2006; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Valencia, Spain

Contract(s)/Grant(s): 939904.06.05.03; Copyright; Avail.: Other Sources; Abstract Only

The Large Area Debris Collector (LADC) is a 10 m(sup 2) aerogel and acoustic sensor system designed to characterize and collect submillimeter micrometeoroids and orbital debris on the International Space Station (ISS). The project is led by the U.S. Naval Research Laboratory (NRL) with major collaboration by the NASA Orbital Debris Program Office at Johnson

Space Center. The U.S. Department of Defense Space Test Program (STP) is responsible for the integration, deployment, and retrieval of the system. The deployment is scheduled for August 2007 with an orbital collection period of one to two years. The combined area time product of LADC will provide a much needed orbital debris population update in the size regime that is important to the safety community - 100 mm and larger. Another key element for LADC is the source identification of the collected samples. Impact features such as track length and track volume can be used to estimate the impact speed and direction of any selected residual embedded in aerogel. Acoustic sensors can provide impact timing and impact location information. The combined dynamical signatures make it possible to reconstruct the orbits of some of the collected samples and lead to their source identification. Compositional analysis on the residuals can also separate debris from meteoroids and provide additional population breakdown for orbital debris (e.g., Al, paint, steel, Al<sub>2</sub>O<sub>3</sub>). To maximize the science return and minimize potential contamination from other ISS modules, a careful selection of the location and orientation of LADC on the ISS is needed. Key issues and engineering constraints encountered during mission preparation, and the expected science return based on the mission configuration, are summarized in this paper.

Author

*Accumulators; Micrometeoroids; Acoustics; Space Debris; Near Earth Objects*

**20080026057** NASA Johnson Space Center, Houston, TX, USA

**Acid Sulfate Weathering on Mars: Results from the Mars Exploration Rover Mission**

Ming, Douglas W.; Morris, R. V.; Golden, D. C.; June 03, 2006; 1 pp.; In English; Bridging Clays, 3-7 Jun. 2006, Oleron Island, France; Copyright; Avail.: CASI: [A01](#), Hardcopy

Sulfur has played a major role in the formation and alteration of outcrops, rocks, and soils at the Mars Exploration Rover landing sites on Meridiani Planum and in Gusev crater. Jarosite, hematite, and evaporite sulfates (e.g., Mg and Ca sulfates) occur along with siliciclastic sediments in outcrops at Meridiani Planum. The occurrence of jarosite is a strong indicator for an acid sulfate weathering environment at Meridiani Planum. Some outcrops and rocks in the Columbia Hills in Gusev crater appear to be extensively altered as suggested by their relative softness as compared to crater floor basalts, high Fe(3+)/FeT, iron mineralogy dominated by nanophase Fe(3+) oxides, hematite and/or goethite, corundum-normative mineralogies, and the presence of Mg- and Ca-sulfates. One scenario for aqueous alteration of these rocks and outcrops is that vapors and/or fluids rich in SO<sub>2</sub> (volcanic source) and water interacted with rocks that were basaltic in bulk composition. Ferric-, Mg-, and Ca-sulfates, phosphates, and amorphous Si occur in several high albedo soils disturbed by the rover's wheels in the Columbia Hills. The mineralogy of these materials suggests the movement of liquid water within the host material and the subsequent evaporation of solutions rich in Fe, Mg, Ca, S, P, and Si. The presence of ferric sulfates suggests that these phases precipitated from highly oxidized, low-pH solutions. Several hypotheses that invoke acid sulfate weathering environments have been suggested for the aqueous formation of sulfate-bearing phases on the surface of Mars including (1) the oxidative weathering of ultramafic igneous rocks containing sulfides; (2) sulfuric acid weathering of basaltic materials by solutions enriched by volcanic gases (e.g., SO<sub>2</sub>); and (3) acid fog (i.e., vapors rich in H<sub>2</sub>SO<sub>4</sub>) weathering of basaltic or basaltic-derived materials.

Author

*Mars Exploration; Mars Surface; Sulfates; Weathering; Acids; Mars Roving Vehicles*

**20080026075** NASA Johnson Space Center, Houston, TX, USA

**Antarctic Meteorite Newsletter, Volume 29, Number 1**

Satterwhite, Cecilia, Editor; Righter, Kevin, Editor; February 2006; 27 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026075>

This newsletter contains classifications for 597 new meteorites from the 2003 and 2004 ANtarctic Search for METeorites (ANSMET) seasons. They include samples from the Cumulus Hills, Dominion Range, Grosvenor Mountains, LaPaz Icefield, MacAlpine Hills, and the Miller Range. Macroscopic and petrographic descriptions are given for 25 of the new meteorites: 1 acapulcoite/Iodranite, 1 howardite, 1 diogenite, 2 eucrites, 1 enstatite chondrite, four L3 and two H3 chondrites, 2 CM, 3 CK and 1 CV chondrites, three R chondrites, and four impact melt breccias (with affinities for H and L). Likely the most interesting sample announced in this newsletter is LAP04840, with affinity to R chondrites. This meteorite contains approximately 15% hornblende, and has mineral compositional ranges and oxygen isotopic values similar to those of R chondrites. The presence of an apparently hydrous phase in this petrologic grade 6 chondrite is very unusual, and should be of great interest to many meteoriticists.

Derived from text

*Antarctic Regions; Meteorites; Petrography*

**20080026093** NASA Johnson Space Center, Houston, TX, USA

#### **The Rocks of the Columbia Hills**

Squyres, Steven W.; Arvidson, Raymond E.; Blaney, Diana L.; Clark, Benton C.; Crumpler, Larry; Farrand, William H.; Gorevan, Stephen; Herkenhoff, Kenneth; Hurowitz, Joel; Kusack, Alastair; McSween, Harry Y.; Ming, Douglas W.; Morris, Richard V.; Ruff, Steven W.; Wang, Alian; Yen, Albert; [2006]; 58 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 361426.04.05; Copyright; Avail.: CASI: [A04](#), Hardcopy

The Mars Exploration Rover Spirit has identified five distinct rock types in the Columbia Hills of Gusev crater. Clovis Class rock is a poorly-sorted clastic rock that has undergone substantial aqueous alteration. We interpret it to be aqueously-altered ejecta deposits formed by impacts into basaltic materials. Wishstone Class rock is also a poorly-sorted clastic rock that has a distinctive chemical composition that is high in Ti and P and low in Cr. Wishstone Class rock may be pyroclastic in origin. Peace Class rock is a sedimentary material composed of ultramafic sand grains cemented by significant quantities of Mg- and Ca-sulfates. Peace Class rock may have formed when water briefly saturated the ultramafic sands, and evaporated to allow precipitation of the sulfates. Watchtower Class rocks are similar chemically to Wishstone Class rocks, and have undergone widely varying degrees of near-isochemical aqueous alteration. They may also be ejecta deposits, formed by impacts into Wishstone-rich materials and altered by small amounts of water. Backstay Class rocks are basalt/trachybasalt lavas that were emplaced in the Columbia Hills after the other rock classes were, either as impact ejecta or by localized volcanic activity. The geologic record preserved in the rocks of the Columbia Hills reveals a period very early in martian history in which volcanic materials were widespread, impact was a dominant process, and water was commonly present.

Author

*Mars (Planet); Mars Craters; Mars Exploration; Rocks; Petrology*

**20080026098** NASA Johnson Space Center, Houston, TX, USA

#### **Characterization and Petrologic Interpretation of Olivine-Rich Basalts at Gusev Crater, Mars**

McSween, H. Y.; Wyatt, M. B.; Gellert, R.; Bell, J. F., III; Morris, R. V.; Herkenhoff, K. E.; Crumpler, L. S.; Milam, K. A.; Stockstill, K. R.; Tornabene, L. L.; Arvidson, R. E.; Bartlett, P.; Blaney, D.; Cabrol, N. A.; Christensen, P. R.; Clark, B. C.; Crisp, A.; DesMarais, D. J.; Economou, T.; Farmer, J. D.; Farrand, W.; Ghosh, A.; Golombek, M.; Gorevan, S.; Greeley, R., et al.; [2006]; 56 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG5-12896; 361426.04.05; Copyright; Avail.: CASI: [A04](#), Hardcopy

Rocks on the floor of Gusev crater are basalts of uniform composition and mineralogy. Olivine, the only mineral to have been identified or inferred from data by all instruments on the Spirit rover, is especially abundant in these rocks. These picritic basalts are similar in many respects to certain Martian meteorites (olivine-phyric shergottites). The olivine megacrysts in both have intermediate compositions, with modal abundances ranging up to 20-30%. Associated minerals in both include low-calcium and high-calcium pyroxenes, plagioclase of intermediate composition, iron-titanium-chromium oxides, and phosphate. These rocks also share minor element trends, reflected in their nickel-magnesium and chromium-magnesium ratios. Gusev basalts and shergottites appear to have formed from primitive magmas produced by melting an undepleted mantle at depth and erupted without significant fractionation. However, apparent differences between Gusev rocks and shergottites in their ages, plagioclase abundances, and volatile contents preclude direct correlation. Orbital determinations of global olivine distribution and compositions by thermal emission spectroscopy suggest that olivine-rich rocks may be widespread. Because weathering under acidic conditions preferentially attacks olivine and disguises such rocks beneath alteration rinds, picritic basalts formed from primitive magmas may even be a common component of the Martian crust formed during ancient and recent times.

Author

*Petrology; Olivine; Basalt; Rocks; Composition (Property); Characterization; Mineralogy*

**20080026133** NASA Johnson Space Center, Houston, TX, USA

#### **Rb-Sr and Sm-Nd Isotopic Studies of Antarctic Nakhlite MIL 03346**

Shih, C.-Y.; Nyquist, L. E.; Reese, Y.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080026133>

Nakhlites are olivine-bearing clinopyroxenites with cumulate textures, and probably came from Mars [e.g., 1]. A total of seven nakhlites have been identified so far. Unlike other martian meteorites (e.g., shergottites), nakhlites have been only moderately shocked and their original igneous textures are still well-preserved. Also, these meteorites have similarly older crystallization ages of approx.1.3 Ga compared to shergottites with ages of approx.0.18-0.57 Ga [e.g., 2]. MIL 03346 is

characterized by abundant (approx.20 vol %) glassy mesostasis, indicating that it cooled rapidly and probably formed near the top [3] or at the bottom [4] of the chilled margin of a thick intrusive body. The mesostasis quenched from the trapped intercumulus liquid may provide information on the parent magma compositions of the nakhlites. In this report, we present Rb-Sr and Sm-Nd isotopic data for MIL 03346, discuss correlation of its age with those of other nakhlites and the nature of their source regions in the Martian mantle.

Author

*Nakhlites; Planetary Mantles; Shergottites; Magma; Olivine; Antarctic Regions; SNC Meteorites; Crystallization*

**20080026155** NASA Johnson Space Center, Houston, TX, USA

**Formation of ‘Chemically Pure’ Magnetite from Mg-Fe-Carbonates Implications for the Exclusively Inorganic Origin of Magnetite and Sulfides in Martian Meteorite ALH84001**

Golden, D. C.; Ming, Douglas W.; Lauer, H. V., Jr.; Morris, R. V.; Trieman, A. H.; McKay, G. A.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Magnetite and sulfides in the black rims of carbonate globules in Martian meteorite ALH84001 have been studied extensively because of the claim by McKay et al. that they are biogenic in origin. However, exclusively inorganic (abiotic) processes are able to account for the occurrence of carbonate-sulfide-magnetite assemblages in the meteorite. We have previously precipitated chemically zoned and sulfide-bearing carbonate globules analogous to those in ALH84001 (at less than or equal to 150 C) from multiple fluxes of variable-composition Ca-Mg-Fe-CO<sub>2</sub>-S-H<sub>2</sub>O solutions. Brief heating of precipitated globules to approx. 470 C produced magnetite and pyrrhotite within the globules by thermal decomposition of siderite and pyrite, respectively. We have also shown that morphology of magnetite formed by inorganic thermal decomposition of Fe-rich carbonate is similar to the morphology of so-called biogenic magnetite in the carbonate globules of ALH84001. Magnetite crystals in the rims of carbonate globules in ALH84001 are chemically pure [Note: ‘Chemically pure’ is defined here as magnetite with Mg at levels comparable or lower than Mg detected by [8] in ALH84001 magnetite]. A debate continues on whether or not chemically pure magnetite can form by the thermal decomposition of mixed Mg-Fe-carbonates that have formed under abiotic conditions. Thomas-Keprta et al. argue that it is not possible to form Mg-free magnetite from Mg-Fe-carbonate based on thermodynamic data. We previously suggested that chemically pure magnetite could form by the thermal decomposition of relatively pure siderite in the outer rims of the globules. Mg-Fe-carbonates may also thermally decompose under conditions conducive for formation of chemically pure magnetite. In this paper we show through laboratory experiments that chemically pure magnetite can form by an inorganic process from mixed Mg-Fe-carbonates.

Derived from text

*Carbonates; Sulfides; Biogeny; Iron; Magnesium; SNC Meteorites; Mineralogy; Magnetite; Meteorites*

**20080026158** NASA Johnson Space Center, Houston, TX, USA

**Thermal and Evolved Gas Analysis of Geologic Samples Containing Organic Materials: Implications for the 2007 Mars Phoenix Scout Mission**

Lauer, H. V., Jr.; Ming, Douglas W.; Golden, D. C.; Boynton, W. V.; March 13, 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations; Copyright; Avail.:

CASI: [A01](#), Hardcopy

The Thermal and Evolved Gas Analyzer (TEGA) instrument scheduled to fly onboard the 2007 Mars Phoenix Scout Mission will perform differential scanning calorimetry (DSC) and evolved gas analysis (EGA) of soil samples and ice collected from the surface and subsurface at a northern landing site on Mars. We have been developing a sample characterization data library using a laboratory DSC integrated with a quadrupole mass spectrometer to support the interpretations of TEGA data returned during the mission. The laboratory TEGA test-bed instrument has been modified to operate under conditions similar to TEGA, i.e., reduced pressure (e.g., 100 torr) and reduced carrier gas flow rates. We have previously developed a TEGA data library for a variety of volatile-bearing mineral phases, including Fe-oxyhydroxides, phyllosilicates, carbonates, and sulfates. Here we examine the thermal and evolved gas properties of samples that contain organics. One of the primary objectives of the Phoenix Scout Mission is to search for habitable zones by assessing organic or biologically interesting materials in icy soil. Nitrogen is currently the carrier gas that will be used for TEGA. In this study, we examine two possible modes of detecting organics in geologic samples; i.e., pyrolysis using N<sub>2</sub> as the carrier gas and combustion using O<sub>2</sub> as the carrier gas.

Derived from text

*Gas Analysis; Mars Missions; Organic Materials; Phoenix Mars Lander; Planetary Geology; Thermal Analysis; Mars Surface Samples*

**20080026168** NASA Johnson Space Center, Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA

**An Overview of Moessbauer Mineralogy at Gusev Crater, Mars**

Klingelhoef, G.; Schroeder, C.; Rodionov, D.; Yen, A.; July 14, 2006; 2 pp.; In English; 36th COSPAR Scientific Assembly, 14-25 Jul. 2006, Beijing, China; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Mars Exploration Rover (MER) Spirit landed on the plains of Gusev Crater on 4 January 2004 [1]. The scientific objective of the Moessbauer (MB) spectrometer on Spirit is to provide quantitative information about the distribution of Fe among its oxidation and coordination states, identification of Fe-bearing phases, and relative distribution of Fe among those phases. The speciation and distribution of Fe in Martian rock and soil constrains the primary rock types, redox conditions under which primary minerals crystallized, the extent of alteration and weathering, the type of alteration and weathering products, and the processes and environmental conditions for alteration and weathering. We discuss the Fe-bearing phases detected by Spirit's MB instrument during its first 540 sols of exploration [2,3]. Spirit roved eastward across the plains from its landing site to the Columbia Hills during the first approx. 150 sols. Rocks are unweathered to weakly weathered olivine basalt, with olivine, pyroxene (Ol > Px), magnetite (Mt), and minor hematite (Hm) and nanophase ferric oxide (npOx) as their primary Fe-bearing minerals. Soils are generally similar basaltic materials, except that the proportion of npOx is much higher (up to approx. 40%). npOx is an oct-Fe<sup>3+</sup> alteration product whose concentration is highest in fine-grained soils and lowest in rock interiors exposed by grinding with the Rock Abrasion Tool (RAT). Spirit explored the lower slopes of the Columbia Hills (West Spur) during sols approx. 150-320. West Spur rocks are highly altered, even for interior surfaces exposed by grinding (Fe<sup>3+</sup>/Fe<sup>T</sup> approx. 0.56-0.84). High concentrations of npOx, Hm, and Mt are present. One rock (Clovis) contains significant quantities of goethite (alpha-FeOOH; approx. 40% of total Fe). The detection of goethite is very significant because it is a mineralogical marker for aqueous alteration.

Author

*Mars Exploration; Mineralogy; Mars Craters; Hematite; Planetary Geology; Oxidation-Reduction Reactions; Mars Surface; Landing Sites*

**20080026183** NASA Langley Research Center, Hampton, VA, USA

**The Chesapeake Bay Impact Crater: An Educational Investigation for Students into the Planetary Impact Process and its Environmental Consequences**

Levine, Arlene S.; March 10, 2008; 1 pp.; In English; 39th Lunar and Planetary Sciences Conference, 10-14 Mar. 2008, Houston, TX, USA

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Planetary impact craters are a common surface feature of many planetary bodies, including the Earth, the Moon, Mars, Mercury, Venus, and Jupiter's moons, Ganymede and Callisto. The NASA Langley Research Center in Hampton, VA, is located about 5 km inside the outer rim of the Chesapeake Bay Impact Crater. The Chesapeake Bay Impact Crater, with a diameter of 85 km is the sixth largest impact crater on our planet. The U.S. Geological Survey (USGS), in collaboration with the NASA Langley Research Center, the Virginia Department of Environmental Quality (VDEQ), the Hampton Roads Planning District Commission (HRPDC), and the Department of Geology of the College of William and Mary (WM) drilled into and through the crater at the NASA Langley Research Center and obtained a continuous core to a depth of 2075.9 ft (632.73 meters) from the Chesapeake Bay Impact Crater. At the NASA Langley location, the granite basement depth was at 2046 ft (623.87 meters). This collaborative drilling activity provided a unique educational opportunity and ongoing educational partnership between USGS, NASA Langley and the other collaborators. NASA Langley has a decade-long, ongoing educational partnership with the Colonial Coast Council of the Girl Scouts. The core drilling and on site analysis and cataloguing of the core segments provided a unique opportunity for the Girl Scouts to learn how geologists work in the field, their tools for scientific investigation and evaluation, how they perform geological analyses of the cores in an on-site tent and learn about the formation of impact craters and the impact of impacting bodies on the sub-surface, the surface, the oceans and atmosphere of the target body. This was accomplished with a two-part activity. Girl Scout day camps and local Girl Scout troops were invited to Langley Research Center Conference Center, where more than 300 Girl Scouts, their leaders and adult personnel were given briefings by scientists and educators from the USGS, NASA, VDEQ, HRPDC and WM on the principles of geology, the formation of impact craters, the consequences of the impacting body on the atmosphere, ocean, surface and sub-surface, the geological, chemical and biological analyses of the core and the cataloguing and storage of the core segments, etc. After the briefings, the Girl Scouts visited the drilling site where they inspected the core drilling rig, examined the core samples and discussed the drilling procedures, cores and interpretation of the cores with scientists and educators from the organizations conducting the core drilling. Demonstrations at the drilling site included demonstrations of impacting objects hitting multi-colored layered mud targets at different angles of entry. The multi-colored layers of mud were instructive in

mapping out the distribution of impact-ejected material around the impact crater. The presentation will include a series of photographs of the Girl Scout participating in activities at the Chesapeake Bay Impact Crater drill site, including retrieving cores from the drilling rig, inspecting the core samples and participating in the impact-crater formation demonstrations.

Derived from text

*Chesapeake Bay (US); Lunar Craters; Planetary Environments; Planetary Craters; Education*

**20080026184** NASA Langley Research Center, Hampton, VA, USA

**Scientific Goals and Objectives for the Human Exploration of Mars: 1. Biology and Atmosphere/Climate**

Levine, Joel S.; Garvin, J. B.; Anbar, A. D.; Beaty, D. W.; Bell, M. S.; Clancy, R. T.; Cockell, C. S.; Connerney, J. E.; Doran, P. T.; Delory, G.; Dickson, J. T.; Elphic, R. C.; Eppler, D. B.; Fernandez-Remolar, D. C.; Head, J. W.; Helper, M.; Gruener, J. E.; Heldmann, J.; Hipkin, V.; Lane, M. D.; Levy, J.; Moersch, J.; Ori, G. G.; Peach, L.; Poulet, F.; March 03, 2008; 2 pp.; In English; 39th Lunar and Planetary Sciences Conference, 10-14 Mar. 2008, Houston, TX, USA

Contract(s)/Grant(s): WBS 892840.01.07.01; Copyright; Avail.: CASI: [A01](#), Hardcopy

To prepare for the exploration of Mars by humans, as outlined in the new national vision for Space Exploration (VSE), the Mars Exploration Program Analysis Group (MEPAG), chartered by NASA's Mars Exploration Program (MEP), formed a Human Exploration of Mars Science Analysis Group (HEM-SAG), in March 2007. HEM-SAG was chartered to develop the scientific goals and objectives for the human exploration of Mars based on the Mars Scientific Goals, Objectives, Investigations, and Priorities.<sup>1</sup> The HEM-SAG is one of several humans to Mars scientific, engineering and mission architecture studies chartered in 2007 to support NASA's plans for the human exploration of Mars. The HEM-SAG is composed of about 30 Mars scientists representing the disciplines of Mars biology, climate/atmosphere, geology and geophysics from the U.S., Canada, England, France, Italy and Spain. MEPAG selected Drs. James B. Garvin (NASA Goddard Space Flight Center) and Joel S. Levine (NASA Langley Research Center) to serve as HEM-SAG co-chairs. The HEM-SAG team conducted 20 telecons and convened three face-to-face meetings from March through October 2007. The management of MEP and MEPAG were briefed on the HEM-SAG interim findings in May. The HEM-SAG final report was presented on-line to the full MEPAG membership and was presented at the MEPAG meeting on February 20-21, 2008. This presentation will outline the HEM-SAG biology and climate/atmosphere goals and objectives. A companion paper will outline the HEM-SAG geology and geophysics goals and objectives.

Derived from text

*Manned Mars Missions; Climatology; Planetary Geology; Mars Atmosphere; NASA Space Programs; Geophysics; Exobiology*

**20080026189** NASA Langley Research Center, Hampton, VA, USA

**Turbulent Aeroheating Testing of Mars Science Laboratory Entry Vehicle**

Hollis, Brian R.; Collier, Arnold S.; [2008]; 48 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 857464.02.07.07.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

An experimental investigation of turbulent aeroheating on the Mars Science Laboratory entry vehicle heat shield has been conducted in the Arnold Engineering Development Center Hypervelocity Wind Tunnel No. 9. Testing was performed on a 6-in. (0.1524 m) diameter MSL model in pure N<sub>2</sub> gas in the tunnel's Mach 8 and Mach 10 nozzles at free stream Reynolds numbers of  $4.1 \times 10^6$ /ft to  $49 \times 10^6$ /ft ( $1.3 \times 10^7$ /m to  $19 \times 10^6$ /ft) and  $1.2 \times 10^6$ /ft to  $19 \times 10^6$ /ft ( $0.39 \times 10^7$ /m to  $62 \times 10^7$ /m), respectively. These conditions were sufficient to span the regime of boundary-layer flow from completely laminar to fully-developed turbulent flow over the entire forebody. A supporting aeroheating test was also conducted in the Langley Research Center 20-Inch Mach 6 Air Tunnel at free stream Reynolds number of  $1 \times 10^6$ /ft to  $7 \times 10^6$ /ft ( $0.36 \times 10^7$ /m to  $2.2 \times 10^7$ /m) in order to help corroborate the Tunnel 9 results. A complementary computational fluid dynamics study was conducted in parallel to the wind tunnel testing. Laminar and turbulent predictions were generated for the wind tunnel test conditions and comparisons were performed with the data for the purpose of helping to define uncertainty margins on predictions for aeroheating environments during entry into the Martian atmosphere. Data from both wind tunnel tests and comparisons with the predictions are presented herein. It was concluded from these comparisons that for perfect-gas conditions, the computational tools could predict fully-laminar or fully-turbulent heating conditions to within 12% or better of the experimental data.

Author

*Aerodynamic Heating; Computational Fluid Dynamics; Hypervelocity Wind Tunnels; Turbulent Flow; Wind Tunnel Tests; Mars Roving Vehicles*

**20080026213** NASA Johnson Space Center, Houston, TX, USA

**Chemical Diversity along the Traverse of the Rover Spirit at Gusev Crater**

Gellert, R.; Brueckner, J.; Clark, B. C.; Dreibus, G.; d'Uston, C.; Economou, T.; Klingelhofer, G.; Lugmair, G.; Ming, D. W.; Morris, R. V.; Rieder, R.; Squyres, S. W.; Wanke, H.; Yen, A.; Zipfel, J.; March 13, 2006; 2 pp.; In English; 37th Lunar and Planetary Science Conference, 13-17 Mar. 2006, League City, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): DLR 50M0014; DLR 50QM0005; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Alpha-Particle-X-ray Spectrometer (APXS) is part of the in situ payload of the Mars Exploration Rovers. It has determined the chemical composition of soils and rocks along the nearly 6 km long traverse of the rover Spirit. The measuring method a combination of PIXE and XRF using Cm244 sources - allowed the unambiguous identification of elemental compositions with high precision. Besides sample triage and quantification of saltforming elements as indicators for aqueous alteration, the APXS also delivered important constraints to mineralogy instruments (i.e., Mossbauer (MB), MiniTES, Pancam) on minerals and rock types. The mineralogy instruments on the other hand provided constraints on minerals used for APXS normative calculations and, e.g. allowed the attribution of S to sulfate, instead of sulfide or elemental sulfur. This abstract gives an updated overview of the data obtained up to our current rover position on sol 720 at the eastern base of the Columbia Hills. We will emphasize elemental correlations that imply the presence of certain minerals that can not be identified by the MER mineralogy instruments.

Author

*Mars Craters; Mars Exploration; Planetary Geology; Chemical Composition; Sedimentary Rocks; Mars Roving Vehicles*

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**SPACE RADIATION**

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics*.

**20080026201** Purdue Univ., Fort Wayne, IN, USA

**Effects of gamma-Radiation on Select Lipids and Antioxidants**

Gandolph, Jacob; Mauer, Lisa; Perchonok, Michele; January 05, 2006; 1 pp.; In English; Habitation 2006, 5-8 Feb. 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Radiation encountered on an extended duration space mission (estimates of 3 Sieverts for a mission to Mars) poses a threat not only to human health, but also to the quality, nutritional value, and palatability of the food system. Free radicals generated by radiation interaction with foods may initiate many unwanted reactions including: 1) autoxidation in lipids that alters flavor, odor, and concentrations of essential fatty acids, and 2) depletion of antioxidants food products and dietary supplements. Studies have shown that antioxidants may provide long term health protection from oxidative stress caused by radiation exposure; therefore, consumption of antioxidants will be important. Stability of essential fatty acids is also important for astronauts long-term health status. The objectives of this study were to characterize the effects of low dose gamma-radiation on lipids and antioxidants by monitoring oxidation and reducing power, respectively, in model systems. Select oils and antioxidants were exposed to levels of gamma-radiation ranging from 0 to 1000 Gy (1 Gy = 1 Sv) using a Gammacell 220 and stored at ambient or elevated temperatures (65 C) for up to 3 months prior to analysis. A Fricke dosimeter was used to verify differences between the radiation doses administered. Primary and secondary products of lipid oxidation in soybean and peanut oils were monitored using conjugated diene and 2-thiobarbituric acid (TBARs) assays. Changes in fatty acid composition and formation and vitamin E levels were also measured. The reducing power of antioxidant compounds, including vitamins C and E and beta-carotene, was determined using the ferric reducing antioxidant power (FRAP) assay. Significant differences ( $\alpha = 0.05$ ) were present between all radiation doses tested using the Fricke dosimeter. Increasing radiation doses above 3 Sv resulted in significantly ( $\alpha = 0.05$ ) elevated levels of oxidation and free fatty acids in soybean and peanut oils. Decreases in concentrations of essential fatty acids upon increasing radiation doses were also observed. Increasing radiation doses caused significant ( $\alpha = 0.05$ ) decreases in reducing power and hence the effectiveness of vitamins C and E as well as beta-carotene. This work establishes a need for quantifying the effects of space relevant radiation doses in the development of a food system for an extended duration mission and for identifying threshold radiation levels that will impact the useful shelf-life of the variety of foods that will be sent. Eventual rancidity of lipids and the loss of antioxidant bioprotective effects are major concerns for the acceptability and nutritional profile of a food system.

Author

*Antioxidants; Lipids; Gamma Rays; Extraterrestrial Radiation; Radiation Effects; Radiation Dosage; Vitamins; Assaying*

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